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Proceedings

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Brno, Czech Republic
May 10-11, 2011

International Conference

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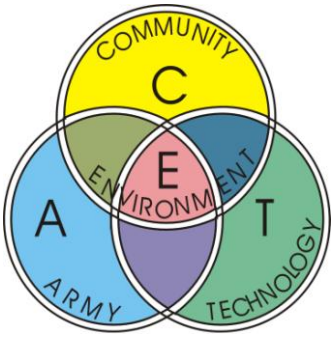

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- using the computer modelling and simulation, especially in the command and control process;
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CONTENT:

SOME ASPECTS OF SIGNAL RECOGNITION

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Abstract: *In the field of modern communications, the signal recognition is of special interest. The analysis and classification of the received signals is the purpose of this paper. An algorithm of signal processing is proposed in the paper in order to return the modulation type and the number of signal states, especially in the real conditions of transmission (with environment influence). The modulated signal is analyzed with the spectrogram and consequently, instantaneous frequency law) is obtained. To separate BFSK, BASK and BPSK of FSK, ASK and PSK with a large number of stages a technique of histogram is used. In the last part of the paper, some experimental results are presented. They confirm the proposed algorithm. Finally, the most important conclusions are also included.*

Keywords: digital modulations, signal processing, modulation recognition.

INTRODUCTION

In the field of modern communications, the signal recognition and classification is of a special interest, particularly in the various classes of military applications. There are many methods for signals recognition based on neural networks like in [1], orthogonal transforms like in [2], time-frequency methods like in [3] etc.

The analysis and classification of the received signals based on time-frequency methods is the purpose of this paper. The first step is to find the modulation type in perfect conditions or in the presence of noise. An algorithm of signal processing is proposed in the paper in order to return the modulation type and the number of states, especially in real conditions of transmission (with environment influence). The modulated signal is analyzed with the spectrogram and consequently, instantaneous frequency law (IFL) is obtained. What distinguishes FSK from the other two digital modulations (ASK and PSK) is the variation or fluctuation of frequency. For ASK or PSK the mapping of IFL is a horizontal line. A criterion to separate FSK of ASK or PSK is based on the average of instantaneous frequency (IF) and on the fluctuation around this average. In fact, if important variations around the average are noticed, it means that the modulation is a FSK one. For the PSK modulated signal, amplitude is a constant and many variations can be noticed with an ASK modulation. The influence of noise in the modulation type recognition process is also studied in the paper. To separate BFSK, BASK and BPSK of FSK, ASK and PSK with a large number of stages, a technique of histogram is used. The accuracy of the algorithm is tested on different types of digital modulated signals with Matlab/Simulink. In the last part of the paper, some experimental results are presented. They confirm the broached theoretical aspects from beginning.

1. GENERATION OF SIGNALS

It is known that a sinusoidal signal has three important parameters: amplitude, phase and frequency. On this line, these parameters can be found in the different types of modulation. According to [3] and [4], there are two kinds of modulation processes concerning the number of values of one particular parameter, namely:

- the binary modulation process: the information is transmitted using a parameter with only two possible values (e.g., 0 or 1);
- the *M*-ary modulation process: the information is transmitted using a parameter which can have *M* values. This kind of modulation allows the association of an *n* binary digit word with one modulation state. So, there are $M = 2^n$ modulation states.

There are three basic forms of digital bandpass modulations: ASK, PSK and FSK. This type of standard signals is generated in Matlab.

2. JOINT TIME-FREQUENCY ANALYSIS

Information contained in a signal cannot often be obtained from the signal itself and this one needs to be modified. Several means, according [5] exist to acquire information: time analysis (TA), frequency analysis (FA) and the time-frequency signal analysis (TFA).

The time domain is the most current representation of the signal. The energy propriety per unit time called the instantaneous power is the aim of TA.

The frequency domain is preferred sometimes to time domain. Based on Fourier transform (FT) one can obtain power spectrum density.

The time-frequency signal analysis appears as a great deal of the two above representations and of their properties. Supplementary, it combines the information given by instantaneous power and power spectrum.

2.1 The spectrogram

Time-frequency representations can be classified into three categories: linear, quadratic and higher order ones. The most important linear time-frequency representations according [5] and [6], are the short-time Fourier transform (STFT) and the wavelet transform (WT). The energetic version of STFT is called spectrogram and respectively, the energetic version of WT is called scalogram.

Spectrogram also called the Fourier spectrogram, can be defined as an energy density domain distribution and is the squared modulus of the STFT:

$$\mathrm{FS}(t,\omega) = \left| \int_{-\infty}^{+\infty} x(u) h^*(t-u) e^{-j\omega u} \, \mathrm{d}u \right|^2 . \tag{1}$$

In Figure 1, some signals in time-frequency domain are presented.

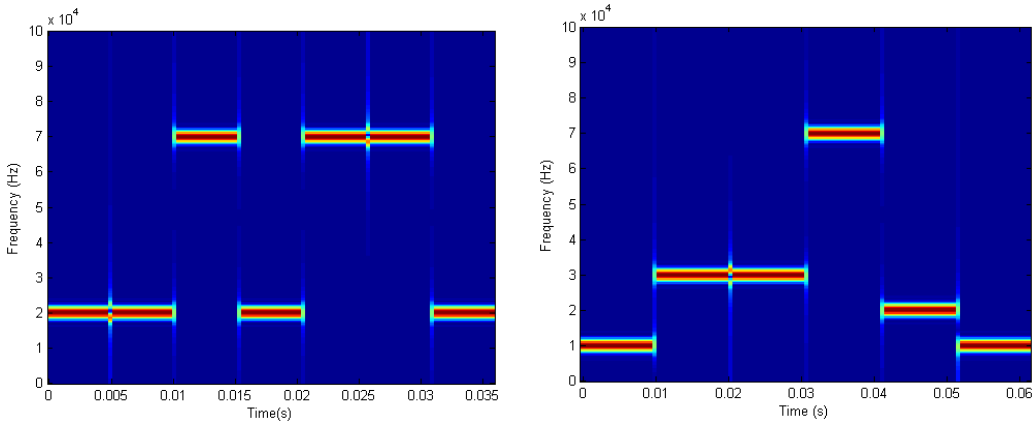

Figure 1. Spectrogram for a BFSK (left) and FSK4 (right) modulated signal.

A BFSK modulation is obviously recognized. The information which is important in this case is the values of the frequencies and their time of apparition into signal. For FSK4 modulation, the spectrogram returns the values of the four different frequencies.

2.2 The proposed recognition algorithm and its criteria

The basic objectives of the proposed recognition algorithm are to classify the different types of modulation on the one hand (the first stage), and to find the number of signal states on the other hand (the second stage). Essentially, this algorithm is based on IFL use.

- *the first stage*

For a time-frequency distribution, the calculus of IF means to calculate the maximums of the spectrogram. The modulated signal is analyzed with the spectrogram and consequently, IFL is obtained. What distinguish FSK than the two others modulation it is precisely its variation or fluctuation of frequency. While for ASK or PSK the mapping of IFL is a horizontal line. The criterion is based on the average of IF and on the fluctuation around this average. In fact, if important variations around the average are noticed, it means that the modulation is a FSK one. For this distinction, the standard deviation is used. Its expression is:

$$\sigma = \sqrt{\overline{\left(x - \bar{x}\right)^2}}, \tag{2}$$

where $\bar{x}$ represent the average of the signal $x(t)$.

The condition is now about the standard deviation related to the average:

$$\sigma(IFL) \geq 0.2 \cdot \overline{IFL}. \tag{3}$$

The next step is to find a proper criterion to distinguish ASK modulation from PSK modulation. For the PSK modulated signal, amplitude (AMP) is a constant and many variations can be noticed with an ASK modulation. With a similar argument to the one made for frequencies, the standard deviation is introduced and the new criterion becomes:

$$\sigma(AMP) \geq 0.2 \cdot \overline{AMP}. \tag{4}$$

In Figure 2, the structure of the proposed recognition algorithm is illustrated.

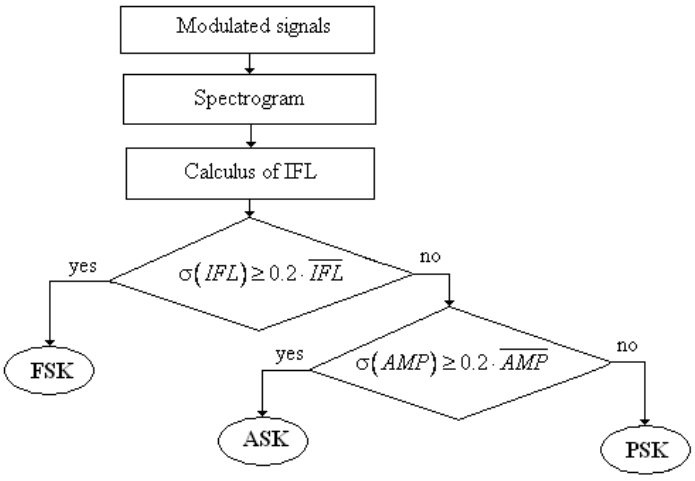

Figure 2. The structure of the proposed recognition algorithm.

At this point, the algorithm is able to an input signal, to recognize its modulation type. The next objective is to find the number of state for each modulation.
Without noise, algorithm returns very good recognition score of 100% for each modulation. By adding Gaussian noise to the modulated signal with different SNR, the recognition process decreases as performance level (e.g., for SNR=22 dB, BASK modulation is classified as an ASK modulation; for SNR=18 dB, ASK modulation is considered as a FSK modulation, and for SNR=20 dB, PSK modulation is recognized as an ASK modulation etc.).

- *the second stage*

Generally speaking, IFL is one of the intrinsic properties for FSK and it will remain. Instead of finding a new parameter to rely on, another condition is added to the first one.

A problem of distinction appears between ASK modulation and FSK modulation in presence of noise. To solve it, amplitude seems to be the good criterion to separate the modulation because for FSK, the level is supposed to be constant.

The technique of histogram will be used and the main magnitude remains IFL. The histogram gathers all values of IFL around four values which represent the four levels in a FSK4 modulation. For a BFSK modulation, only two bars appear and without noise, only one is draw for two other modulations (ASK and PSK). With noise and when the inequality given by (3) equation is true for ASK as well as FSK modulation, histogram controls the decision: for ASK modulation, another vertical bar appears due to the fluctuation of IFL. A threshold is defined and if the minimum is not superior to the quart of the maximum, it means that modulation is an ASK one. Supplementary, the histogram for BPSK modulation in presence of noise contains two verticals bar of equal amplitude etc.

In Figure 3, the basic principle used to find the number of signal states is presented.

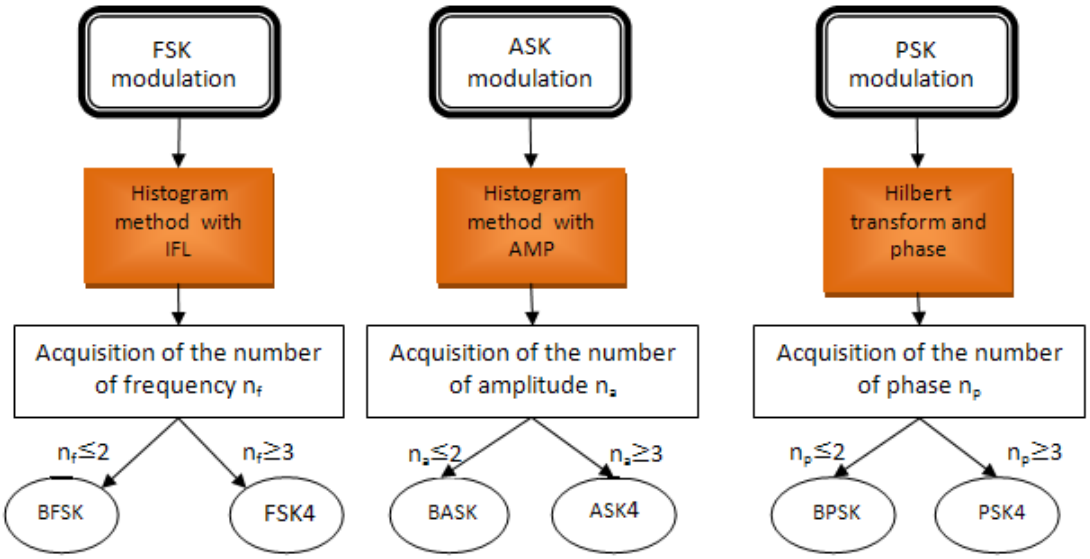

Figure 3. The structure of the algorithm used to find the number of signal states.

After this stage, the histogram of the IFL is calculated. The following results were obtained:
a) if modulation is a BFSK without noise, than only one or two vertical bars appear on the histogram and a third one is created by noise but with lower amplitude;
b) if modulation is a FSK4 without noise, than four bars are drawn but it could be three with almost the same level of amplitude;
c) the method of histogram will be apply too for the separation between ASK and PSK modulations. The results expected are the following:
- for BASK modulation, the vertical bars corresponding to the minimum and the maximum should be enough high and the average one should be equal to zero;
- for ASK4 modulation, there are four levels of amplitude and the intermediate levels are contained in the average values;
- for PSK modulation without noise, only one vertical bar should appear in the middle corresponding to the average value.

3. EXPERIMENTAL RESULTS

The robustness of the proposed signal recognition algorithm is evaluated in real conditions. For that purpose, two computers were used, like in Figure 4.

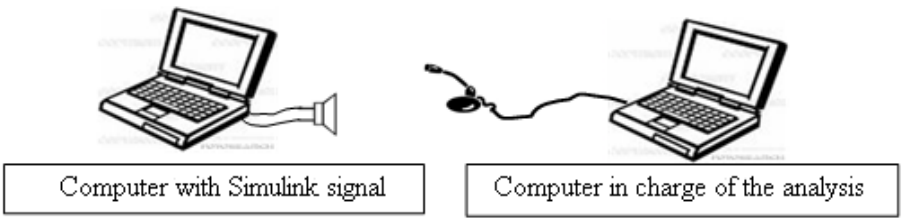

Figure 4. Experimental setup.

The different modulated signals are generated on a first computer using Simulink tool. Audible frequencies are used and the modulated signals are transmitted by a speaker. A second computer is in charge of the classification: the acquisition is done by the way of a microphone and the signal is recreated using Matlab toolboxes.

To make representative series of tests, different environments were proposed: the first one was without added noise, in a relatively quiet room; the second one had the aim to show influence of a low voice conversation; the third one had the aim to show influence of an aloud conversation and the last one represents the influence of a hands clapping.

In case of FSK modulation, the obtained experimental results are synthetically shown in Figure 5. As one can see in this figure, the proposed algorithm assures good recognition scores (in %) for this type of modulation.

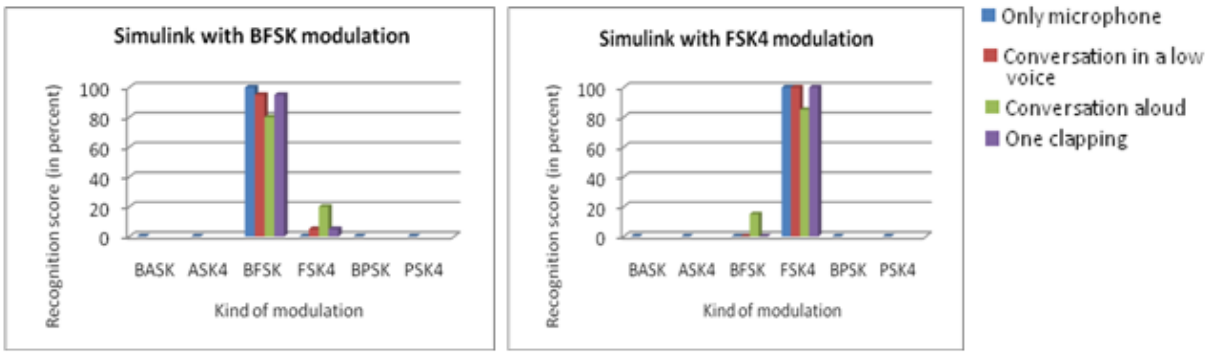

Figure 5. Experimental results obtained in case of FSK modulation.

The experimental results obtained in case of ASK modulation are illustrated in Figure 6.

I another train of thoughts, the noise introduces too many disruptions as well as algorithm often identifies ASK4 modulation as an FSK modulation because of the variations in IFL. Due to their similitude, BASK and BPSK modulation could also be confused etc.

In case of BPSK modulation (Figure 7), the recognition score had good values, but in case of PSK4 modulation with noise, these values seriously decreased. This problem could come from the algorithm itself or possibly, from the way where modulated signal is generated. Consequently, PSK4 modulation is difficult to generate with Simulink tool.

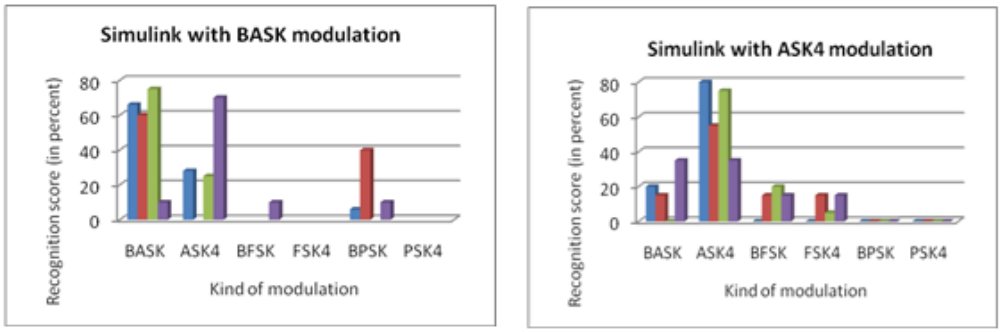

Figure 6. Experimental results obtained in case of ASK modulation.

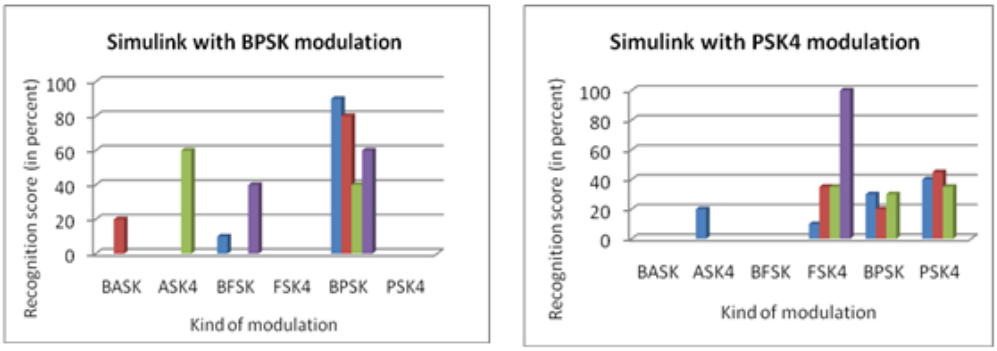

Figure 7. Experimental results obtained in case of PSK modulation.

CONCLUSION

The theoretical and experimental results presented in this paper lead to the following remarks concerning the efficiency of the proposed signal recognition algorithm, namely:
*c*1) experimental results shown that the proposed algorithm works. The best recognition score is for FSK signals. To separate different kind of modulation, IFL is a right option;
*c*2) without noise, algorithm returns good recognition score for each type of modulation;
*c*3) adding Gaussian noise with different SNR, the recognition process is not so got for example, with SNR=22 dB, BASK modulation is classified as an ASK modulation;
*c*4) the histogram technique used in the recognition algorithm improve the performance level in case of noise presence;
*c*5) the difficulties to generate a PSK4 modulation leads to bad recognition score even if the results for the other kind of signal modulation were quite good.

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DISTRIBUTION OF INFORMATION THROUGH VANET IN URBAN ENVIRONMENT

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Abstract: *In the article we focus on the simulation of communication in wireless ad hoc network (VANET) formed of cars driving in traffic. Our simulations were focused on safety of road traffic achieved by early warning system. It was all situated into urban environment. Changing weather was causing puddles on roads to grow and later on to evaporate. Cars equipped with on-board computer, GPS and VANET capable device were automatically sending and receiving messages about dangerous puddles. Later on on-board computer was able to warn his driver to slow down to drive through the puddle safely. The goal of the experiments was to compare several proposed algorithms for distribution and evaluation of relevance of received messages.*

Keywords: VANET, Ad-Hoc, communication, information, distribution, broadcast, traffic.

INTRODUCTION

Vehicular ad hoc network also known as VANET is an important element for the intelligent transport systems of future. Nodes communicate in VANET directly without any aid of network infrastructure devices, thus this type of network is suitable for deployment in terrain, during military missions, humanitarian actions, in areas with infrastructure destroyed but also for commercial purposes. VANET is supposed to increase safety of road traffic and to optimise usage of road infrastructure. However there is also space for improvement of passengers' comfort.

In order to VANET become a real and acceptable technology a lot has to be improved in field of distribution of information. A complex of services which can be successfully realised in VANET has been designed. However the improvement in the field of the data distribution in VANET is a subject of various factors which ultimately influences the whole network. This concerns the technical parameters of the network and the communication devices. [1]

One could assume that VANET should become an attractive opportunity for commercial applications. However many of them are in need of reliable connection, usually so that client can communicate with the server. Otherwise it would not be able to perform its task [2, 3]. Such a reliable connection is not offered by VANET (not even by MANET in general). Mobile network nodes usually move in a nomadic way and it is a very frequent phenomenon that the connection between the two concrete nodes is not possible to be established in certain time. Also an existing connection is prone for disruption and when in happens it takes some time until it is regenerated again. [4]
Data distribution in VANET has become to be the field of interest for developers of different adaptive distributed systems. When dealing with this problem, one usually considers road topology, distribution of cars in area and nature of data being distributed. The main goal is to deliver information and to avoid overloading the network. [6]

1. IDEA OF EXPERIMENT

In our experiments we have simulated a system of early warning for road users of impending danger on the road. The problem was simplified into cars driving in a closed road network. Cars were capable of wireless communication and were therefore forming VANET network.
Cars can face danger in the form of puddle on the road. Crossing the puddle is dangerous, however, if the driver has been warned, he could pass through it slowly and safely. If car was able to detect the act of crossing puddles by itself, it could send an alert message automatically to its surrounding through the VANET, warning others of the puddle at its current position.

The experiment, we have done, included a simulation of automobile traffic in urban environment. Road network is illustrated at the figure 1. It covers an area approximately 1.5 km long and 2 km wide. Car speed was randomly generated from interval 10-20 ms^{-1}.

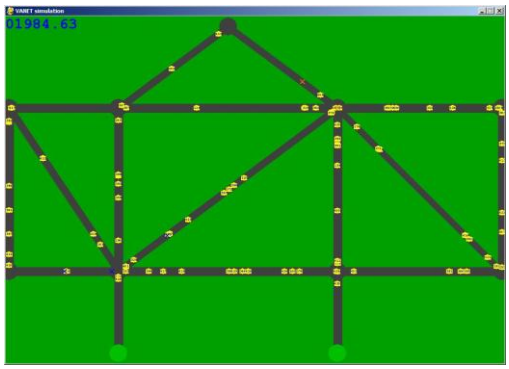

Figure 1. Road network used in simulation.

The simulation model included a simplified simulation of the weather. Weather simulation consisted of alternating periods of rainfall and sunny weather. Rainfall created puddles on the road, which were later dried by sunny weather. Puddles in simulation occurred randomly.

Each car was equipped with a device for wireless communication using Wi-Fi (proposed IEEE 802.11p). Each car had also a device to detect its geographic location. Cars were also capable to recognize that it had just crossed the puddle. All cars in one simulation run were running the same software in their on-board computers.

In the experiment we studied the average count, how many times the car passed through a puddle (*warned*) by being warned in advance and traffic in communication network (*packets*).

2. BROADCASTING ALGORITHM

The aim of this algorithm is particularly the simplicity. It tries to send a message to the largest possible number of participants using broadcast messages. It contains only a simple mechanism that prevents network overloading as a consequence of broadcast storm. Each node forwards one message once at most.
The algorithm uses the values resulting from the environment and the used technology:
RANGE = maximum radio communication range
DISTANCE = distance between message sender and recipient.
MESSAGEAGE = age of the information represented by the received message

Algorithm can be configured by parameters, which do not result from the characteristics of the environment or the used technology:
DEFERMAX = maximum time when the node waits for forwarding of the captured message. The value of this parameter must be large enough so that the network would not be overloaded. On the other hand, it may not be too large as well, because then the cars can move too far.
KEEPALIVE = time in seconds while the information transmitted in the message is considered to be valid. The value must correspond to the time at which the danger persists. It means the time which needs the puddle on the road to get dry.
GOSSIP = probability of the message being resent by its recipient

- Vehicle passes through the puddle:
  (1) Send a message that contains the event type, geographic location of the puddle, the time of event creation and its identification
- Vehicle captured the message for the first time. (Recognized by the vehicle identifier, puddle location and time of event creation):
  (1) *GENERATED* = random number from interval 0…1
  (2) If *GENERATED* > *GOSSIP* then exit
  (3) $DEFER = DEFERMAX \frac{RANGE - DISTANCE}{RANGE}$
  (4) Sleep (*DEFER*)
  (5) If the same message has not been captured during defer period and *MESSAGEAGE* is higher than *KEEPALIVE* then forward the message further
- A car captured the same message again:
  (1) Nothing is done

3. REPEATING ALGORITHM

The aim of this algorithm is to maintain information about the impending danger in the geographical proximity of its origin. One message is rebroadcasted by one node multiple times in order to distribute information to the cars coming into the area.
Analogically to all algorithms based on gossiping, messages are forwarded only with some degree of randomness. In addition, the likelihood of forwarding is decreasing with the distance from the point of impending danger.
The algorithm is managed by the following values obtained from the environment:
DISTANCE = the distance from the point of impending danger
MESSAGEAGE = age of the information represented by the received message
Algorithm can be configured with the following parameters:
KEEPALIVE = time interval, in which the information about danger is considered to be valid
SMALL = distance from the places of danger, which is considered to be critical. If the car is closer, the message is forwarded with 100% probability.
LARGE = distance from the point of danger beyond which the risk is no longer considered to be actual. If the car is farther-out, the message will not be send for sure. The likelihood of the message forward is decreasing from 100% to 0% with increasing distance between *SMALL* and *LARGE*.
DEFERMIN = minimum time the node waits for forwarding of the captured message.
DEFERMAX = maximum time the node waits for forwarding of the captured message.

- Vehicle passes through puddle:
  (1) Sends a message that contains the event type, geographic location of the puddle, the time of event creation and its identification number
- Vehicle captured the message for the first time:

(1) If *MESSAGEAGE* is higher than *KEEPALIVE* then exit
(2) *DEFER* = random number from interval *DEFERMIN*…*DEFERMAX*
(3) sleep (*DEFER*)
(4) $PROBABILITY = \begin{cases} 1 & if \quad DISTANCE < SMALL \\ 0 & if \quad DISTANCE > LARGE \\ 1 - \dfrac{DISTANCE - SMALL}{LARGE - SMALL} & else \end{cases}$
(5) *GENERATED* = random number from interval 0…1
(6) If *GENERATED* > *PROBABILITY* then exit
(7) Go to step (1)

- Vehicle captured the same message again
  (1) Nothing done

4. THE SIMULATION EXPERIMENT AND RESULTS

In the first phase of experimentation, we had to deal with a high number of parameters that can influence the behaviour of individual algorithms. So we fixed defer time to constant value, because it only exists to prevent a broadcast storm. Traffic congestion appeared as the more important simulation parameter. We determined several different marginal traffic densities:

- Very sparse traffic - about 20 cars in the whole system
- Sparse traffic - 40 cars throughout the system
- Medium-heavy traffic - about 70 cars in the whole system
- Heavy traffic - about 100 cars throughout the system.

During simulation of broadcasting algorithms, we changed the parameters *KEEPALIVE* and *GOSSIP*. The results are displayed in Table 1. For each combination of parameters we have performed eight experiments and the results were evaluated by the average. In the column Warned there is a percentage ratio of the puddles the car already knew about when it crossed them to the overall number of passed puddles. Packets column contains the average number of packets that were transmitted during the dissemination of information for one puddle crossing.

Parameters		**Results**							
		20 cars		**40 cars**		**70 cars**		**100 cars**	
KEEPALIVE	**GOSSIP**	**Warned**	**Packets**	**Warned**	**Packets**	**Warned**	**Packets**	**Warned**	**Packets**
60	0.33	83.58%	3.65	94.51%	5.41	99.41%	10.31	99.75%	8.80
60	0.67	85.87%	5.83	96.49%	8.31	99.25%	7.32	99.75%	11.30
60	1.00	87.61%	7.57	97.27%	10.16	99.51%	11.84	99.78%	12.33
90	0.33	86.93%	3.64	96.98%	5.41	99.03%	7.43	99.76%	8.84
90	0.67	89.82%	5.57	98.09%	8.31	99.49%	11.80	99.76%	11.32
90	1.00	93.29%	7.71	98.24%	10.19	99.46%	10.42	99.78%	12.34
120	0.33	88.55%	3.51	97.36%	5.33	99.38%	7.38	99.74%	8.78
120	0.67	92.65%	5.85	98.50%	8.36	99.43%	10.39	99.74%	11.30
120	1.00	94.25%	7.60	98.54%	10.21	99.54%	11.85	99.79%	12.38

Table 1. Results of the Broadcasting Algorithm simulation.

Simulation results of the Repeating algorithm are displayed in Table 2. In addition to traffic density, that we changed in the same way like in the simulation of Broadcast algorithm we edited parameters *KEEPALIVE*, *SMALL* and *LARGE* for individual experiments. For each combination of parameters 8 simulation runs were performed and the results were averaged like for the Broadcast algorithm.

Parameters			Results							
			20 cars		40 cars		70 cars		100 cars	
KEEPALIVE	SMALL	LARGE	Warned	Packets	Warned	Packets	Warned	Packets	Warned	Packets
60	100	400	88.18%	4.01	97.62%	3.72	99.63%	6.11	99.82%	2.60
60	100	800	89.65%	6.17	98.31%	5.66	99.64%	5.53	99.81%	4.12
60	100	1200	91.07%	7.72	98.16%	7.01	99.63%	6.36	99.82%	4.86
60	200	400	87.64%	4.82	98.16%	4.26	99.73%	5.83	99.83%	2.89
60	200	800	91.09%	7.07	98.10%	6.31	99.74%	3.82	99.82%	4.33
60	200	1200	92.03%	8.59	98.38%	7.46	99.76%	5.75	99.83%	5.11
60	300	400	90.25%	5.57	98.09%	4.70	99.75%	5.11	99.82%	3.10
60	300	800	91.94%	8.15	98.38%	6.90	99.76%	6.19	99.81%	4.61
60	300	1200	91.67%	9.51	98.66%	7.89	99.74%	3.83	99.83%	5.35
90	100	400	92.61%	4.06	98.67%	3.76	99.61%	3.09	99.83%	2.63
90	100	800	95.59%	6.27	99.21%	5.69	99.64%	4.73	99.84%	4.06
90	100	1200	94.85%	7.91	99.28%	7.00	99.67%	5.72	99.84%	4.92
90	200	400	93.70%	4.91	99.12%	4.19	99.62%	3.39	99.84%	2.86
90	200	800	95.69%	7.18	99.30%	6.23	99.62%	5.11	99.84%	4.33
90	200	1200	95.96%	8.76	99.45%	7.35	99.66%	3.71	99.84%	5.11
90	300	400	94.58%	5.56	99.05%	4.80	99.71%	3.08	99.83%	3.14
90	300	800	96.10%	8.18	99.40%	6.93	99.76%	4.75	99.83%	4.63
90	300	1200	96.72%	9.48	99.31%	8.16	99.72%	3.46	99.84%	5.30
120	100	400	94.11%	4.01	98.95%	3.74	99.75%	5.16	99.83%	2.65
120	100	800	96.54%	6.18	99.37%	5.67	99.75%	6.04	99.84%	4.05
120	100	1200	96.76%	7.91	99.45%	7.05	99.76%	5.48	99.84%	4.89
120	200	400	95.50%	4.90	99.27%	4.25	99.77%	6.37	99.84%	2.91
120	200	800	96.81%	7.23	99.44%	6.27	99.73%	3.04	99.84%	4.32
120	200	1200	97.21%	8.93	99.44%	7.50	99.75%	4.75	99.84%	5.05
120	300	400	96.48%	5.77	99.32%	4.89	99.75%	3.44	99.84%	3.14
120	300	800	97.15%	8.26	99.45%	6.91	99.77%	5.48	99.84%	4.57
120	300	1200	98.22%	9.72	99.51%	8.20	99.77%	6.30	99.84%	5.34

Table 2. Results of the Repeating Algorithm simulation.

CONCLUSION

Simulation showed that the more complex Repeating algorithm provides more reliable results than the Broadcasting algorithm. Moreover, these results can be provided at lower communications costs, thus can prevent overloading ad hoc network.

One can also observe that a change of parameters has meaningful effect in sparse traffic only for both algorithms. With increasing traffic density parameter changes ceases to be meaningful.

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INSTRUCTION ADAPTATION MODELLING USING FUZZY PETRI NETS

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Abstract: *The aim of the Learning Management System – LMS is to direct communication as to the knowledge and abilities of a student, thus changing the amount and demandingness of materials submitted to him. In the theory of management there is an obvious transition from combination procedures to sequence chains and optimized processes. For the description and consecutive management of such teaching method can aptly be used Petri nets. By means of application of fuzzy logic into Petri nets originates a strong tool for the modelling of teaching processes, mainly thanks to comprehensibility and sophisticated mathematic mechanism, rather simple design, for the modularity of solution and robustness of the design.*

Keywords: Petri nets, fuzzy Petri nets, LMS, educational process, fuzzy rules.

INTRODUCTION

With the rapid advance of the Internet, e-learning systems have become more and more popular [1],[2]. An e-learning system provides the following functions: (1) delivery of learning content for students via the Internet; (2) record of learning progress and portfolio; (3) management of learning content, assessment and course; and so on [3]. One of the important advantages of e-learning is the adaptive learning environments, in which the providing of learning content must meet individual student's demand [4],[5],[6]. Adaptive learning environments have been proved that it facilitates student to learn more efficiently and effectively [7],[8].

The electronic education (e-Learning) and LMSs markedly contribute to the fulfilment of the dreams of many pedagogues, cyberneticists and theorists at the beginning of the third millennium. They were introducing their models in the early 20th century, but they had no sufficient tools to their effective implementation at that time [9]. E-Learning has brought many other automated components to the programmed learning. Most of the universities combine form of learning using one of a number of commercial or free LMS (CMS, LCMS). Learning Content (Course) Management Systems (LCMS) are mostly web-based systems that combine the management and administrative functionalities of LMS and CMS to author, approve, publish and manage learning content. They are developed to facilitate the collaborative creation of content, organization, control and to manage the publication of documents in a centralized environment [10],[11].

The target function of LMS managing the instruction is the direction of communication as to the student´s knowledge and abilities, thus changing the amount and demandingness of the materials submitted to the student. In the theory of management there is an obvious transition

from combination procedures to sequence chains and optimized processes (the strategy of continuous assessment of the student instruction reflection, and based on that, adaptation of the following instruction, is comparable with the dual principle of identification and adaptive management). For the description of the communication of a man with a computer it is suitable to use graphic tools [12], allowing for suitably describing and expressing the interaction. The teaching interaction between a student and an information system managing the instruction is a complex process, for which Petri nets should be applied. Another attitude to the description of true and real teaching procedures is an application of fuzzy modelling [13]. Most frequently, the personalization of e-learning courses is realized based on extracted knowledge of usage data by means of the web log mining techniques [14], [15], [16], however, we focus on the personalization using fuzzy Petri nets.

1. DESCRIPTION OF TEACHING PROCESSES USING FUZZY LOGIC

If we want to describe all teaching processes in details, it would lead to an enormous number of detailed information, which nobody could be able to read. If so, then a natural language would be needed in order to understand the essence of what is described in them; however, it will result in an inaccurate characteristics. If it be to the contrary, it would inescapably be lost in exact details, since human psychic has only limited possibilities. It turns out that accuracy is only an illusion, since, on principle, it is unreachable. All these facts stand in the background of considerations of the founders of fuzzy logic [17]. Nevertheless, fuzzy logic arises from the theory of fuzzy aggregates and is focused on vagueness, which it mathematically describes. In this context, fuzzy aggregate is a set, which, besides a full or null membership, allows also for a partial membership. The function, which assigns the degree of adherence to each element of the universe, is called adherence function. Fuzzy theory tries to cover reality in its inaccurateness and vagueness, and during its almost 40-year-long existence it has earned a good reputation in terms of solving several technical problems, which could not have been handled in the practice by means of other means. It is possible to gradually assign each element the so-called degree of adherence, which expresses the rate of adherence of the given element to the fuzzy aggregate. In classical determination, in this case, it is rather difficult to define the limit of what is still allowed and what is already not allowed. It can be done by allocation of a number from the <0,1> interval, which expresses the measure of our confidence. The task of the fuzzy theory is to catch the vaguely specified requirements in the query and adequately calculate the degree of adherence to it. Fuzzy logic allows for using vague requirements either directly, or can simply represent them [18].

2. DESIGN AND CREATION OF EDUCATIONAL MODEL USING PETRI NETS

The advantage of teaching processes modelling using Petri nets is their formal description complemented by a visual graphic representation. This allows for a precise and exact specification of the process, thus removing ambiguity, vagueness and contradiction. Besides the visual graphic representation, Petri nets have also a well-defined mathematic basis, which can be advantageously used in various software tools for the specification and analysis of computer solved company processes. For the description of teaching processes, such as going through the study material in e-learning education, mathematical and graphic methods can be suitably used, where serial machines are mostly used, which, however, have certain limitations. The issue can be preferably solved using Petri nets, thanks to their precise and accurate specification. For extensive teaching materials, where links among individual

activities can be described only partially, it is suitable to build in fuzzy logic into classical Petri nets [19].

2.1 Petri nets vs. fuzzy Petri nets

Petri nets are one of the most frequently used tools for modelling and designing complex systems with parallel processes and hierarchic structure. They have innumerable applications in the area of data processing, parallel programming, operating systems, distributed databases and management of complex processes of any kind including the designing and modelling of information systems. Petri nets are capable of simply modelling the synchronization of processes, parallel operations, conflicts or source assignment.

Let us give an example of the description of a simple process of communication with the information system using Petri nets. The particular places in the net represent the following operations: log-in, log-off, information display, information update, form filling and form depiction [20].

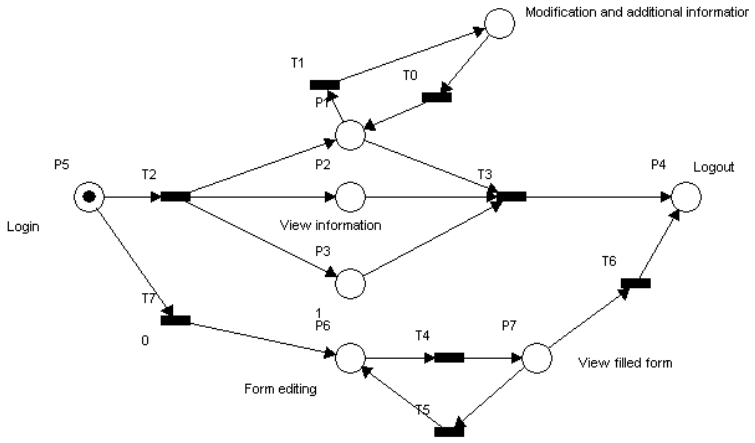


Figure 1. Process model in Petri net.

When simulating any processes using Petri nets, we sometimes encounter the necessity to depict the status, of which we are not sure , whether it would happen or not. For the formation of such a net we can come out of the classical logic and of the fuzzy logic. Token is contained in the place, if the expression is true (1), or it is not contained, if it is false (0). But if we do not know whether it is contained or not, we can use fuzzy logic, which acquires the values from the aggregate (0,1), i.e. the expression can be fulfilled only partially, somewhat, roughly, little, much, and the particular values 0.2, 0.4, etc.

Incorporating the fuzzy logic into the classical Petri nets can be realized in this way: We draw from the definition of the fuzzy logic Petri nets.
FLPN = (P,T,F,M_0,D,h,a,θ,l) where
P = {p_1, …, p_n} is the finite set of places,
T = {t_1, …, t_m} is the finite set of transitions,
F$\subseteq$ (P x T) $\cup$ (T x P) is the flow relation, where
$\forall t \in T\ \exists p,q \in P : (p,t) \vee (t,q) \in F$,
M_0: $P \to \{0,1\}$ is the initial marking,
D is the finite set of statements – $P \cap D = T \cap D = \varnothing, |P| = |D|$,
h: $P \to D$ is the associated function, representing the bijection from the place to the statement,

a: $P \to [0,1]$ is the associated function representing the value in the place out of the set of real numbers 0 through 1,

θ,l: $T \to [0,1]$ is the associated function representing the transition through the value out of the set 0 through 1.

For $\forall p \in P$, the following marking applies:

$M'(p) = M(p) + 1$, if $p \in t^{\bullet} - {}^{\bullet}t$;

$M'(p) = M(p) - 1$, if $p \in {}^{\bullet}t - t^{\bullet}$;

$M'(p) = M(p)$, otherwise,

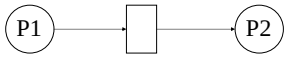
$\alpha(p) = \lambda_t \alpha(p')$ if $\alpha_1 \geq \theta_t \wedge p \in t^{\bullet} \wedge p' \in {}^{\bullet}t$.

For $t \in T^{AND}$ $\alpha(p) = \lambda_t \min_{\forall p' \in {}^{\bullet}t} \alpha(p')$ applies, if $\min_{\forall p' \in {}^{\bullet}t} \{\alpha(p')\} \geq \theta_t \wedge p \in t^{\bullet}$

and for $t \in T^{OR}$ $\alpha(p) = \lambda_t \max_{\forall p' \in {}^{\bullet}t} \alpha(p')$ applies, if $\max_{\forall p' \in {}^{\bullet}t} \{\alpha(p')\} \geq \theta_t \wedge p \in t^{\bullet}$.

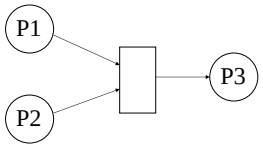
Now, let us express, by means of Petri nets, the rules of the IF-THEN type and their transformation into the fuzzy logic:

The rule IF P1 THEN P2 will be expressed as



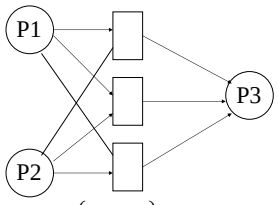
and in the fuzzy logic $\alpha_2 = \lambda_t \alpha_1$ if $\alpha_1 \geq \theta_t$.

The rule IF P1 AND P2 THEN P3 will be expressed as



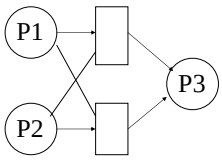
and in the fuzzy logic $\alpha_3 = \lambda_t \min_{\alpha_i \geq \theta_{t^{AND}}} \{\alpha_1 \alpha_2\}$ for i=1 ∧ 2.

The rule IF P1 OR P2 THEN P3 will be expressed using inhibition edges as



and in the fuzzy logic $\alpha_3 = \lambda_{t^{OR}} \max_{\alpha_i \geq \theta_{t^{OR}}} \{\alpha_1 \alpha_2\}$ for i=1 ∨ 2.

The rule IF P1 XOR P2 THEN P3 will be expressed using inhibition edges as



and in the fuzzy logic $\alpha_3 = \lambda_{t^{XOR}} \alpha_1$ if $\alpha_1 \geq \theta_{t^{XOR}} \wedge \alpha_2 = 0$,

$\alpha_3 = \lambda_{t^{XOR}} \alpha_2$ if $\alpha_2 \geq \theta_{t^{XOR}} \wedge \alpha_1 = 0$.

Such definition of FPN comes out of the definitions of the transfer of the classical logic into the fuzzy logic.

In the following table the survey of basic functions will be described.

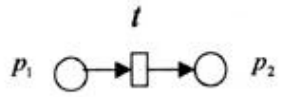
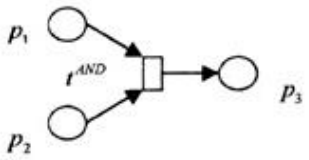
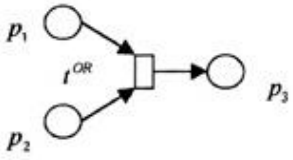
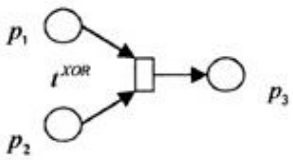
No.	Rules	Logical Petri Nets	Fuzzy Computing
1	IF d_1 THEN d_2		$\alpha_2 = \lambda_t \alpha_1 \quad if\ \alpha_1 \geq \theta_t$
2	IF d_1 AND d_2 THEN d_3		$\alpha_3 = \lambda_{t^{OR}} \min_{\substack{\alpha_i \geq \theta_{t^{OR}} \\ i=1 \wedge 2}} \{\alpha_1, \alpha_2\}$
3	IF d_1 OR d_2 THEN d_3		$\alpha_3 = \lambda_{t^{OR}} \max_{\substack{\alpha_i \geq \theta_{t^{OR}} \\ i=1 \vee 2}} \{\alpha_1, \alpha_2\}$
4	IF d_1 XOR d_2 THEN d_3		$\alpha_3 = \begin{cases} \lambda_{t^{XOR}} \alpha_1 \ if\ \alpha_1 \geq \theta_{t^{XOR}} \\ \quad \wedge \alpha_2 = 0 \\ \lambda_{t^{XOR}} \alpha_2 \ if\ \alpha_2 \geq \theta_{t^{XOR}} \\ \quad \wedge \alpha_1 = 0 \end{cases}$

Table 1. An outline of basic functions of logical rules of Petri nets [21].

3. INSTRUCTION ADAPTATION MODEL USING FUZZY RULES

For the specification of a concrete model of adaptation of teaching we have to define model inputs first. Let us assume that we are able to name these input information:

3.1 Definition of the model of adaptation

Inputs

environs = {very bad, bad, good, very good}
motivation = {low, average, high}
memory = {very good, good, average, bad}
concentration = {low, average, high}
regime = {very good, good, bad}
time of teaching = {improper, suitable}
length of learning = {very short, adequate, very long}
time = {very short, short, average, long, very long}
reading = {easy, normal, thorough, difficult, extraordinary}
attitude = {low, average, high}
theory = {very little, little, average, a lot of, very much}
examples = {very few, few, average, a lot of, very many}

Outputs

knowledge = {excellent, very good, good, poor, very poor}
understanding = {excellent, very good, good, poor, very poor}
application = {excellent, very good, good, poor, very poor}

Rules

IF (environs = very bad AND concentration = low) THEN knowledge = very poor
IF (motivation = low AND time of teaching = improper) THEN understanding = very poor
IF (memory = bad AND regime = bad) THEN application = very poor
IF (environs = bad AND length of learning = very long) THEN knowledge = poor
IF (environs = good AND reading = extraordinary AND attitude = low) THEN knowledge = poor
IF (motivation = average AND time = very short) THEN understanding = poor
IF (memory = average AND theory = very little) THEN application = very poor
IF (concentration = average AND examples = very few AND) THEN comprehension = bad
IF (regime = good AND time of learning = suitable AND reading = extraordinary) THEN understanding = bad
IF (time of teaching = suitable AND reading = thorough AND theory = extended) THEN knowledge = poor
IF (memory = very good AND length of learning = adequate AND examples = very few) THEN understanding = poor
IF (reading = difficult AND theory= a lot of AND attitude = average) THEN knowledge = poor
IF (regime = very good AND time of teaching = suitable AND examples = few) THEN understanding = poor
IF (memory = bad AND time of teaching = improper AND attitude = low) THEN application = very poor
IF (memory = good AND length of learning = adequate AND theory = adequate) THEN knowledge = good
IF (reading = normal AND time = average AND examples = adequate) THEN understanding = good
IF (environs = very good AND theory = adequate AND examples = adequate) THEN application = good
IF (time of teaching = suitable AND memory = good AND theory = adequate) THEN knowledge = very good
IF (memory = very good AND reading = easy AND examples = adequate) THEN understanding = very good
IF (motivation = high AND time = long AND examples = many) THEN application = very good
IF (time of teaching = very short AND reading = difficult) THEN knowledge = very poor
IF (time = short AND attitude = high) THEN application = very poor
IF (time = very long AND reading = difficult AND examples = few) THEN understanding = poor
IF (concentration = high AND examples = a lot of AND time of teaching = suitable) THEN understanding = excellent
IF (environs = very good AND memory = very good AND theory = adequate) THEN understanding = excellent
IF (motivation = high AND memory = very good AND time of teaching = suitable) THEN knowledge = excellent
IF (reading = thorough AND attitude = adequate AND theory = adequate) THEN knowledge = excellent
IF (concentration = high AND time of teaching = suitable AND examples = a lot of) THEN application = excellent
IF (reading = normal AND regimen = fair AND concentration = high) THEN application = excellent

The first rule can be expressed by means of the Petri net:

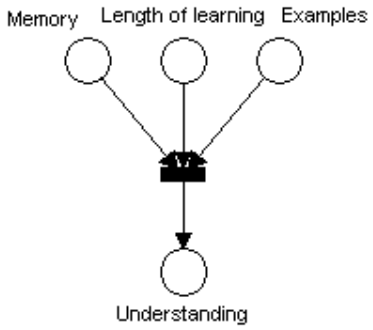


Figure 2. Formulation of the rule using Petri nets.

Similarly, we can create Petri nets for other rules and interconnect them.

CONCLUSION

Basic requirements, which are imposed on LMS (Learning Management System) from the point of view of the needs of a teacher, are to present the contents of instruction, manage the instruction, communicate with students, motivate them to study, observe their progress and evaluate them. The bottleneck of the description of all these processes realized within LMS is the formalization of the description of obligation of individual operations and management of individual activities. Therefore, for the provision of a good quality management of e-learning education it is suitable to integrate the classical LMS with the process system. This integration will allow for changing the way through the study of teaching materials and other compulsory activities of a student. Individual parts of teaching materials are automatedly activated by means of the process system, i.e. that LMS provides for the advancement of functions for students, thus passing messages to the process system, which assesses it and makes an advancement in the process map [20].

By the application of fuzzy logic into Petri nets originates a strong tool for the modelling of educational processes, mainly thanks to:

- understandability and sophisticated mathematic mechanism,
- rather simple design,
- modularity of solution – it is possible to add and remove individual module without the necessary complete re-working of the whole system.

Robustness of the design, i.e. the system, need not be adjusted in case of a change of parameters of solution of the task within the framework of a certain environs.

LITERATURE

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INNOVATIVE TEACHER IN RECESSIONARY TIMES

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Abstract: *The paper makes a small contribution to a growing body of evidence on what comprises effective, efficient and engaging teaching in specific educational settings. Learning and teaching methods and designs that might work very well in resource-rich educational settings may not work very well in more challenging contexts (1). By using model of the university teacher at the Department of Informatics it is shown how already implemented communication and information technologies can improve teaching process and prepare competitive graduates for IT positions in Armed Forces and joint multinational deployments.*

Keywords: innovation, recession, education, time management tool, virtualization, self-learning.

INTRODUCTION

Current problems in education resulting from the recession can be outlined as decreasing teachers and student morale, reductions of teachers and supporting staff, decreasing salaries and an insufficient resources (financial and equipment). Teachers must adapt to the current economic situation and react in an appropriate manner, use available communication and information technologies in order to (a) better organize their time, (b) continuous self-learning (c) enrich learning environment (d) interact with colleagues and students, and prove their personal agility (2) (3).

By using model of the university teacher at the Department of Informatics it is shown how already implemented communication and information technologies can improve teaching process and prepare competitive graduates for IT positions in Armed Forces and joint multinational deployments. It is shown that the use of wide spectrum of available on-line services and resources together with virtualization can substitute, to some extent, a lack of IT equipment quantity and/or quality.

1. SETTING THE STAGE

Learning should prepare students theoretically and practically in the studied field, it gives them understanding of relevant concepts, methods and approaches and helps them to become fully developed human beings. Military education and training is characterised as a process of establishing and improving capabilities of military personnel in their respective roles. The department of informatics as part of the Armed Forces Academy plays an important role in educating future warriors with focus on information technologies (IT). Because the area is broad and under permanent development there is a permanent pressure on teachers and students to quickly and effectively learn and absorb new information. Because the military budget decreased in the past due to world economic recession, organizations (including our Armed Forces Academy) seek for internal reserves to continue in their business. University teacher plays an important role in military education; he must adapt to current economic

situation and react properly. As noted in the introduction, following discussion will be focused on five areas where improvements are required, visible and they do not always ask for additional (financial) resources.

1.1 Time management

Both students and teachers become addicted to instant accessibility and immediate response to our colleagues, friends and family as well. We moved from scheduled meetings and off-line communication (e-mail) to text messages, instant messengers, blogs which send an e-mail notification for every update, social networks telling us everything about our friends' activities and on-demand multimedia communication. Instant communication negatively affects our ability to control our time and makes us „slaves" serve to personal and work messages in fear we would lose out.

The phrase "time management" is self-explanatory and translate into administration of time. The basic concept of time management is an effective use of time in realization of the task at hand. Experts believe that the following are a few considerations for efficient time management:

- prioritizing the tasks at hand in the order of importance and based on the resources available,
- advance planning and use of the time available in the most efficient way,
- control distractions and deviations that break the smooth flow of the work according to the schedule,
- increase the efficiency and reduce the stress on the schedule and the personalities involved in the project (4).

Even there is a lot of time management tools (paper planner or its electronic form) modern innovative teacher expects that time management tool will be handy, usable and garbage-free. Handy means to have your paper planner or notebook (smartphone, PDA, …) always with you. It is not uncommon that students try to arrange meeting (consultation) with teacher immediately after the class or later somewhere in campus. The word usable represents a feature of the system that combines your work and personal entries (messages, notes, contacts etc.). Garbage-free is usually a mobile electronic device (can't hold any paper) but for paper planner it means that if you shake it, nothing will fall out. Another note to garbage-free electronic time management tool – software has a plenty of features, use those you need and do not fill information that you do not use, but can be stored in.

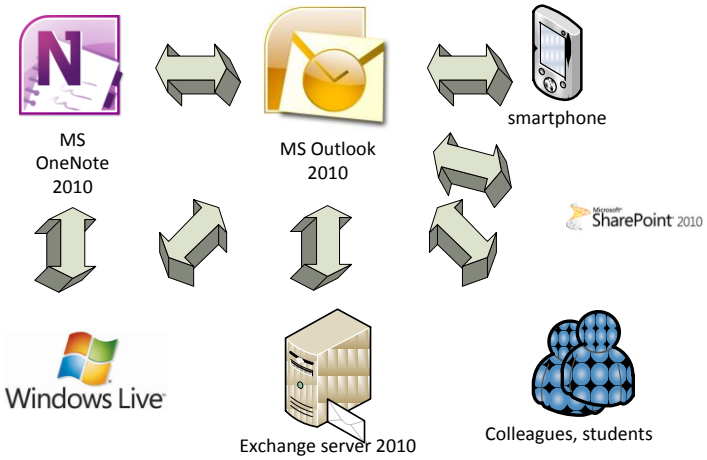

Figure 1. Time management tool.

As a proven and reliable time management tool I use Microsoft Outlook (currently in the version 2010) with all supporting and cooperating applications. Outlook is a tool to access my personal and work contacts, e-mails, tasks and meetings. The data is stored and secured in a university Exchange server, they are synchronised to my smartphone and windows live portal. No matter where I am, I have all information with me and changes made from web interface, smartphone or outlook client are distributed over exchange server and live portal. Outlook manages all my e-mails from different mail accounts and helps me to keep track on existing communication threads, unifies my personal and work contact lists and more. Sharing and assigning tasks, contacts and planning meetings is easy in this environment and for those not using the same system there is simple and effective html selective export capability.

For those not actually owning license for Microsoft Outlook there is windows live service available on-line (http://live.com) with great functionality and high availability. After free registration you will get huge space to store your files, pictures, contacts, e-mails and you will also get platform for creating, editing, sharing documents, creating on-demand working groups communicating and accessing social networks at the same time.

Even in recessionary times and limited budgets for buying new software and hardware this approach is not asking for money, it is here for students, teachers and others to take advantage of knowledge and existing infrastructure.

Once you have powerful time management tool it is especially important to structure your workday. It follows with some of the well-known time management strategies of structuring your time when you are focused on particular tasks, not multitasking and not susceptible to distraction.

Clinical psychologist and certified life coach tells „A powerful habit to develop that takes advantage of concept of full engagement is to set aside 90 minutes of "full engagement" each day. This means concentrating for 90 minutes on accomplishing a task with no interruption. That means no other people to answer to, no land line or cell phone, no SMS and no e-mail. If you dedicate yourself to that 90-minute period every day, you will be amazed at how much you can accomplish in the long term“ (5).

To conclude the topic - do not be dissatisfied if your approach to time management is not perfect at once, there is a lot of tools and approaches to choose from, it's taken me years to create a time-management system that's just right for me.

1.2 Self-learning

In times of financial crisis, when headlines speak more about layoffs and funding gaps than achievement gaps or the infusion of new technologies, educators have an imperative to focus on growing as professionals. It is a common refrain, but a good teacher, like any good professional, never stops learning. Today's educators must "stay abreast of education trends - whether by reading professional association periodicals and journals, or books, magazines and newspapers; through conversations with peers or experts in particular issues; or through their own action research or professional development experiences" (6).

Thanks to investments to information technologies done in past, self-learning using on-line resources requires only time, internet connection and initial orientation. Leaders in IT development take care of customers and created learning centres both paid and free of charge.

As orientation of Department of Informatics is naturally on computer science, I use specific places used by teachers, instructors and content creators to exchange class presentations, training resources, software, tools, podcasts and videos (for example Microsoft Faculty Connection, The Cisco Learning Network, etc.).

Because on-line material is multimedia rich and spread across multiple locations, it was sometimes difficult to me to find the resource I used in past. Even when I downloaded e-book or pdf version of material, it was difficult for me to take effective notes in electronic form (from lectures, from web for later reference or citation) available anytime and anywhere. Currently I use Microsoft OneNote - Figure 2 as tool for making private and work notes in the electronic form. I use the product to make notes from meetings, during search over internet resources and more. Templates available in OneNote simplify common tasks, and I can assign tags to my notes. In case that I need to create a task, it is easy to send it to MS Outlook and of course received e-mail can be send to OneNote as well. Everything I copy and paste from the web browser to OneNote has URL address associated and I can easily find the source of the information later. The product is well integrated with Microsoft Outlook and live.com (Figure 1) and allows sharing content between groups of users. It is not a problem to stop work in the office, go home or virtually anywhere with internet connection, synchronize your notebook and continue research with no delay. OneNote provides adequate search capabilities and take care of automatic save of entered information. Export of stored information is easy and sensitive parts of workbook can be password protected.

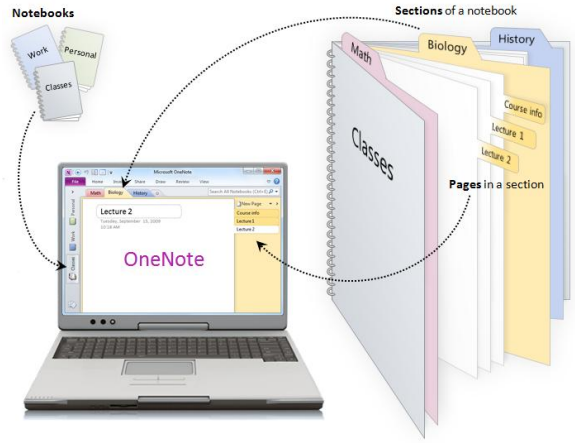

Figure 2. OneNote – concept of notebooks.

1.3 Enriching learning environment

Enriched Learning Environment (ELE) provides a way to create and maintain high-performance and compelling environment for teaching. Because information technologies taught by the Department of Informatics is an area with rapid development and demand special professional skills, a selective student focused approach for teaching is applied.

"An effective learning environment can be developed by focusing on four dimensions of the environment.

- A Focus on Meaning - meaningful learning, growth in performance, and creating processes/products that make a difference in the world. Embedding meaning in the context and artifacts of the environment.

- Support for Each Person - align each person with their talents--what they like doing and what they do best, safe environment for taking risks, create alignments with values and interests of individuals, opportunities for professional growth, feedback.
- Structure for Each Person - clear performance criteria, scope, schedule, challenge and resources.
- Collaboration that Adds Value - Supporting others, using effective practices such as assessment and compelling goals.

The quality of a learning environment is measured along six dimensions:

- Meaning
- Learning and Growth - Do people find meaning in the learning, are people growing their performance levels?
- Support for Each Person - is each person treated as an individual, receiving feedback,
- Structure for Each Person - are there clear performance criteria, scope, schedule, challenge and resources?
- Collaboration that Adds Value - are people supporting others, is assessment adding value, how?
- Energy" (7).

As an example how ELE can be used during labs I use managing active directory in Windows 2008 environment scenario. The subject has a high demand both on hardware and software resources and traditionally was live demonstrated by teacher on one installation. Students had no chance to try configuration. After using ELE approach – Hyper-V technology was used, every student in the class has own instance of training environment and can configure the system personally. Moreover, it can take his image file after lab and continue to work at home later.

If sufficient hardware infrastructure is missing, or there is no time or software licence for evaluating / teaching specific application, you can try to use Microsoft virtual labs (http://www.microsoft.com/events/vlabs/default.mspx). The site provides testing environments and lessens for IT professionals, developers and IT and Business Decision Makers. Microsoft Virtual Labs provides free, quick and professional working environment to learn and test commercial products – ideal for students and teachers to save money and time and be connected with the latest technologies.

1.4 Interact with colleagues and students

Meeting colleagues and providing a time for reflective questions and feedback, modern teachers can enhance their own instruction and gain new ideas from others. This approach helps a modern teacher to seek advice about pedagogy, student engagement and ideas for areas of research.

To help students to adapt to new (military university) environment and start to be effective from the very first semester, introduction to on-line searching and classification of information is made followed by time management lesson and take lecture notes orientation. Once students have sufficient knowledge in IT area, accent is made to get awareness about working in on-line shared environment and working remotely. Especially network infrastructure oriented study plan relays on remote configuration of network devices and operating systems. ELE approach can help to prepare students for their first professional positions in the armed forces.

Even both students and teachers intensively use IT to communicate, learn, and teach (shop, entertainment, etc.) it is time to promote cultural change of the information-sharing paradigm from "need-to-know" to "will-to-share". In ELE approach it meens to provide all available

not „just necesairy“ learning materials and engage all participants to participate in sharing the resources.

1.5 Show signs of personal agility

“Agile people conceive and approach the world and their assigned tasks differently from those who are less agile. In general, agile people have a propensity to seek improvements, are more willing to consider information that is at odds with preconceived notions, and are more willing to be different and take risks. These basic characteristics can be enhanced or suppressed by education, training, and culture” (8).
It is important for teacher to be agile and collaborative leader, because taking on leadership roles enables him to see connections among student needs, system demands, and university policies and need to become involved in leadership is more critical now than ever.

CONCLUSION

Even in recessionary times, it is expected that the university teachers be viewed as competent, professional and innovative (agile) teachers. Effective use of IT can support a modern teacher in many ways often without demand for additional financial and equipment resources.
University teachers face higher workloads as result of work positions reductions and financial problems that affect salaries and amount of equipment and supplies. Flexibility, creativeness and innovation can overcome many problems and if demonstrated properly both to students and other colleagues can create momentum to make education at given department/ university attractive and effective. Teachers should manifest a positive attitude and enthusiasm even in recessionary times and not forget to continual self-learning and bringing new ideas and thoughts to students, which will increase their market value once recessionary times are over.

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CONTEMPORARY TRENDS IN LANGUAGE TRAINING - PRACTICAL IMPLEMENTATION OF ICT IN TERTIARY EDUCATION

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Abstract: *The latest research demonstrates that one of effective ways to influence students' motivation and study results in foreign language learning positively is the implementation of information and communication technology (ICT) in the educational process. A significant role while choosing appropriate ICT is played by teachers' as well as individual students' attitudes to this technology. This thought is a base for both contemporary work and research of the Language Training Centre of the University of Defence in Brno, which is dealt with in the first part of the article. The next part considers possibilities of students' involvement into the process of creating study supports, especially for teaching and learning specific terminology. The co-operation with students enables their more active participation in the study material preparation and during the lesson itself.*

Keywords: ICT in tertiary education, LMS Barborka, web-based videoconferencing, study support, students involvement.

INTRODUCTION

When ICT became an integral part of the educational process, along with it came possibilities to create and develop new approaches of teaching and learning. New technologies have brought a qualitative change to the educational process, such as the possibility for "real-life simulations" and the introduction to a larger degree of learner-centred approaches both of which are to lead to learners being less fearful of the failure and/or the loss of the social status. The successful use of multimedia technology in the language training requires, however, an approach to learning that harmonizes the content of the message with the technical potential of the particular technology chosen.

The development of ICT has also led to significant changes in the ways we perceive how foreign languages are learned and taught. The traditional concept of "face to face" teaching is in some cases complemented by the use of different forms of ICT, in other ones it is even replaced by the technology itself. Language learners can use multimedia, have access to the Internet and foreign language documents on the World Wide Web. They can communicate with their teachers, classmates, colleagues and native speakers electronically. New directions in incorporating ICT in the language training are driven by the easy access to sources of information on the Internet and by enhanced possibilities for communication. If ICT has become a means to improve and facilitate human activities in a variety of fields, it is important to consider its use in improving and increasing the efficiency of foreign language learning and teaching. If used wisely from a methodological and technical perspective, these technologies have a significant potential to be employed and exploited for foreign language learning in the 21st century. Indeed, educational policies of individual EU countries already underscore the significance of ICT for the field of education [3].

One of important changes dealing with foreign language learning and teaching is Computer - Assisted Language Learning (CALL), which has come of age with the advent of a new phenomenon, referred to as Network-Based Language Learning (NBLL). According to Warschauer, it is a language teaching approach that involves the use of computers connected to one another in either local or global networks. NBLL represents a new and different approach to CALL, in which the human-to-human communication is the focus. Language learners can communicate with each other or with their teachers, possibly native speakers in far away locations, regardless of the place and time. Recently new exciting developments have taken place in this area. There appeared e.g. blogs, wikis, podcasting, Web 2.0 and 3.0 applications, distance learning devices, computer mediated communication tools, virtual worlds and interactive boards [7].

As the choice of ICT tools available for language teaching is really wide, the task of teachers is to select the appropriate ones in accordance with the needs of students, their computer abilities and the purpose of the language study. When the decision is made, it is necessary to take into account that all the materials have to be methodologically processed so that the use of ICT for language learning was not accidental and the development of all language skills was facilitated. The positive approach to ICT can be achieved both on the side of teachers and students by finding out their preferences, which can enhance their motivation [4].

Teachers of the Language Training Centre (LTC) of the University of Defence (UoD) apply ICT in variety of ways. Their primary goal is to develop and practise all four language skills equally. Nevertheless, all ICT tools do not enable to do it at the same time, so we use the following:
- LMS BARBORKA to practise reading comprehension and writing,
- Web-based videoconferencing technologies to practise listening comprehension and speaking.

These two possibilities were chosen by teachers but after some period of implementation we wanted to know what students' attitudes are. We decided to carry out a qualitative research, semi-structured interviews, to find out if the teachers' and students' opinions are similar and to what extent.

1. QUALITATIVE RESEARCH: ROLE OF ICT IN LANGUAGE TRAINING

The research, task of which was to find out what technologies students choose to study a foreign language and how their choice influences the study of a foreign language, was carried out at the LTC of the UoD. Apart from that, the authors were interested in the role of ICT within university language training with the emphasis put on the development of particular speech abilities, and, last but not least, attitudes students assume towards using ICT; if and how they really use ICT in foreign language studies. We also tried to find out if the results can provide information applicable to creating long term prospects of using ICT in language training. Via analysing crucial factors (personality and technology) we tried to point out possible stimuli that can work as accelerators in the process of using ICT in university students' language training. Thus, the research target was represented by the relationship between a university student and his/her second language studies and ICT [2].

As a research method we chose semi-structured interviews. We recorded all of the interviews and then we made written transcriptions of the recorded interviews and analysed them. The

first part of the analysis was represented by open coding, which is, according to Strauss and Corbin, an analysis of data, its conceptualisation and synthesis. This means an analysis of a sentence or a paragraph and the assignment of a name – something that substitutes or interprets a particular phenomenon [6]. We compared individual interviews in the way that similar phenomena were assigned same names.

As soon as we identified particular phenomena in the data, we started to arrange the concepts into groups. The process of arranging the concepts, which seem to belong to a particular phenomenon into groups, is called "categorization". We named most of the categories in the way to relate as much as possible to the data they represent and to recall what they refer to. We borrowed some names from professional literature. In some interviews we found words that immediately attracted our attention and that we could use, so called "in vivo codes". We set abilities within individual categories (feature or characteristic belonging to the category). Then, we divided them into dimensions that helped us express the abilities on the scale. Following categories appeared most frequently: activities, time, evaluation, use possibilities, personal preferences and development, ICT devices, sources.

The next part of the analysis was represented by axial coding that helped us arrange acquired data after open coding in a new way; via connection among categories. Such arrangement runs in the spirit of a coding paradigm which includes conditioning aspects, context, strategic action, interactions, and consequences. Very simply said, the model looks like this:

(1) casual conditions → (2) phenomenon → (3) context →(4) intervening conditions → (5) strategic action and interaction→ (6) consequences [6].

This model enables a systematic interconnection between individual categories and subcategories.

The last part of coding is selective coding. This is a process in which one central category is chosen. The central category is then systematically introduced in relation to other categories. The acquired data are systematically developed into such a picture of reality that is conceptual, understandable, and confirmed. We reached this goal by inserting a framework of a story, and explicating the story in an analytical way. In practice it means that it is necessary (as well as with open and axial coding) to name a central phenomenon which then becomes a central category that is to be developed in the sense of its features.

2. FINDINGS

ICT completely change the perspective on educational process, and, generally, on second language learning, too. All participants' answers were very positive. The most frequently mentioned ICT device was the Internet, at the same time students gave reasons for their choice. The reason of the choice which was stated frequently was utility and suitability of a chosen activity. The comparison with the classical teaching-learning process appeared very often, too. This comparison ended up in favour of lessons where ICT were used in:

"*This way of learning is much easier in comparison with the classical one; it is simpler and I have a feeling that I understand everything better*." (Tom)

The reason for this may be found in the aspect of informality that appeared in lessons where ICT were used, and also an individual feeling of own "choice". Students mentioned the

opportunity to choose time and place of studying. The significance of educational environment certainly plays an important part. If students feel relaxed in a given environment, they don't fear getting disgraced in front of their teacher or classmates, then lessons where ICT are used are preferred to the classical lessons:

"The fact that I can be in my room alone and nobody disturbs me, or I can be in the classroom with someone in front of whom I am not afraid to make a mistake and I can focus in a given topic".(J.P.)

The time and place are not the only factors important for students' choice. It is, above all, the choice of the activity because students are aware of their weak points. The possibility to practise skills the students are not very good at in a way that is attractive to them is a motivating factor to use ICT in their studies. Apart from individual activities, their combination is being also mentioned. The most commonly appeared combination is listening and speaking. One of the best ways to study a foreign language is a stay abroad. If such a stay is not possible, it is desirable to find a corresponding way to reach one's goal. It can be substituted by the native speaker or the Internet and all the possibilities it can provide. Besides the above mentioned combinations of activities we find very important to mention the fact that university students and modern technologies belong together:

"I cannot imagine my studies without a PC. I can find a lot of material in the Internet; everything is much easier with a computer, but I have already said so." (Susan)

Knowledge of foreign languages and computer literacy are key skills to make a good career:

"Well, I am going to mention two things. There is a great development in technologies, there are many web pages in English, everything is much more worked out, easier, and more entertaining. When I am going to make my career, everybody will ask me about my knowledge of foreign languages and ICT. And a driving licence, of course". (Kamila)

From the analysis of semi-structured interviews followed that students mainly appreciated the possibility of the choice of educational environment and time, and also pointed out the close connection with ICT, which can facilitate their language practice of individual skills. Important factors which motivate them to use ICT are their own pace while studying, individual perception of improvement and the use of ICT outside the educational process. If they realize that ICT is helpful in their private lives, they are willing to use it also while studying. They see ICT as the prerequisite for their future personal development as computer literacy and language knowledge create significant conditions for getting appropriate jobs.

3. STUDENTS' ACTIVE ROLE IN THE EDUCATIONAL PROCESS

The implementation of ICT into language training is the first step of the achievement. The following one is in accordance with constructivist theory to enable students' active participation in the lessons. In the first phase students co-operate with teachers on the choice of suitable topics for Web-based videoconferencing and were offered a specific portal called "Talking to learn" for chatting and further discussions on the topics.

In the second phase students' participation is reflected by their own choice of vocabulary areas needed for their future specializations. Students of the 1st form of the master study

programme were asked to use their knowledge of specialized military subjects as well as military training and help us with the creation of study supports for the courses of Military English and English for Management. They agreed with great enthusiasm because they can utilize the gained information and practical military training. In addition the chosen students have a very high level of English (Stanag SLP 3), are interested in military and have a plenty of authentic literature. Teachers and these students co-operate on methodological processing of authentic texts to tailor them for e-courses and future e-book. The students' involvement motivates both sides of the educational process and influences them qualitatively. Teachers profit from students specialized updated knowledge of the topics, students combine their knowledge from specialized subjects with English and ICT, and thus their knowledge becomes complex. From the pedagogical point of view, teachers and students become active partners in the educational process, so they both share the responsibility for students' study, which is one of the basic goals of tertiary education [1].

CONCLUSION

The recent development proved the irreplaceable position of ICT in foreign language teaching. However, we are aware of the fact that ICT implementation itself should not prevail in the teaching environment and the personal development of both teachers and students has to be the main priority of the educational process. E- learning can be useful and efficient only if it works as the part of the well-planned and sufficiently supported system of education and if students are properly motivated. ICT implementation in the educational process consists of two parts, pedagogical and technological, where the pedagogical one still plays the crucial role [5], [8].

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KNOWLEDGE SYSTEMS AND DISTANCE LEARNING

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Abstract: *The need for professionals who are able to work with knowledge in companies and organizations leads to the reflection on the sources and content of preparation. The starting point is the experience gained in solving the military research project MENTAL. The article describes the problems of preparation of knowledge engineers and steps to create a knowledge base. They include analysis, design, creation and verification of an ontology, the implementation of the ontology into the ATOM2 environment and complementation of the knowledge base. The process in modeled by the education of students. The knowledge systems have a potential for the distance learning, because the knowledge could be divided into suitable parts, dynamic connected, and eventually changed.*

Keywords: Knowledge System, ontology, Army of the Czech Republic, MENTAL, ATOM2, TOVEK, distance learning.

INTRODUCTION

The development of information and knowledge society needs well trained professionals who will be able to work with knowledge in commercial enterprises, organizations and government institutions, and will be able to innovate controlling, manufacturing, service and administrative processes. The interest of the European Commission in this matter is declared by means of the aims in the Strategy i2010 to develop the information society [1] and its innovations for the period till 2020 [2].
Meeting such demands is not an easy task. Therefore, besides an increase in the potential of knowledge, the students should develop creative skills and personality traits that would lead them to the enhancement of their problem solving skills.
The issue of Knowledge Management and creation of knowledge-based systems is urgent and relatively new, still under dynamic development; but in practice, some of the knowledge systems have been successfully implemented, as well as the principles of work with knowledge, such as lifelong learning [3]. The knowledge systems have a great potential for the distance learning, because the study of knowledge is divided into suitable parts that can be dynamic connected, and eventually changed.
The first part of the article shares the experience of development of the Knowledge Management System (KMS) MENTAL [4]. The second part of the paper deals with the application of this experience in teaching of students and explains the possibilities of the KMS in distance learning.

1. THE KNOWLEDGE SYSTEM MENTAL DEVELOPMENT

A precondition for the successful solution of the project was the preparation of domain experts from the CIS, security, and command and control areas for the role of knowledge engineers to meet the objectives of the project. The sequence of work was based on the designed methodology which was being verified when solving the project. Its steps include:

1. Collecting information sources and their processing utilizing TOVEK software.
2. Selection of the theoretical basis and providing SW technology.
3. Training and preparation of the research team and creation of the first ontology.
4. Clarification of the terms in the area in focus.
5. Verification of terms regarding the document base; the use of TOVEK SW.
6. Ontology design and its verification; the use of VUE SW.
7. Editing the ontology into the ATOM2 SW environment.
8. Creating a knowledge base.

The first step when creating a knowledge-based system is to collect the available data sources; they will be used for searching basic concepts. Creating a document base, its analysis and processing was carried out in groups according to the domain orientation of the team members in line with the objectives of the project. By using the Tovek Tools modules (Index Manager, Tovek Agent, InfoRating, Query Editor and Harvester), the information sources can be easily analyzed, and thus the prerequisites for the design of taxonomies, dictionaries and, consequently, ontologies can be created.
The training of the team included the topic of Knowledge Management, Topic Maps (the theoretical basis for the intended knowledge system) [6], and Tovek Tools and ATOM2 SW technologies. The team members studied the fundamentals of ontologies and tried to create their own ontologies in a selected environment. The creation of ontologies can be included in the information conceptual modeling. Those who are familiar with conceptual modeling, such as the creation of data structures or the design of information system architecture, can benefit from their experience.

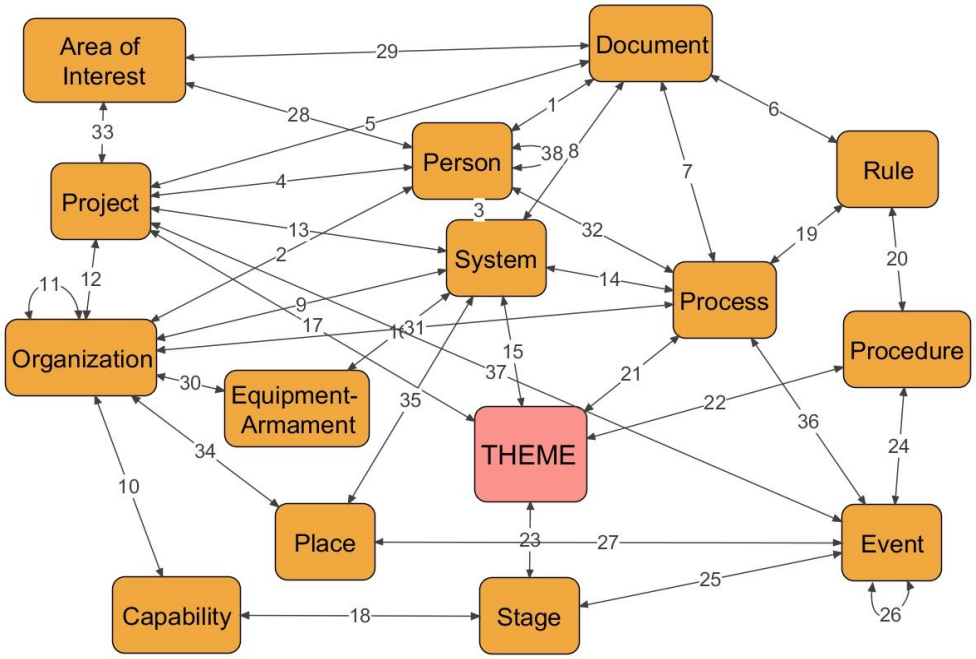

Figure 1. Domain ontology design – classes and associations.

Then the basic concepts of the subject area are clarified; for example, by the analysis of the document base, which characterize the selected domain. Basic concepts of a domain are organized into taxonomies. Taxonomy is a set of concepts, where the concepts of higher levels can be further developed by the concepts of lower levels.
The document base has to be put into a unified format, which means the selection of documents by language and format. In such a base, the Tovek Agent module can properly check the occurrence of terms in taxonomy. At the same time, a reverse process using the

Harvester module is run; it carries out a final revision of the analyzed concepts. So, the concepts which were not included in the taxonomy as a part of the preliminary consideration can be found and then added.
The design of the domain ontology diagram was and the result prepared using VUE (Visual Understanding Environment) SW [7]; see the diagram of classes and associations in Figure 1.

Figure 2. Ontology design in ATOM2 environment.

After designing and verifying the ontology by the team, the ontology is transferred to the ATOM2 software environment that is an ontology management tool for knowledge-based system; see Figure 2. Then the knowledge base is created by entering and linking the pieces of knowledge from the domain of interest (NEC).

2. EDUCATION ON KNOWLEDGE APPROACHES

The procedure and method of teaching the knowledge approaches and creation of knowledge-based systems to students model the methodology used in the MENTAL project. An example is from the domain of conferences on information, knowledge and communication systems. At first, the basic concepts and work with information sources are introduced to students, and simultaneously, the TOVEK SW modules are described.

The task assignment for student work is intentionally general and ambiguous, so that the students have to search their own approach to the analysis of information sources. For example:
"Analyze the information sources of the WMSC-2010 multi-conference [8], produce an overview of the information systems field, the processing of knowledge, social networks and communication systems that were discussed at conferences".

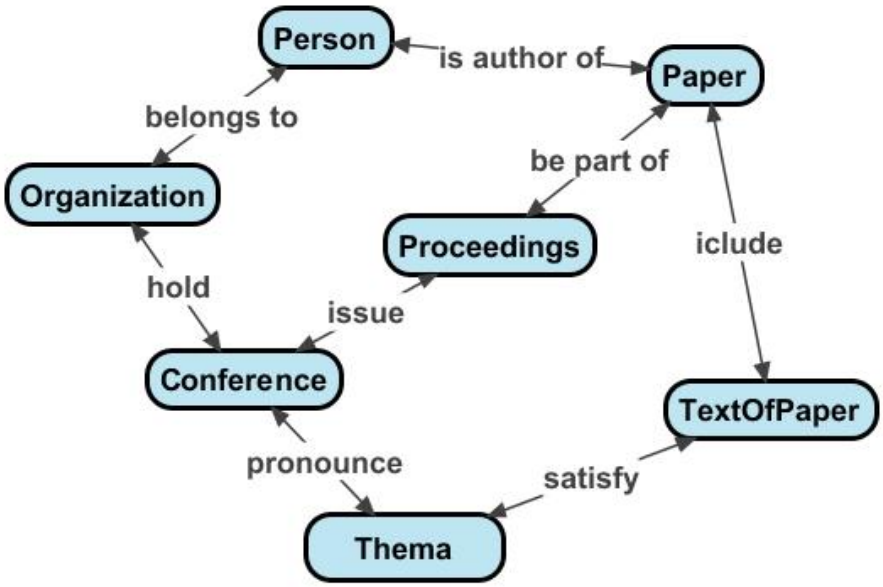

Figure 3. Ontology design on conferences.

Without any more details stated in the assignment, the students are expected to carry out the indexing of information sources, and to select the articles that cover the given field and examine them in detail. The students are supposed to finds the details of each article (about the authors and their workplace, research and implementation tasks carried out, methods and tools used, the results obtained). If the students' reports on processing the information sources are not satisfactory, they have to correct them. At the same time, the students get familiar with the specific domain, as a preparation for building the knowledge base.

	Conference	Proceedings	Paper	TextOfPaper	Theme	Person	Organization
Name	X	X					X
Firstname						X	
Secondname						X	
Title			X	X	X	X	
Abbreviation	X						X
Date	X						
Abstract	X		X				
Place		X					X
ISBN		X					
WWWpage	X	X				X	X
Text				X		X	X

Table 1. Classes and their characteristics of the ontology on conferences.

Consequently, the students are introduced to knowledge approaches, creating ontologies and the ATOM2 SW environment. The assignment is built on the previous activity; for example:

"Create a knowledge base on WMSC-2010 multi-conference; within the knowledge base, process selected articles on information systems, knowledge processing, social networks and communication systems".

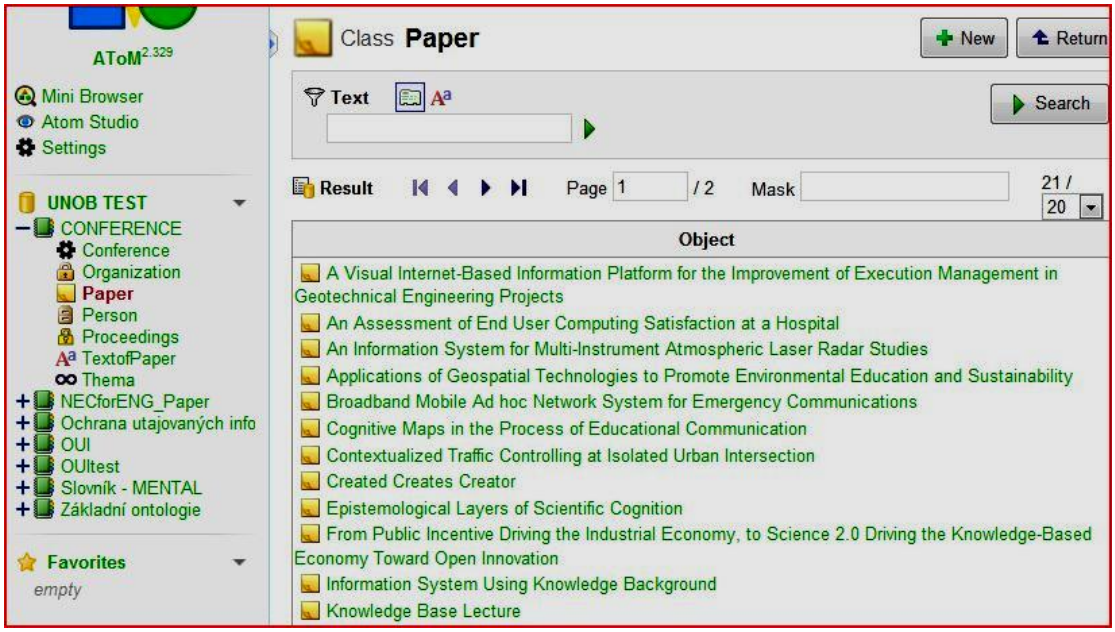

Figure 4. Example of knowledge base on conferences in the ATOM environment.

It results in the ontology design in VUE, see Figure 3 and characteristics definition and assign them to the classes, see Table 1. Than is the ontology prepared in the ATOM2 environment and knowledge base prepared, see an example at the Figure 4.

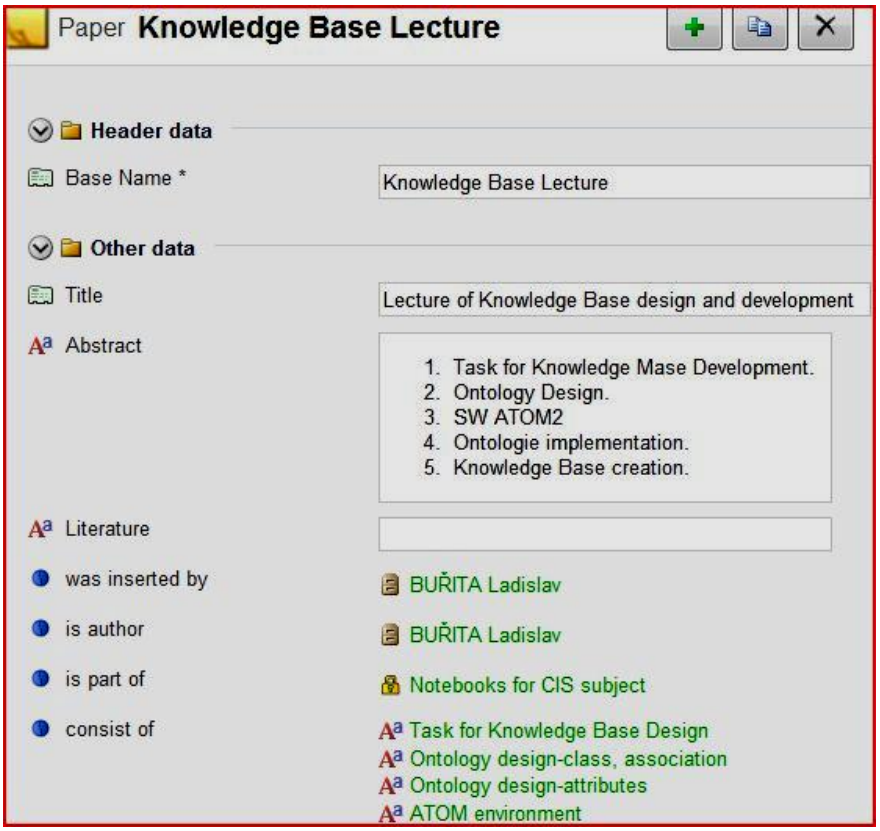

Figure 5. Various starting point for the study.

The opportunity of the KMS for the distance learning is resulting from its characteristics. The embedded information and knowledge can be divided into small parts and connected in requirement net. Ontology driven KMS offers the chance to study various themes according ontology concepts (classes). Each occurrence of the class is a start point for the new study problem, see Figure 5. The next advantage is complex environment where is no problem to add or to change new study material.

CONCLUSION

This paper aims to summarize experience, knowledge, ideas and recommendations for knowledge applications development and education, taking into account the conditions in the Czech Republic. The used SW technologies are mentioned.

ACKNOWLEDGEMENT

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SIMULATION IN AIR FORCE OFFICERS PROFESSIONAL MILITARY EDUCATION - POLISH PERSPECTIVE

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Abstract: *The paper discusses the use of simulation in Polish Air Force officers professional military education. Lessons observed at the Air Force Institute of the National Defense University in Warsaw are presented. Utility of both dedicated military simulation models and academic educational models for air force officers professional military education is discussed and assessed. A balanced approach to use mix of dedicated and academic simulation models is proposed. Based on Polish observations an assessment of value added by simulation to professional military education of air force officers is presented.*

Keywords: officers' professional military education, simulation, air force, Poland.

INTRODUCTION

The value of simulation for professional education and training seems obvious for civilians and military nowadays. As military tend to use simulation mostly for specialized training, it is worth discussing in more details how simulation is used for military educational purposes. What is the role of simulation in officers professional military education? The scope of discussion is limited to lessons observed by the Air Force Institute of the National Defense University in Warsaw and service intermediate level professional military education academic programs for Polish Air Force. Trends observed in relation to the evolution of air force officers professional military education during last twenty years serve as a background for a more thorough assessment of simulation technology available, and implications for today's academic activities. As the discussion uses mainly pedagogical lenses it focuses on conditions for integrating simulation into air force officers education, and importance of simulation for achievement of educational objectives. After utility of both dedicated military simulation models and academic educational models for air force officers professional military education is discussed, a approach recommending a balanced use of dedicated operational and academic simulation models is presented.

1. EVOLUTION OF AIR FORCE OFFICERS PROFESSIONAL MILITARY EDUCATION IN POLAND

The professional military education of air force officers in Poland after democratic transition of 1989 has undergone some significant changes that influenced, among others, use of simulation technologies in education and training. Years until 1999 saw intensive efforts to westernize overall philosophy of professional military education in Poland and preparations for NATO membership. Air force officers education after 2000 was influenced by rapid reductions and reorganizations of Polish armed forces, reforms of higher military education system and finally, decisions on introduction fully professional army, without compulsory military service. During the last decade of twentieth century the model of air force officers'

education remained similar to Warsaw Pact solutions. After graduating as second lieutenants – engineers from higher officers schools or master engineers from military technical university junior officers attended specialized training courses that prepared them to serve at various assignments in tactical units. There was no formal requirement for follow up professional military education that precluded promotion up to rank of major. Preparation of officers to perform command and staff functions at tactical unit level and for higher military positions was responsibility of the National Defence University (that transformed from former the General Staff Academy). In the first half of nineties Polish Air Force officers with approximately seven years of command and staff experience at squadron, battalion or company level (usually captains), studied for two years to prepare for command and staff assignments at regimental level or equivalent. The curricula for those command and staff oriented studies were developed separately for offensive tactical air units including army aviation, air defense units and air force logistics. Officers graduating from those studies were awarded the title "oficer dyplomowany" (officer possessing a diploma) equivalent to master degree. During two years of studies a significant portion of military history, operational art and tactics as well as problems of command and control were thoroughly studied. The educational programs included substantial elements of operational capabilities assessment and calculations, war gaming and modeling of combat operations. The teaching content of studies was considered sufficient for officers to serve up to lieutenant colonel assignments without any further professional military education or training and up to colonel assignments without further military studies. Academic preparation of air force officers for general officer positions was executed through dedicated strategic and operational level studies at the National Defence Academy for joint groups of officers from different services and branches.

At the end of nineties, as Polish Air Force downsized, the number of students declined significantly and a single "all air force" specialization was created in the NDU to allow students from different air force branches study together the same subjects. To maintain the core specialty expertise, separate modules for air force aviation units, army aviation, GBAD and radar units, and air logistics were established. However; it must be noted that the portion of professional content decreased as more general issues from the service perspective were taught. The graduates were still expected to be assigned to regimental, squadron and battalion level command and staff positions, but as the prerequisite of command or staff experience was abandoned meanwhile, the reality was sometimes different.

The major shift in air force officers professional education came in 2004. As a result of legal framework for professional military service changes made by the Ministry of Defence a strict connection between promotion and education was established. Only those officers planned for promotion were sent to the National Defence University for one year studies that prepared them to serve as majors at different levels of air force organization. While civilian education was considered equivalent to military one, more and more air force officers decided to enroll for civilian extramural studies to meet promotion criteria. Such a situation resulted in decrease of professional military preparation of officers and demanded swift corrective actions. Between 2006 and 2008 a number of short-term specialized courses were run at the Officers Career Development Centre of the NDU to increase operational knowledge of newly promoted officers with civilian academic background.

Nowadays, two years long master level studies for junior air force officers are conducted at the NDU's Management and C2 Faculty with specialty subjects taught by the Air Force Institute teachers. The scope of teaching content is focused on general operational and tactical knowledge. As graduates are typically assigned different captain and major positions across

air force organizations, it is difficult to focus on specific set of job related skills. The preparation for specific assignments is achieved by follow on specialized courses. Education of senior air force officers to prepare them for positions of lieutenant colonels and higher is conducted through joint operational and strategic level studies.

2. SIMULATION TECHNOLOGIES USED IN EDUCATION

Simulation started to be used in professional military education of Polish Air Force officers as soon as relevant technologies became available. During late seventies and early eighties of the last century some computer programs developed by academic community were used to assist in combat capabilities assessment and modeling of air operations. As the huge ODRA computers demanded separate infrastructure and specialized personnel to program them, the use of simulation in educational programs was limited to major war gaming events, usually a few times a year. The limited fidelity of computer models available made use of simulation in professional military education of Polish Air Force officers difficult at that time. While ODRA-based simulation models offered quite fair modeling of quantitive aspects of operational level warfare, at tactical level the results of simulation were often oversimplified and disputable if compared to textbook' algorithms.

The situation changed from the second half of eighties when personal computer technologies became commonly available. To make the most effective use of computer technologies in air force officers' professional education significant efforts were devoted to create simulation programs that might be useful to teach tactical level operations. As personal computers offered limited computing power at that time, some compromises on the scope and fidelity of simulation had to be accepted. The solution adopted by the Aviation and Air Defense Forces Faculty was to develop a family of simulation models for distinctive aspects of tactical air operations that could be run on personal computers. The most interesting ones among those models were: simulation of enemy air defense penetration by combat aircraft (PRZENIKANIE), combat effectiveness of air attacks against ground targets (EFEKT) and combat range calculations for combat aircraft. Databases used for those models were limited to NATO and Warsaw Pact weapon systems and tactics, with some limited weather conditions and terrain inputs. One of the compromises mentioned before was to run simulation on personal computer. While it impacted graphic interface performance and complexity of the simulation it provided access to simulation methods for a single student on daily basis. The choice of personal computers as a platform for simulation precluded more complex modelling of air operations and limited its use in academic war gaming. It was also impossible to federate air defence, logistics and tactical air models as they were using different (author's genuine) algorithms.

Lack of theatre level air simulation became acute in nineties when there was a need to prepare air force officers to function within NATO. Simulation models for air operations (such ALICE) observed in Fuhrungsakademie der Bundeswehr in Hamburg inspired research activities in Aviation and Air Defence Faculty and ultimately led to development of the GAMBLER tactical and operational level simulation for air operations. Although it was, similarly to previous systems, based on personal computers, an increase in computing power availability and implementation of network solutions along with federating of models of different aspects of air warfare made GAMBLER a useful tool for education. From 2004 GAMBLER system was used in teaching air force officers different subjects related to air operations, air defense and combat capabilities assessment. The system databases allowed to

add quite easily new systems (not only weapon systems) and objects (not only targets), so it was useful for modeling not only purely military scenarios but also those irregular ones involving air terrorist threats or crisis response scenarios. Thus, GAMBLER is nowadays used by civilian students to help them understand the complexity of air environment and assess aviation contribution to crisis response during natural or man-made disasters. Implementation of weather conditions models and terrain databases and their full correlation with other federated models resulted in high fidelity of simulation. The disadvantage of GAMBLER related partly to use of networked personal computers was limited capabilities for simulation of large scale operations involving hundred or more aircraft.

As professional military education of Polish Air Force officers included since 2004 teaching of joint force air component level operations it became obvious that additional simulation tools would be needed. The choice was the U.S. Joint Theatre Level Simulation system that was introduced in 2006 in Poland's Armed Forces. Although the system demands specially qualified personnel to feed it and assess simulation results, creation of the Armed Forces War Gaming and Simulation Centre as a part of the National Defence University means that it is available for teaching purposes at no additional costs. Recent availability of ICC tools expanded opportunities for use of tactical level air operations simulation in Poland's Air Force officers professional military education. After more than twenty years of use of simulation in Polish Air Force officers education it becomes clear that both academic developed and oriented models as well as operational simulation models were successfuly used. While they offered different capabilities for simulation and had some limitations their complementary use served well purpose of officers' education.

3. LESSONS OBSERVED

Simulation of air operations has been considered a vital part of Polish Air Force professional military education since it was enabled by available technologies. Looking back at pedagogy, there have been two major preconditions that influenced the most how simulation contributed to education of air force officers at intermediate service and senior joint studies: tools availability and users' preparation. Judging from the education results, benefits from simulation were significantly expanded by instant accessibility. During nineties officers attending two year long studies were able to prepare and run individually simulations for selected aspects of air operations. As simulation results were demanded to be discussed during seminars and reinforced theoretical knowledge, officers at that time gained significant interdisciplinary professional knowledge and what's more important became acculturated with modeling and simulation. It must be however noted that such situation was possible not only because of availability of simulation based on personal computers. The second decisive factor was a relatively high level of professional knowledge and skills that students gathered during service before studies.

Use of theatre level simulation for educational purposes has proved to be more difficult. It always demanded a number of students, instructors and operators to feed the system. Time needed to develop and load the scenarios that supported specific educational curricula was also a factor. As theatre level simulation encompassed a broad range of operational problems, subject matter experts were needed to avoid basic mistakes that could adversely impact the outcomes of the simulation. Facing both decrease in the number of students and duration of studies it becomes more and more difficult to benefit fully in the classroom from theatre level simulation and meet acceptable equilibrium of efforts versus outcomes. Partial solution to that

problem is to use the same or similar scenarios for several times and for different studies or courses. However, as the simulation creates only the starting point for further analyses and seminar discussion, the weight of effort is not lowered significantly. Judging from the Institute as well as allied military colleges experience, to make use of theatre level simulation profitable from didactic standpoint, a module of at least two weeks long computer assisted exercise is needed along with preparatory lectures and seminars. When the duration of studies for Polish Air Force officers decreased twofold, it became obvious that there has not been enough time to make theatre level simulation a separate part of professional military education curricula.

An interesting aspect that has been observed for years while using simulation in professional military education of Poland's Air Force officers at the National Defence University is "fighting the computer". It has been quite common for students to focus on simulation models weaknesses rather than on operational aspects resulting from the simulation. "Fighting the computer" approach will probably remain a part of using simulation for educational purposes, but it will not hurt possible benefits as long as may be discussed during seminars. What has made use of simulation for Polish Air Force officers education difficult was limited scope of professional expertise in a class. For example, while some GBAD specialists or transport pilots didn't attend studies during a particular academic year, students representing different fields of specialization had to run the simulation and discuss its results related to GBAD operations and air transport with a higher level of uncertainty.

More than two decade long experience of the NDU Air Force Institute related to use of simulation for air force officers professional military education revealed problems and dilemmas tied to selection of simulation models and hardware. It proved beneficial to develop simulation models by academic instructors, because such models fit well with educational needs and reinforced theoretical parts of the curriculum. Academic simulation models are unclassified and easier to use than their operational counterparts, which makes them more easily available to students. On the other hand their databases don't mirror exactly real world weapon systems and the results of simulation seem often weird to personnel with operational experience. Another disadvantage of using academic models is such that graduates just after completion of studies start using operational simulation systems that are significantly different. Use of operational simulation systems demands physical and cyber protection for both software and hardware. That restricts their availability to students. Such systems are also much more costly than their academic counterparts. But the real benefit is that students are able to study and train as similar to future operations as possible.

4. IMPLICATIONS

Simulation and computer models became an integral part of today's society life. Especially for young generations, they lost their "magic value" and are treated as any other tools for different aspects of life. Fidelity of commercially available simulations raised also expectations related to military simulation systems. Such situation is closely tied to cultural preconditions for use of simulation as a part of officers military professional education. To be attractive for educational purposes simulation models need to be perceived as modern and trustworthy (modeling reality as precisely as possible), or they will be rejected up from the start as "waste of time". This issue raises the question of life time expectancy for simulation models designed or used for educational purposes. With IT technology pace of development it might be fair to assess that simulation models developed by academic community for its

teaching needs may in the years to come start ageing much faster than before. When taking into account time needed to develop a new simulation model, IT development tempo may preclude development of such models by academic community to meet its educational needs. Such assessment was made in recent years by the Air Force Institute, when its GAMBLER system started becoming outdated.

So, facing such dilemma, it is necessary to either team with industry to create new simulation models for academic purposes or to turn to use of operational simulation models in classroom environment. While first solution is attractive for its conformity with educational needs it requires both time and resources, and may lead to disagreements with industrial partners over final design and system architecture. Use of operational simulation models for officers professional military education offers instant availability and conformity with operational environment, where graduates of professional military studies will operate. However, classification level for both software and hardware adversely impact availability of simulation tools to students. In case of theatre level simulation models additional requirements of specialized personnel and infrastructure need to be taken into account. Luckily, the creation of the Armed Forces War Gaming and Simulation Centre as a part of the National Defence University made theatre level simulation available for professional military education of Polish Air Force officers readily available without additional costs and personnel.

Technology development has made availability of simulation for professional military education of Polish Air Force officers easier and easier in recent years. But, as the tools for simulation are more easily available and become much more user friendly, the shift in overall philosophy of professional military education in Poland, impacts adversely potential educational benefits that might be offered by simulation. Making studies shorter, while keeping curricula broad and complex, creates a situation in which there is not enough space for introduction to simulation methodology, its application and correlation of its results to other educational areas. That allows only for a brief introduction to modeling, which is valuable, but doesn't fully exploit possible opportunities offered by simulation to professional military education of air force officers.

CONCLUSION

Use of simulation for air force officers professional military education is determined by a number of interdisciplinary factors. As the lessons observed by the Air Force Institute of the National Defence University in Warsaw suggest, both technology and human factors need to be considered for use of simulation in officers professional education. While discussions focused on utility of simulation for military training and capabilities offered by IT technologies are quite common, it is necessary to remind that simulation is important also for education as it supports critical thinking and allows a broader perspective. For an academic institution that prepares a limited number of air force officers through both academic educational programs and specialized courses, simulation is a valuable tool that reinforces teaching objectives achieved by lectures and seminars. As academic programs duration decreases, the scope of simulation is also subject to limitations, which adversely impacts its contribution to educational objectives. Taking into account an accelerated pace of IT development, it is hard for a relatively small academic institutions to develop own simulation programs. As the Institute observed, a reasonable solution might be a balanced mix of academic and operational simulation models to assure both availability of simulation tools to students and to keep in touch with operational environment.

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THE RESULTS OF THE CURRENT PROJECT "INNOVATION OF STUDY PROGRAMME MILITARY TECHNOLOGY" AT THE DEPARTMENT OF MATHEMATICS AND PHYSICS

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Abstract: *The paper presents the existing results of the project financially supported by the European Union. The project is implemented under the European Social Fund (ESF) through the Operational Programme Education for Competitiveness, focused on improving and modernizing primary, tertiary and further education, integrating them into a comprehensive system of lifelong learning and to improve conditions in research and development. The focus of the project was chosen so as to lead to the modernization of teaching methods and resources used in teaching mathematics and physics in the study programme "Military Technology" at the University of Defence. To be specific, the innovation and creation of study materials, teaching aids and laboratory equipment. As the great emphasis is laid on improving our students skills in English a part of the project outputs is devoted to teaching mathematics and physics in English, for interested students. The development of didactic materials is another important part of our results, e.g. teaching texts, step-by-step examples, animations and videos used in teaching mathematics and physics, both in Czech and English.*

Keywords: Teaching of mathematics and physics in English, ESF, LMS, computer lab, Maple.

INTRODUCTION

The Faculty of Military Technology (FMT), one of faculties of University of Defence in Brno, solves the project *Innovation of Study Programme–Military Technology* under the operational programme Education for Competitiveness. The aim of this project consists in substantial expansion of study possibilities for civilian and foreign students and upgrading education of military students [1].

The whole project was divided into three activities. The first of them *Creation of new and innovation of current courses* represents a complex innovation and formation of fully new courses for existing study programmes of FMT. All these courses significantly exceed the framework of study programmes in order to increase the possibilities of interdisciplinary studies with special intent to the technology of protection of property, individuals and information. The second of realized activities *Expanding education of specialized courses in English* contributes to the creation of study materials and providing with program equipment in English for already accredited or in future accredited study specializations. Under the third activity *Modernization of didactic methods and innovation of study literature, facilitations and laboratory equipment* the following results have been created: new laboratory workplaces and new PC laboratory, guidelines for newly created laboratory exercises and electronic supports for lectures, exercises, laboratory exercises and examination of students. Eight

teachers of our Department of Mathematics and Physics participate in solving the second and the third activity of this introduced project [2, 3].

Using the funds gained through the above mentioned project for equipment of a computer lab we have achieved a progress in extending the use of computer technology in the teaching of both subjects. The new computer lab is widely used for practical teaching of numerical methods in our courses. Integral parts of the intensive use of computer technology are didactic materials for lectures, numerical and laboratory tutorials.

1. SOLVING ACTIVITIES IN PHYSICS GROUPS

1.1 LMS used in physics teaching

LMS used in physics teaching in our department was created fully by our own initiative, because none of offered commercial systems met our concepts and visions in regard to technical properties (inserting mathematical formulas and figures, creation and implementation of didactic contents with minimum requirements on computer literacy). Also the way of application both in direct teaching and in individual training of students did not meet our requirements. Our system is intended for more users, because it works on client-server architecture. All data are processed in server and only the results (answers) are sent to user and then presented by web interface.

Teaching is typically asynchronous without necessity of teacher presence. All didactic contents are created so that for their best understanding no verbal commentary or supplementary materials are necessary. On the other hand, synchronic tests checking individual training of students can be (and often are) realized in the beginning of exercise lessons. Database server and web server are necessary for the operation of system. As the LMS is based on Linux solution, the database is realized using MySQL and web server uses PHP technology. Also sufficient disc space is necessary above all for files of didactic contents, e.g. for video sequences. Behaviour of the system on client PC is nearly independent of the platform. It is represented using web interface (HTML language) which is visualized by web browser of user. The browser must support frames and if need be specific supplements for visualization of some didactic contents.

As the system is determined for teaching physics, it was necessary to incorporate a support for editing mathematical terms and formulas. For this reason TeX was chosen: the user only writes the formulas in TeX, all other (typesetting, export to .gif format and visualization in final text) is done without any user participation automatically. Insertion of files completing the text contents (e.g. figures) is solved by simple interface called *Editor*. It enables uploading files directly on server and their structuralization into components according to user demands. Special component of the system is represented by tests, which enables students to prove their knowledge. Besides using as teaching tool, the system can be applied for testing students during the semester. The system in its present form contains three basic parts: *lectures*, *theoretical exercises* and *laboratory exercises*. Two different user interfaces are available: for *presentation* and for *testing*. Two types of users are distinguished at the present time: *student* and *teacher*.

1.2 Computational and laboratory exercises

The LMS described in previous paragraph was conceived for application in various forms of teaching as well as for individual training of students. Its practical applicability is determined

by the extent of didactic contents, which are created within the frame of the solved project. For computational exercises the tests are created in order to evaluate the level of student individual training. During testing the student chooses from more answers the only one, which is correct. The number of correct and wrong answers determines the fruitfulness of every student. Each of tests contains five to seven questions. The test can be represented also by solving an example, where the questions check particular steps of example solution. Now the whole range of tests for bachelor stage is ready, i.e. 16 tests. But it is in fact only necessary minimum, in future rich database of questions is planned, which allows composing individual test for each of students using random choice of questions.

Other type of didactic contents is represented by step-by-step solved examples. Solution of the example is divided into circa 10 steps with one question and several offered answers, from which just one is correct. If incorrect answer is chosen, the incorrectness is explained and the way to correct solution is suggested. Passing of step-by-step solved examples is possible with or without counting incorrect answers. Up to now 50 examples are prepared covering the whole range of bachelor course of physics.

Experiences with using of step-by-step solved examples are not only positive. The biggest advantage consists in more intensive involvement of students during exercises and in very easy and quick diagnostics of knowledge of students. On the other hand, the offer of answers entices above all weak students into random choice of answers instead of targeted rational selection, but substitution of choice offered answers by creation of own answers is impossible due to extraordinary difficult evaluation of these answers by the system. Also the record of solution procedure in notebooks is quite difficult above all for weak students, speaking nothing of its later reconstruction. For lazy students the mechanical overwriting from table is easier than using the system. The preparation of didactic contents of this type is extremely laborious and time consuming for this system but no other LMS is known where the preparation is easier [4].

Also didactic contents for laboratory exercises in physics are incorporated into the system. In contrast to textbook they show the instruments used for measurements and measurement performance is presented by video sequences or animations. Also individual training of students during home preparation for measurement can be checked. Up to now only one third of didactic contents are ready because of extremely time consuming creation of animations and video sequences. A positive contribution is evident in the extension of our repertoire of laboratory experiments on the measurement of specific electron charge. We have used support gained through the project and realized five laboratory suites.

1.3 Support of lectures and individual training

Performance of real physical experiments during lectures is longstanding tradition in physics teaching in our department. Some of experiments are not well observable for all students in classroom, therefore they are screened. Better than static scanning and projection the application of moving camera with changing magnification has proved competent. The best possibility is to project off-shelf video clips simultaneously with performing experiments. These clips can be available for students during their individual training as well as they can be a part of teaching text in electronic form.

During solving the project circa 30 video clips in the branches *Waves*, *Oscillations* and *Wave Optics* were prepared. Their records are screened during the lecture simultaneously with really

performed experiments. They are also incorporated in so called *condensed* texts, which mean texts in electronic form containing certain volume of knowledge, which represents necessary minimum. These condensed texts with figures, animations and video clips supplementing and explaining the texts represent very useful help for students missing at lectures and also for distant students (our as well as foreign experiences show that fully recorded lecture is neither suitable nor popular material due to its large volume and time consuming playback). Although the condensed texts cannot fully substitute deep study from lecture notes or textbooks, animations and video clips substantially and effectively help to understand basic physical phenomena. Now the suitable solution how to make the texts accessible in PC net is searched.

Substantial effort was given by the authors to the creation of animations of physical phenomena in branches *Waves*, *Oscillations* and *Wave Optics*. Here more than in other branches the presentation of phenomena in dynamic mode is useful for deep understanding. E.g. explanation of the difference between propagating and standing waves is more difficult and less effective using static figures than animations and real experiment. Difficulty of animation creation consists in the fact that only skilled and trained teacher can create them successfully and effectively. Up to now circa 23 animations are finished to the state that they can be directly and fully used in teaching.

1.4 Teaching of physics in English

In our department physics (as well as mathematics) is thought in English already in the fifth year. All forms of teaching are covered, i.e. lectures, theoretical (computational) exercises and laboratory exercises, also all tests are prepared in English. The content of teaching in English is the same as in Czech. Choice of learning in English is for students fully voluntary. Timetable of teaching allows students to change the language of physics teaching during the semester if they find it useful and really time to time somebody passes to Czech group if problems with physics or English appear. On the other hand, most of students appreciate the possibility to hear and speak English in wider extent and learn the vocabulary very suitable for their further study in their specialization. Naturally, also teachers are grateful for the possibility to increase the level of their practical use and promptness in expressing in English.

The project mentioned above started after beginning of teaching physics in English, but after all it brought new possibilities for faster development. Within the frame of the project some educational materials were already created (English-Czech vocabulary, textbook for theoretical exercises and first part of textbook for laboratory exercises), now textbooks for some lectures will be written. We hope that teaching physics will be extended for bigger part of Czech students and that we will be very well prepared for foreign students, whose teaching is expected in immediate future.

2. SOLVING ACTIVITIES IN MATHEMATICS GROUP

2.1 Teaching of mathematics in English

Since the beginning of the academic year 2006/2007 Department of Mathematics and Physics offers to students the opportunity of studying mathematics in English during the first year of bachelor degree, [2, 3]. A major problem concerned learning materials, which the department did not have at the disposal. In the first year English dictionary of mathematical terminology was created at the department, [5]. In the following years some textbooks and learning materials in English were purchased, but their content does not match fully the subjects

Mathematics I and Mathematics IIA. With the help of ESF project activity *Expanding education of specialized courses in English* the situation has changed. As a part of mentioned activity two textbooks on Differential and Integral Calculus of one variable will be prepared. They cover almost the entire first semester of undergraduate study. These textbooks contain not only the necessary theory, but also a number of examples with detailed commentaries and comprehensive exercises at the end of each chapter. Additionally, these texts will have their hypertext form, which will help the students to gain a better understanding of the concepts. Moreover, interactive texts and self tests will be added to the hypertext versions, which will enable the students to self-test their knowledge. As the native English speaker is now working at the University, the author asked him to consult and correct the created English texts. His assistance seems to be invaluable and leads not only to improvement of the texts but also to enriching of phrases used both in mathematical and regular text.

Another benefit of the project was the extension of the existing form of *Dictionary of English mathematical terminology*, [5]. New terms and some topics (for example Fourier series) were added. The dictionary now covers all mathematical concepts discussed in the first and second semester. As well, it has a hypertext form, supplemented by several tables of integral and differential calculus and pictures of basic quadratic surfaces.

Other teaching texts that support the learning process of mathematics in English will be two *Collections of examples in statistics and probability*, with hints and answers. Probability and Statistics are lectured in the second part of the second semester. These collections will include a brief overview of basic concepts and formulas and examples and exercises. This overview of concepts will partially enrich the above mentioned dictionary of mathematical terminology. Moreover, short simple tests to check the understanding of the concepts of each chapter will be a part of these *Collections of examples*.

2.2 Use of Maple

All textbooks and collections will contain some examples of solutions using Maple. Version 12 of this program was purchased for the Department in 2008. After the first positive experience with this program in tutorials 33 licenses of Maple 13 were bought. This purchase was paid from the financial sources of the ESF project. Maple program allows symbolic and numeric calculations; its functions cover many branches of mathematics from the basics of differential and integral calculus, linear algebra, up to solving of algebraic, differential and difference equations etc. Currently, this program was upgraded to version 14. A new feature of this version is the possibility of cooperation with Matlab (translation of source code, import and export of data files and direct Matlab functions calls directly from Maple). Matlab is used at the university at some departments. The work with spreadsheets, drawing of 2-D functions with discontinuities, a tool for displaying the current coordinates in 2-D images and other things were improved from the user point of view in this version.

Using this program detailed contents of all laboratory tutorials in the first year of undergraduate study were created-three for the first term and four for the second term. Moreover, three contents for the first year of master study (course Mathematics IIIA) and namely five tutorials on numerical methods (course Mathematics IVA) were prepared. Last year, the first usage of all these materials was realized. Most students assessed them positively; some have already met and used Maple. Some students also used Maple within their home preparation, because Maple is accessible to them at the college. Mainly they checked the results of exercises and drew diagrams. Some of them used Maple in processing

problems from other academic subjects (mainly physics). A great disadvantage, however, is the impossibility of using the program at home (due to license terms).

All prepared materials are available to students and other teachers on the department server. Furthermore, other materials are continuously prepared for laboratory tutorials and lectures. These concern mainly numerical problems and animations used to explain particular concepts. Some of these materials have been already used in teaching; others will be included continuously from the next academic year.

CONCLUSION

The focus of the project was chosen so as to lead to the modernization of teaching methods and resources used in teaching mathematics and physics in the study programme "Military Technology, namely the innovation and creation of study materials, teaching aids and laboratory equipment. As the great emphasis is laid on improving our students skills in English a part of the project outputs is devoted to teaching mathematics and physics in English, for interested students. Using the funds gained through the ESF project for equipment of a computer lab we have achieved a progress in extending the use of computer technology in the teaching of both subjects. The new computer lab is widely used for practical teaching of numerical methods in our courses. Integral parts of the intensive use of computer technology are didactic materials for lectures, numerical and laboratory tutorials. The development of didactic materials as texts, step-by-step examples, animations and videos is another important part of our results. A positive contribution is also evident in the extension of our repertoire of laboratory experiments on the measurement of specific electron charge.

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INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

LEARNING WITH ICT: PARTNERSHIP FOR LEARNING PROGRAM

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***Abstract**: The rapid development of adult education has stemmed primarily from economic demands and the need to continually innovate products and services (including the introduction of new technologies) in order to increase productivity, quality and efficiency, thereby increasing competitiveness. An increased demand for the use of information and communication technology (ICT) and for foreign language skills, have generally accompanied these economic influences on education.*
Drawing on the work of Lev Vygotsky (1986), it is clear that learning is not an isolated process but rather a product of inter-relationships between partners - learners and teachers using cultural tools, including language and computers. From the socio-cultural perspective that his work supports, learning is understood as a life-long, social act of constructing knowledge in a dialogic activity with others. In the sociocultural context of an organization, Somekh (2007) focused her research upon the process of innovation, and identifies five key concepts for successful learning. One of the key concepts she uncovers is the construct of partnership, which she understands to mean the developing of "shared meanings" and bringing people together to create virtual, international partnerships. Web 2.0 is a vehicle for supporting these kinds of partnerships.
This paper presents the Partnership for Learning Program (PLP), a multinational project aimed at promoting social learning through interpersonal communication supported by a Web 2.0, video-based web conferencing technology. This avenue for conducting face-to-face communication in real time allows a more immediate and enriched form of contact than e-mail, blogs, forums or chats. The quality of the visual and audio streaming made available through desktop, video-based web conferencing results in participants having access to basic features of face-to-face interactions such as nuances of tone and the nonverbal language imbedded in gestures and expressions – crucial factors in quality communication. The project description, project content, and the experiences recorded over a sustained period of time, as well as the potential future of this form of training are described.

Keywords: Web 2.0 technology, video-based web conferencing, adult education, partnership.

INTRODUCTION

While higher education is experiencing significant changes, these changes are putting pressure on stakeholders in the system - policy makers, teachers and learners. In other words, there is resulting pressure at all levels to improve productivity and quality. The dream and anticipation of many stakeholders in the educational processes is that ICT could offer the solutions needed. Ironically, the implementation of ICT is providing learners with new possibilities for autonomy in their choice of learning activities beyond the formal institution. Indeed, with these new possibilities, individuals have an increased range of educational resources and opportunities to share ideas with other learners on an international scale -

opportunities that were once reserved to formal classrooms. These new possibilities outside the educational system are in turn transforming traditional classrooms within it.
Drawing on the work of Lev Vygotsky (1986), it is clear that learning is not an isolated process but rather a product of inter-relationships between partners - learners and teachers using cultural tools, including language and computers. From the socio-cultural perspective that his work supports, learning is understood as a life-long, social act of constructing knowledge in a dialogic activity with others. In the sociocultural context of an organization, Somekh (2007) focused her research upon the process of innovation, and identifies five key concepts for successful learning. One of the key concepts she uncovers is the construct of *partnership*, which she understands to mean the developing of "shared meanings" and bringing people together to create virtual, international partnerships.
Web 2.0 is a vehicle for supporting these kinds of partnerships. Web 2.0 is a set of newer generation socially-based technologies that are web-dependent and whose users are actively involved in communicating and collaborating with each other as they build connections and communities across the web. This paper briefly discusses the educational application of one such Web 2.0 technology, video-based web conferencing (VBWC), while drawing on insights from Lev Vygotsky's theory of social constructivism (http://e-language).

1. INTERACTIVE WEB BASED VIDEO CONFERENCING

Many learning institutions already use video conferencing to complement traditional teaching methods in a variety of situations, especially in adult education. In some cases, video conferencing is helping to cut costs, for example by having one teacher deliver a lesson to many classes simultaneously. Another advantage is that it allows learners to interact with other learners with whom they would otherwise not have contact. In this scenario, institutions use video conferencing as a way of bridging cultural gaps with learners of similar age, but whose backgrounds, experiences both professional and personal, are different. A native speaking student for example from Canada could interact with military students from the Czech Republic.

But videoconferencing has the potential to offer more to learners than just the opportunity for cultural or professional exchange. Indeed the significance of using a web-based, interactive videoconferencing is only beginning to attract attention. Bustamante (2005) observes: "Videoconferencing lends itself to viewing multiple perspectives on an issue and it better addresses the needs of visual learners. Also, collaborative learning is practically automatic with videoconferencing. Videoconferencing helps set up authentic learning situations – students are working on a real world problem or project and they are communicating with real people involved in the problem or project. This also supports the idea of authentic assessment – you must have your information pretty accurate before you connect with an expert and ask meaningful questions." In other words, VBWC provides students with the opportunity to learn by participating in a visual and audio two-way communication platform for the purpose of building knowledge. Teachers and experts from various parts of the world can be brought to classes in remote or otherwise isolated places. Students from diverse backgrounds can come together to learn about one another. Students are able to explore, communicate, analyze and share information and ideas with each other. These are just some of the benefits using VBWC as a tool for both teaching and learning. Essentially, a key factor in the VBWC is that it provides real-time, oral and visual-supported multi-site communication in contrast to the limitations of writing–based communication technologies.

2. PARTNERSHIP FOR LEARNING PROGRAM

The Partnership for Learning Program began as a doctoral research project under the leadership of Dr Paula Charbonneau-Gowdy (Charbonneau-Gowdy, 2009). The objective of the multinational project was to promote English language learning through international communication with the support of modern technologies. The planning, funding, and assessment of this ongoing project have been shared by the Czech Republic and Canada. The PLP is an on-line program using videoconferencing software and desktop computers that takes place via the Internet. ICI*Wave* Design, a Canadian company developed a specialized telecommunication technology for the PLP and has an exclusive copyright for the technical know-how that supports the real-time video and sound interchange between distant clients. The ICI*Wave* web application is a key user tool that allows a synchronous interactive communication among learners themselves as well as between learners and their teacher. This system is based on a web interface made by Adobe Systems Incorporated – Flash technology and a server application using original procedures for distribution and compression of both video and voice. The application used for the project is a protected and exclusive design of the ICI*Wave* Company. Any multi-media computer working on a technological platform that is equipped with a web browser containing a Flash technology player can support this telecommunication system. An installed web camera (or any device recording video pictures) and headset with microphone are also essential.

The application provides communication among users, in pairs or in sub groups; at the same time it also allows communication between teachers and individual learners or a particular group of the participating learners. Such conversation can be made either private or public within the group of participants. There is a display board incorporated in the interface for written text for teacher or user to use for providing visual reinforcement of new terminology or to support and underline explanations as needed. A whiteboard serves as a tool to create and share simple graphs, diagrams, notes, or drawings and is an added feature of this system. Such features are regularly being adjusted, upgraded, developed or discarded in response to users' feedback and experiences. Accessing the interactive interface is simply a matter of opening a web link - www.talkingtolearn.com, then logging in using an authorized user name and password provided by the system administrator. Although the space is exclusive to authorized users, the application does need to contend with security matters due to the fact that transferred data over the web are not considered "sensitive".

3 METHODOLOGY

Both quantitative and qualitative research was conducted in the Czech Republic and in Canada. The quantitative data presented here was collected in the Czech Republic between October 2005 and May 2007.
In 2005, we designed the Pedagogical Experiment to determine if and how ICT contributes to the quality of English language learning and the development of communicative skills in the language. The research was divided into three phases: questionnaire, semi-structured interviews and experiment.

The first phase of the research was the completion by participants of a questionnaire. The goal of the 12 questions contained in the questionnaire was to determine students' preferences and needs while using ICT in the language classes. One hundred and four university military students participated in this part of the research.

The second phase of the research consisted of a semi-structured interview to determine more detail about students' preferences in their language learning choices. The interview data also was used to form the following research groups:

- **Group I** – (27 students) using a classical approach to language learning without ICT;
- **Group II** – (32 students) - using a language learning approach that includes ICT through access to an in-house Study Portal, materials from the Internet and web quests;
- **Group III** – (29 students) - using a language learning approach that includes ICT through access to the in-house Study Portal, materials from the Internet, web quests AND complimented by online synchronous communication with Canada.

All three groups took part in pre and post standardized language tests which are official tests used in NATO military language programs.

The third phase was the experiment. At the beginning of the academic year, all students were tested to find out their entrance level of English using the American Language Course Placement Test (ALCPT). This test measures listening and speaking skills. On average, entrance scores for all three groups were found to be similar with no statistically significant differences between groups. Then each group took part in their respective language training programs during two semesters of sixty lessons. At the end of a year, the students were tested again using the STANAG 6001 test, a standard NATO language test, in order to compare all language skills (listening, speaking, reading and writing). The test results were evaluated by the statistical student t-test.

The qualitative data collected in the Canadian government sites took place between October 2007 and March 2008. The participants consisted of 32 federal government employees, male and female, representing a variety of professions and departments in the Prairie, Quebec, National Capital and Atlantic regions of Canada. The aim of this research approach was to permit the voices of the participants to emerge through the findings, believing that their voices could lead to a critical understanding of their learning experiences involving technology and as a means of promoting change in theirs and potentially other learning contexts. In the Canadian context a participatory action research (PAR) approach to the inquiry was employed. Changes to their current perceptions of computer-assisted language learning (CALL) were negotiated through the use of computer-mediated communication (CMC) tools - the video-based web conferencing technology and a Community of Practise (CoP) shared website. The on-line courses using the video-based web conferencing were conducted in the early morning twice a week for 1.5 hours per session for eight weeks. Learners were expected to go to the CoP sites for at least one hour between these online sessions to read case studies. The case studies, based on professional themes, are intended to spark discussions of the participants' personal work experiences in the classrooms and to have these discussions continue in written dialogue with other participants between sessions at the CoP site. In the inquiry at the Canadian site, ethnographic research methods were used to uncover the nature of any language learning as well as tensions experienced by the participants over the period of the sessions. Employing these methods also helped to reveal the participants' individual responses to both the web-conferencing and the Communities of Practice (CoP) social networking sites. Data collection methods included observations of online interchanges, video-taped collaborative dialogic interviews both face-to-face and through web conferencing, participants' entries in the CoP sites, participants' written feedback questionnaires teacher journals and field notes from trips taken by the researcher to job locations of some of the participants.

4. FINDINGS

4.1 Findings in the Czech site

The outcomes of the research in the Czech site acknowledge considerable benefits of video-based web conferencing technology in the educational process. The test results from the STANAG 6001 evaluated by the statistics-based student-t test are the following:

- **Reading**: The results of final tests show that there are no statistically important differences among the three groups in reading. This is not to say that progress in reading competencies were not made but that at the end of the study period each of the groups was approximately equally capable in this skill.
- **Listening**: Results on the listening test show significant statistical differences among groups in listening. We can confirm with a reliability of 95 % that Group III performed better than Group II and Group III and Group II performed better than Group I in listening.
- **Speaking**: There were no statistically significant differences between Group I and Group II in speaking but we can confirm with reliability of 95% that the participants in Group III performed better than Group I and Group II in speaking.
- **Writing**: The data indicated that were no statistically significant differences between Group I and Group II in their writing performance on the tests. But with a reliability factor of 95%, the data indicated that Group III performed better than Group II in writing at the end of the 2 semesters.

Students from Group III, those using a language learning approach that includes ICT through access to the in-house Study Portal, along with materials from the Internet, web quests AND complimented by online synchronous communication with Canada, had significantly better test results in listening, speaking, and writing, in comparison with the two other groups including those who just used ICT without the online sessions. If we sum up all skills, we can confirm with reliability of 95% that there are statistically significant differences between Group I and Group II, Group II and Group III and Group III and Group I which confirm the influence of web conferencing technology in the educational process.

Student reactions to this program gathered from the interview process are very positive. All PLP participants were interviewed and their feedback was only positive. The following are examples of students´ general comments about their online experience:

"I take part in PLP in order to practise listening and speaking skills. There I have to respond instantly. Though I know the topic of our conversation in advance and can read something concerning the topic beforehand, I am not prepared to answer every single question. That is very difficult, but I enjoy it. It is very useful, I mean, to react promptly, and then to write something about the lesson. Actually, it is like a real life conversation: action and reaction." (Kamila, May 2005). Kamila's reaction to the advantages she has noticed while using the web conferencing technology for learning English are typical of those expressed by others in the Czech site. In this context, finding opportunities to use English in authentic situations where one is not sure what the questions will be in a conversation are quite limited. Despite the challenges that such opportunities present to her linguistically, she finds them enjoyable and obviously worthwhile. She, like others, knows intuitively that such opportunities prepare her for the real-life situations, most probably international military operations, where feeling prepared to interact in English will be vital.

"This way of learning is much easier in comparison with the classical one; it is not so complicated and I have a feeling that I can understand things better." (Zuzana, June 2005).
Zuzana speaks positively about her experiences using the web conferencing technology too. Compared to more traditional approaches based on rule and structure formation predominant in her institution for teaching English, learning online through dialogue is less complicated and more pleasant. She is also aware of the cognitive advantages of her experience in the PLP, the fact that she understands better, which is an indication of long-term retention of what is being learned (Cechova, 2010).

The positive statistics noted here as well as the representative comments from Kamila and Zuzana add to the already significant qualitative data gathered in the Czech context as well as in other research contexts during the larger study (Charbonneau-Gowdy, 2005). Importantly, these empirical data are supported by well-recognized theories that indicate that learning is by its very nature a socio-cultural activity (Vygotsky, 1978) and dialogue-dependent (Bakhtin, 1981) and that the learner-centred practices that were made possible by using the web conferencing technology had a powerful influence on the fact that participants' identities changed (Weedon, 1997).

4.2 Findings in the Canadian site

Strong quantitative evidence and positive satisfaction from learners in the Czech site were supported as well by the addition of qualitative findings that were collected in the Canadian context. The participants in the Canadian context reported changes to previously-felt marginalized second language identities. For example, many participants reported in interviews that prior to the sessions they refused to use the other language for fears of making errors and thus feeling inadequate, experiencing a loss of face. This presented a significant drawback to them in the bilingual Canadian public service context in which they work where the use of the other official language is a necessary either in terms of maintaining their present employment or in being promoted. By the end of the program, these same individuals expressed that they experienced a change in their feelings about using the other language and in their identities. The following comments vividly illustrate the significant change in subjectivity that just one of the participants, Anne, a francophone learning English showed over the course of the study.

Early interview: "I have to make all my thoughts simple to be able to express [myself]. Then I don't feel intelligent. In French, I feel I am intelligent but not in English. I am afraid the [others] are going to think I am stupid. They will ask themselves – "How did she get that job?" (Anne, interview February, 2008).

Later interview: "Something happened to me during that course. Now I can speak on phone without problems. I feel confident." (Anne, interview, April 28, 2008).

The dynamic change in a relatively short period of time in Anne's second language subjectivity in relation to speakers of the other language from fearful at being considered "stupid" and ill-chosen for her position to being a second language user of confidence who is proactive in the other language is powerful evidence of the influence these sessions had on her learning and identity. Anne's decision after the sessions to communicate only in English, rather than the usual French that was the norm with her English-speaking supervisor prior to the study is not only another sign of changes in her SL identity but of her moving towards self-directedness that is characteristic of a life-long learner. Her comments and decision-

making at the end of the program are repeated again and again by many other participants in the web conferencing sessions.

Learners were not alone in noticing changes as a result of the on-line sessions. Some of the teachers expressed they too felt changes to their own language teaching identities and importantly to their teaching practices. Lori, one of the Montreal teachers who taught a group of participants in Quebec and the Atlantic Regions expressed these changes in her words:

"I find I don't do as much from my lesson plans as I would do in a traditional classroom. I think the teacher on the web conferencing must be ever more flexible and patient than they need to be in a traditional class …it's easier to leave the floor for the students and for me to speak less." (Lori, Journal notes, February 2008). For Lori, the on-line sessions offered her little choice but to let the students in her group take charge of the discussions. Her teacher-directed ways were forced to be put aside and her role took on a more facilitator approach. It is this kind of teaching approach that is being shown elsewhere in the literature to be most conducive to self-directed learning, the highest form of learning. Such teaching practices have also been shown to lead to learners constructing more powerful identities – the kind of identities that have implications for life-long learning.

Some teachers in the study expressed less favourable experiences during the on-line sessions. Data findings indicated that less comfort with the technology and a reluctance to encourage a learner-centred approach had implications for learner involvement in the discussions. In these cases, the evidence of learners' linguistic and identity changes were less dramatic. These findings have important implications for the powerful role that teachers and their approaches play in learning, no matter what the context, traditional or involving technology.

4.3 Constraints of the writing site

It is also interesting to note that activity on the interactive writing-based CoP site, where participants were to interact in writing between sessions was generally quite limited. The CoP activities the participants did consisted almost exclusively in collecting material for the classroom discussions. Indeed, this general lack of engagement at the CoP site occurred despite teachers' strong encouragement of learners and their awareness of the positive implications of writing in the second language as a means to error correction and developing speaking skills. Disappointingly, learners reported that using valuable time to compose comments in such a public space was too overwhelming a task. While a few participants did post a comment or two initially on the site, they reported that due to receiving no response from others that even their enthusiastic interest quickly waned. It appears that the lack of commitment and basis for relationship building that this particular writing-based Web 2.0 technology offered to this group of learners held little enticement for them to interact. Baron (2008) predicts the demise of some technologies in her comment: "Like language, technology does not remain static. At the same time, just as certain components of language hang around for centuries while others come and go, we can anticipate that some - but not all - electronic language media will have staying power." (p.233-234). Baron is not alone in her predictions. Recent reports, even on relatively new Web 2.0 technologies such as blogs and wikis, especially those that are entirely writing-based, are already showing dips in usage among younger generations.

Baron quotes Diane Rehm, the celebrated host of National Public Radio in America saying in a May 2007 university commencement address:

“In this day and age of email, voicemail, office memos and text messaging, we hardly ever hear each other in real time anymore, much less listen to each other. In fact, I think many of us have forgotten how to listen.” (Baron, p.230).

We feel strongly that when individuals are provided with the opportunity to interact and listen to one another guided by a skilled teacher or subject expert, just as the participants in the Partnerships of Learning were able to do, that there is the greatest potential to profit from the unique strengths and experiences of others to construct new knowledge, enthusiasm for prolonged interest in learning and an empowered sense of self.

CONCLUSION

The international research conducted and sustained since 2004 between the Czech Republic and Canada offers strong support for the relationship between web-based videoconferencing and student learning along with changes to learner identity. We believe that this research is a clear indication to all stakeholders in the field of education of the powerful potential this particular web-based learning tool has for enabling cognitive development through constructing knowledge in a social learning context and at the same time in enabling the kind of learner identity changes that lead to life-long learning – the basis of all effective educational systems.

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ARCHITECTURE FRAMEWORKS ANALYSIS FOR THE NEED OF AIR FORCES TACTICAL CONTROL CENTER MODEL DEVELOPMENT

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Abstract: *NATO organization uses several types of architecture frameworks for development of various systems or architectures. The purpose of these frameworks is different as well as their content. Each architecture framework can be used for different types of products development but the "leading force" is the NATO Architecture framework version 3 (NAF v3). Other frameworks like NAF v2, DODAF (Department of Defence Architecture Framework), TOGAF (The Open Group Architecture Framework), MODAF (Ministry of Defence Architecture Framework), Zachmann framework, C4ISR Architecture framework, etc., are useful too, but for the real architecture development, the NAF v3 is probably the best solution. Another point of view is in the field of modelling. This paper analyses several architecture frameworks from the air force tactical control centre modelling perspective, and assesses them according to modelling approach of this specific area.*

Keywords: architecture framework, modelling, simulation, command and control.

INTRODUCTION

There are several ways to describe a model development. Almost every organisation which develops models or deals with simulations uses different means for model development based on their know-how as well as on their needs and experience. Also NATO organization develops its simulation and modelling capabilities which are used for combat simulation, command and control simulation, vital processes simulation (operational research), etc. The whole spectrum of military areas needs little bit different approach to every modelled entity because each entity has specific demands for implementation to simulation environment. Those demands are mostly described as a collection of attributes, characteristics, information requirements, cooperation requirements (relationships), capabilities, etc. To find a way how best describe each model is very difficult and challenging process. Inside as well as outside the NATO organisation, there are several methodologies for structural, procedural or organizational description. These methodologies are not primary predetermined to model development, however could be used also for modelling, because consist of very sophisticated and detailed templates, patterns or methods for system development or analysis, does not matter if real or virtual. This paper is not intended to be a detailed Tactical Control Centre (TCC) model or description of architecture frameworks. It is intended to be a comparison of most used architecture frameworks (in the military). The paper also suggests the best one for this type of models (TCC).

1. PROBLEM FORMULATION

Simulation of air force entities within simulated air scenario consists of several entity categories. There are entities or models of tactical effectors like fighters, bombers, radars, ground based air defence (GBAD) and in some cases (and within more robust simulation) also tactical control centres (TCC). The representation of TCC is not visible, although it can be

situated in the simulation as a visible entity (building, box, etc.). The TCC consists of procedures and agents collection that contribute to the whole TCC model via procedural and activity control. This model is intended as a virtual control centre that enable to locate own as well as enemy air forces via connection and fusion of assigned radar models. Another TCC function is allocation of own air force modelled entities to specific tasks like enemy track engagement and to evaluate incoming threat as well as to reallocate own assets to another threat. Thus, the main problem is not to describe structural characteristics and shape of the entity (like in case of vehicles, airplanes, etc.) but the procedural and activity model in relation to other entities. Relationship between TCC and these entities is than characterised through information flow within simulation according to valid procedures and dependent (based on instructions, reports, and allocations) or independent (based on enemy behaviour) activities.

2. SOLUTION STRATEGY

First, the TCC model characteristics description should be defined to know what the model consists of and how it is described. This description helps to find the final requirements for model architecture and then the ideal architecture framework. It is also possible, that no tested architecture framework will be suitable and therefore the need for a further model description templates will emerge. In that case it is necessary to propose architecture templates or products (views) that support our model description needs. Above stated process can be summarized as:

- What we need to describe
    - Model environment
    - Model inputs and outputs
    - Model structure
    - Model functions.
- How to describe it
    - Architecture frameworks analysis according to suitable views and subviews
    - Picking the best architecture framework for TCC model description
    - Applying this framework.

3. WHAT WE NEED TO DESCRIBE

According to solution strategy, the “what we need to describe” process should be defined first.

3.1 Model Environment

TCC model is the model of control centre, which control other assigned models within a simulation. Those models are simulated entities of own air forces (including ground based defence assets) that contributes to thorough defence capabilities of simulated friendly organisation or forces. TCC has no command authority although part of this authority can be delegated according to delegated decision rights from higher entity model. That means the TCC model is not intended to “improvise” but has to follow strict procedures and decision rights, which to the certain extent provide easier model structure, especially decision algorithms. What also matter are simulated enemy forces that are subject to TCC functions, especially defence control.

3.2 Model Inputs and Outputs

Inputs of the TCC model consist mostly of information about simulation itself. The TCC collects information about own controlled air forces as well as about enemy entities and tracks through DIS/HLA interface or other communication means. This information is collected via simulated sensor entities (e.g. radars) or via simulated information distribution from other simulation entities (other TCC in different area of responsibility, higher echelon, etc.). In general, the TCC collects inputs in the form of each simulated "in range" entity movement attributes – position and speed vector (speed, heading, elevation) as well as other attributes like identification, assigned entities status, etc.

Outputs are mostly in the form of allocation instructions that means the allocation of own simulated entities to enemy entities.

3.3 Model Structure

The TCC has to be divided into several parts conducting specific processes or activities and emitting specific information flow to be realistic mirror of real-like centres. Multi-agent form seems to be a best solution for that kind of models. Each agent within the TCC has specific purpose and scope, therefore specific decision rights, information flow routing, allowed communication interaction, assigned activities, etc. Multi-agent set-up allows not only multi-thread algorithms processing but especially allow replacing one agent (through proper interfaces, software and hardware) by real operator in case of further TCC model implementation to tactical simulators.

3.4 Model Functions

Each model has specific functionality that places it into the wider context of the simulation. In general, the functionality in this case can be described as a group of answers to the questions "what to do", "when to do it" and "how to do it".

The "What to do" question is answered via set of possible activities and information flows, which the TCC model is able to conduct. In fact, it is a list of procedures (procedure is nothing more than sequence of activities and information flow transmissions) that are available within the model.

The "When to do it" question is answered via list or set of trigger events (inputs/actions) from simulation environment that initiate some model activities (outputs/reactions) that again affect the simulation environment.

Last, the "How to do it" question is answered via model algorithms description as well as the list of affected friendly controlled entities from the simulation environment that follow the TCC instructions.

4. HOW TO DESCRIBE IT

As stated above, there are tens of architecture frameworks for the development or analyses of various systems and structures. These architecture frameworks were developed according to

specific application areas and usually cannot be used beyond a certain scope. Some frameworks were developed primarily to the business organisations, others for system design and development. At any rate, each framework is different itself as well as it has different structural description techniques. To choose a right architecture framework for "standardized" model description and implementation, it is necessary to analyse them according to modelling and simulation needs. In this paper, just several architecture frameworks are analysed, especially those connected with the military environment. Analysed architecture frameworks are:

- TOGAF (The Open Group Architecture Framework)
- ZACHMAN Framework
- C4ISR[1] AF version 2 (C4ISR Architecture Framework)
- MODAF (Great Britain Ministry of Defence Architecture Framework)
- DODAF version 2 (USA Department of Defence Architecture Framework)
- NAF version 3 (NATO Architecture Framework).

Some architecture frameworks were excluded according to language[2] limits. Also aspects of technology standards description of the model were not considered according to limited space. Each architecture framework was assessed according to above stated model description aspects. The whole assessment process is not stated here according to limited paper space, there are only results here.

4.1 C4ISR AF v.2

This architecture framework was one of the first compact frameworks for the military needs that help to describe C2 systems and organisation structure. Its advantage is in simplicity of described templates for system (or model) description or development and consists of four views of the system (model):

- All view – contains information about overall description, purpose and scope of the system (model). It is not pure view itself, because deals with overall architecture description and therefore is valid for thorough architecture and its other views.
- Operational view – contains templates for system (model) description according to operational and logical aspects.
- System view – contains templates for system (model) description according to physical aspects (interfaces, systems layout, parts layout, communication details, etc.).
- Technical view – standards for system development and implementation.

4.2 TOGAF

This architecture framework was developed especially for the needs of business organisations to describe and develop their requirements, structures etc. Its core consists of four main architectures – business, application, data and technology architectures. These architectures are in fact methods or views, how to describe certain architecture. Even it is much evolved architecture framework (today in version 9), for the needs of modelling of C2 entities including battle management as well as tactical military entities is less suitable than other frameworks, because its focus is not primary on the development of military architectures with all of their important aspects (battle management, weapons systems specificity, etc.).

[1] C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance

[2] Like French AGATE

4.3 Zachman Framework

Zachman framework is very well known architecture framework; its principles were implemented to many frameworks developed later. It consists of several models in accordance with several perspectives. There are six models (contextual, conceptual, logical, physical, as-built and functioning) and all of these models are describes based on the six perspectives (data, function, network, people, time, motive) or basic questions (what, how, where, who, when, why). The potential system/model description or development is than very structural and transparent. Even it is not possible to utilize all of the potential of the Zachman framework for the TCC model (or air force operation model) description and development, it is very well organized and relatively easy to apply and therefore very suitable for model description even it was not primarily designed for the development of weapons systems or description of battle management structures.

4.4 MODAF

MODAF is the Great Britain Ministry of Defence Architecture Framework (today in version 1.2.004). This framework consists of seven views that allow the system/model architecture description. These views are All View, Strategic View, Operational View, System View, Technical View, Acquisition View and Service Oriented View. The MODAF has all views that are contained in the C4ISR AFv2 (All, Operational, System and Technical View) and contains three new views based on the needs of the network centric warfare and network enabled capability principles (Strategic, Acquisition and Service Oriented Views). For the TCC modelling, the All, Operational and System View will be suitable and allow realizing the above stated model requirements.

4.5 DODAF

DODAF is the United States Department of Defence Architecture Framework, today in version 2. The core of this architecture framework (AF) is based on the former architecture frameworks like TOGAF. This framework was also in the group of frameworks (together with the MODAF and others) which were melted to produce contemporary NATO-wide framework NAF v.3 (considered below). The main structure of DODAF is also made of several views and subviews that help to organize and develop system/model architecture according to different aspects or domains. These views are All View, Capability View, Data and Information View, Operational View, Project View, Services View, Standard View and Systems View. For TCC modelling, especially All View, Operational View, Systems View and Data and Information View are important. The main difference between DODAF and MODAF is that DODAF has separate View considering Data and Information, while MODAF implemented it into Operational and Systems Views.

4.6 NAF

NATO Architecture Framework (NAF), now in version 3, went through the evolution process, where its main keystones were based on the implementation of know-how from three different frameworks, the C4ISR AF, the DODAF and the MODAF. These frameworks were shaped according to NATO needs, because each framework was developed according to specific environment and aspects of military structures in the countries of origin (C4ISR AF and DODAF in USA, MODAF in Great Britain). Today, NAF follows the Network centric

Warfare and Network Enabled Capability requirements. NAF is also suitable for system/model development in NATO multinational environment. Nevertheless, the structure is very similar to MODAF, DODAF. NAF has seven views – NATO All View, NATO Capability View, NATO Operational View, NATO Service-Oriented View, NATO Systems View, NATO Technical View and NATO Programme View. For the TCC modelling, the All, Operational and System View will be suitable and allow realizing the above stated model requirements.

5. ANALYSIS

There exist several architecture frameworks within NATO military environment as well as within civilian environment. From the not-military environment, two frameworks were analysed – the TOGAF and Zachman Framework. While the TOGAF seems to be less suitable for command and control modelling techniques and following C2 model development, the Zachmann Framework seems to be very "designer friendly" according to its well-arranged architecture description. For the TCC model development the three Zachman Framework model views seem to be a suitable tool for model development. These are contextual, conceptual and logical model description from the perspective of data (what), function (how), network (where), people/model-agents (who), time (when) and motive (why).

Based on above stated, the TCC model can be well described and implemented within a simulation environment. However, for the development of C2 model that is used in military simulation environments, the military architecture framework should be preferred for model description.

Military architecture frameworks analysed here were C4ISR AFv2, MODAF, DODAFv2 and NAFv3. The result of this analysis is very tricky because all frameworks have many common features. All frameworks contain three basic views and one common view originated in the first framework C4ISR AFv2. These are Operational View, System View and Technical View (in DODAF called Standard view) and one common or overarching view – the All View. Based on assumption, that the most important views for TCC modelling are All View (to describe context of the model within a wider simulation environment), Operational View (to describe logical and operational aspects of the model, its operational structure and logical functions) and System View (to describe physical aspects of the model, its algorithms and real information flow), the result is that all of above stated military frameworks could be used for TCC model description. According to required simplicity of the TCC model description, the C4ISR AFv2 (from 1997) seems to be the best choice for TCC model description. However, the need for NATO simulation environment and systems implementation rises a request for modern and widely-understandable framework, that is "living", up-to-date (state of the art), multi-nationally implemented and NNEC[3] friendly. According to this important demand, the NAFv3 seems to be the framework that should be used for model development and description (for further implementation to simulation environment). Within NAFv3, there are also another four views – Capability View, Programme View, Technical View and Service-Oriented View. The Programme View is intended to serve as a connection through other projects and acquisition programmes, therefore not suitable for simple model development and description. Also Technical View serves as a catalogue or list of used standards or rules as well as future standard perspective. For TCC model development would be suitable only in

[3] NATO Network Enabled Capability

case of wider implementation. In case of development within known and already existing simulation environment (e.g. MAK technologies simulator) is redundant because all standards and rules are already implemented in simulation architecture. The Capability View is very useful for implementation within wider military systems or networks but for the need of TCC modelling is redundant. Model capabilities are already described within Operational View because a capability is in fact set of operational and system functions as well as logical and physical characteristics that allow these functions. The Capability View serves to arch over these functions and characteristics and to summarise them in the form of capabilities and their mutual relationships. Analogous to Capability View, the Service-Oriented View is redundant for TCC model description (it does not mean that cannot be used too, it is just more work on already described matter) because a service is nothing more than a set of available and possible activities and information flows that are conducted according to requests (inputs). It is than a description of specific reactions to certain predictable inputs which is already included in Operational and System Views (e.g. Operational Activity Model, Operational Activity Sequence & Timing description, Information model, etc.).

CONCLUSION

According to above stated conclusion, it is suggested to prefer NAFv3 architecture framework as a generic tool for model description and development although all military frameworks are very similar and therefore useful. As a tool for model development and description within non-military applications (civilian control centres modelling, game development, etc.) it is suggested to prefer Zachman Framework that is very simple in structure but robust in application.

This paper is the final stage of the process of available architecture frameworks analysis that is intended to be used within the TCC model development and description. The analysis results can be used not only for the TCC modelling but also as a guide for standardized military modelling approach that can consolidate different approaches to military modelling.

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E-LEARNING NEEDS ENCOUNTER AND CORPOREAL LEARNING
A PLEA FOR SOCIAL PHASES, IN WHICH FLESHLY EXISTENCE, MOTION AND COMMUNICATION IS TAKEN SERIOUSLY

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Abstract: *Movement is a crucial component of one's identity. Thus, I can say: "I move myself, therefore I am." However, working, learning and playing on the computer reduce movement, and therefore changes how people feel about their identity. E-learning forces students to sit and not move. Computer game addiction is a serious illness. Teenagers are especially at risk and hardly exercise, causing a great impact on personality and brain development. Due to the fact that people are moving less, instances of ADHD has risen. To combat this problem, we have to look for solutions, e.g. E-learning must include social phases, which takes into account the human need for movement. A good combination of E-learning and social phases that enhances communication and corporeal learning should be encouraged. The school should assist in providing an education of identity through motion, therefore: Moveor ergo sum – I move myself, therefore I am.*

Keywords: e-learning, encounter, corporeal learning, motion, ADHD, identity

INTRODUCTION

"Let him that would *move* the world, first *move* himself." (Socrates)

Nowadays we are dealing with "no moving" society. It is interesting that children are moving all the time – they have to. Elderly people usually forget how important is to move. We recognize this need, when we are not able to move (illness etc.) This paper wants to show, why is movement for us important, especially now, when we are surrounded with technology and how to reduce illnesses like Attention – Deficit Hyperactivity Disorder (ADHD).

1. REDUCED MOVEMENT CAUSED BY WORK AND PLAY AT THE COMPUTER AND E-LEARNING

The PC has many advantages – this is indisputable.
E-learning is a notable achievement in education, and provides valuable chances for students to broaden their knowledge.

1.1 E-learning contributes to the problem of people moving less.

We need physical exercise for language, and thus, to interpret the world. However, a lack of exercise, despite rich cognitive information on the PC, causes a lack of language competence, and therefore, a lack of ability to interpret the world.

The decrease in school performance found in students, especially male adolescents, coincides with the mainstream introduction of computer games and game consoles. Due to a lack of exercise, their kinaesthetic skills are not trained (Korte 2009, 196f.).

Today, a large number of children and adolescents are developing impaired motor skills. “Too much time in front of the computer and too little sport” is the simple, but far-reaching formula, according to Logar. “We have to teach and show children to care for their physical health and to preserve and look after their body functions through sensible eating habits, a reasonable amount of physical activity and conscious anatomic-functional movements in everyday life” (Logar 2006, 82). Logar suggests that, “it is necessary to provide attractive and encouraging places for exercise to preserve the positive aspects of physical exercise for the human development, health and socialization” (Logar 2006, 82).
Are we promoting a lack of physical exercise through E-learning?

1.2 Computer game addiction - a serious illness

Teenagers who hardly exercise are especially at risk for computer game addiction, which could have a great impact on their personality and brain development.
“On the [I]nternet, I´m somebody important,” writes a person addicted to computer games on the internet platform www.onlinesucht.de. “In that game there were different levels to reach. The higher the level the higher the reputation. Within eight months I had reached the highest level. I was respected, I was liked. Exactly what I have always wanted. In reality I mostly was teased, I was nobody. But in the game I was SOMEBODY IMPORTANT” [sic] (Bauer 2007, 23).

Educationalist Wolfgang Bergmann and brain research scientist Gerald Hüther clearly state in their 2006 book *Computer Addicted Children Captivated by Modern Media* that “no child is born with an aptitude for computer addiction.” This behaviour is an acquired, learnt behaviour. Using pictorial methods, researchers discovered that, when activated, neurological connection patterns and synapses in the brains of children and adolescents are so strongly paved (“motorways”) and fixed that the aforementioned behaviour starts more and more easily and finally, almost automatically, if an opportunity arises.

“The reason for children and adolescents becoming computer addicted is not their computer or computer games, nor their bad genetic predispositions or their incorrectly wired brains, but the disturbed relationships of people whose influence they grow up under and whose community they grow into.” Young people who are strong, competent, able to build relationships, open-minded, creative or in love with life never become computer addicted.

Some could manage to find a way out of this addiction crisis by finding and rediscovering one's self again. Most respondents said, “At some stage something happened; somehow they have made a new experience strengthening what they seemed to have lost: their self-esteem, their confidence, their courage, their lust for life, for discovering and creating things. Sometimes a way out were encounters with other people” (Bergmann – Hüther 2006, 139ff).

2. CONSEQUENCE: ILLNESSES

More and more illnesses are presented in societies. The most of them are even curable. But in the educational process we are dealing especially with ADHD, where the movement plays a big role and is one of the most investigated. Next few lines are describing this illness and one in the market interesting technological product – interactive boards, which help the children and teacher in the educational process.

2.1 What is ADHD?

ADHD is one of the most common childhood behavioural disorders. It is possible that ADHD continues through adolescence and adulthood and can cause depression, difficulties staying focused, etc. Kids with ADHD act without thinking are hyperactive and have trouble focusing (Kingley 2008). It is normal for all children to be inattentive, hyperactive or impulsive sometimes, but the symptoms and key behaviours of ADHD are present over a long period of time. It affects an estimated 8 to 10% of school-age children (Kingley 2011). In some other analyses, these numbers are lower. The numbers are variable because of the different diagnostic criteria, methods of investigation, geographical regions and number of investigated people. An average of 1 to 5% of children has ADHD (Brandau 2004).

2.2 Subtypes of ADHD?

Doctors and other experts have developed special criteria to determine symptoms of ADHD. The disorder is broken down into three subtypes: **Predominantly hyperactive-impulsive, predominantly inattentive, and combined hyperactive-impulsive and inattentive** (Brandau 2004). Each subtype has its own pattern of behaviour.

2.3 What Causes ADHD?

The experts are unsure about what causes ADHD. Some research shows that genes play a large role. However, other factors such as prenatal and perinatal injuries, mental and physical development and social environment contribute to ADHD (Brandau 2004). Symptoms of ADHD can occur under a number of disorders that start as post-traumatic reactions to bad behaviour, maltreatment or abuse, autism, mental disability, giftedness that is not fostered and psychosocial stress (domestic violence, depression, anorexia, psychosis, and anxiety).

2.4 How is ADHD treated?

Doctors usually use several different treatment methods, called a multimodal approach (medication, psychotherapy), which helps a child to create a routine, avoid distraction and discover a talent.

2.5 Working with an »ADHD child«

Working with ADHD children is a challenge. Franz Sedlak wrote in his paper, "Ten Commandments" [...] (Sedlak 2001), suggestions on how to treat, to react and to work with ADHD children.

Hyperactive and attention-disordered children …

1. [...] are often tense as steel springs - therefore, use every opportunity to relieve stress and promote relaxation!
2. [...] have very receptive moods - so, create a positive, balanced and accepting atmosphere.
3. [...] are often very exhausting and often provoke warnings, fines, etc. These actions often cause new stress - thus, break the vicious cycle, and instead, provide critical help!
4. [...] are very sensitive - thus, avoid any over-stimulation!

5. [...] have an unproductive urge to move - therefore, it is useful to find outlets for overactive children.
6. [...] are easily overwhelmed – so take a break often!
7. [...] often have a hunger for adventure - so provide intense experiences!
8. [...] experiences sometimes get worse by an unbalanced nutrition - therefore, encourage and foster a healthy lifestyle!
9. [...] often lag behind in development – therefore, provide help in learning and concentration.
10. [...] have difficulties with the distinction between "figure" and "background," (in both important and unimportant situations) - therefore, give hints about what is important and unimportant in learning tasks and practical problems.

2.6 New technology – interactive boards

Interactive technology in the educational process brings for all children, especially for children with ADHD, something new. It helps not only a teacher, but also the pupils, students to follow the lessons. It can help to concentrate the content, which is available in readable version after the lessons (at home etc.) Advantages of this kind of work it is certain the opportunity to follow the technology process also in education and in a new way to teach the children and other. However all societies should be aware that technology is created for human being to help him stay healthy and not for uncontrolled, misused use.

3. "RUN FOR YOUR LIFE"

E-learning must include social phases, which take into account the human need for movement. Therefore, we conclude that neurobiological findings must be taken seriously – literally: "Run for your life."

3.1 The body's memory

Doctors and neurobiologists like Joachim Bauer suggest that life experiences do not only make an impression on our brain but also on our body (Bauer 2002). Thus, we should facilitate positive experiences that are stored and can be retrieved as resources.

3.2 Psychomotricity (Motopädagogik) assists in correcting a lack of motion

Children have fun with physical exercise. The more exercise they do, the better it is for their language development and interpretation of the world.
However, if physical exercise is reduced, language competence also suffers, resulting in a decreased ability to express experiences.
For children with a physical handicap and brain damage, Kiphard developed a system of exercise in the 1950s called "psychomotor exercise treatment"(Kiphard 2009). Later, the term moto-therapy was adopted. This system attempts to develop people´s movement deficits through therapeutical means, which has a positive effect on cognitive development. Out of moto-therapy, moto-pedagogy was developed.
Physical exercise is a strong component in the moto-pedagogy method. In the gym or outside, exercises are developed, ultimately combining action with thinking. Everybody gets cards with tasks: For example, „Climb onto the climbing wall – on top you will find a quotation from the Bible. Read it through and enjoy the view out of the window!" "When you reach

your goal, you´ll find the quote, "*In your strength I can crush an army; with my God I can scale any wall. "* (Psalm 18:29).

3.3 Therapeutic functional exercises combine thoughts with motion.

Teachers can do many simple exercises in class to promote moto-pedagogy. For example, the teacher can strike a triangle at different tones, beginning with a loud sound. As the tone becomes quieter, the pupils make themselves smaller and smaller. Students will develop an auditory perception in their thinking (loud = tall; quiet = small) and actions (posture).
Therapeutic functional exercises positively contribute to the development of a pupil's personality. Support of physical movement through motor-skill training has highly positive effects on how willing pupils are to learn and perform. Rhythmical musical education holds a crucial position among all these exercises because it promotes body control, concentration, and continuous development of a pupil´s personality.

3.4 Open forms of learning can integrate movement into their learning concepts by using the "station plan"

Based on ideas from Maria Montessori and other progressive pedagogues, open forms of learning (i.e., free work) were developed. Through prepared materials in a free environment, the pupil has the opportunity to work on their own. Students, in these instances, educate themselves and become „the builder of him- or herself".
Movement is inherent in the concept of free work. Pupils get a station plan with an overview of the various tasks and activities. The pupil goes to the stations where the teacher has prepared material and tasks. There, the assigned tasks are completed, and after having checked the results by themselves (self-correction), the tasks are checked off on the plan. Then, the pupil moves on to the next station.

3.5 Body and motion play a major role in the concept of "multiple intelligences" (H. Gardner), especially in the bodily-kinaesthetic and musical-rhythmical intelligences.

Howard Gardner sees intelligence as a „family" term with different dimensions. He describes eight forms of intelligence, but suggests that eight is not a definitive number and can be extended depending on the point of view (Gardner 2002).
The bodily-kinaesthetic intelligence is based on physical exercises. Ballet dancers, for example, get to know certain melodies only after having put them into motion and expressing them physically. In order to have deeper and more intense experiences during learning, it is useful to express certain goals and then put them into movement. In that way, the most effective combination of intelligences is reached by people singing their aim (verbal-linguistic and rhythmical-musical intelligence) or dancing it (bodily-kinesthetic intelligence).
The combination of all three types of intelligences intensifies the learning process. Hand in hand with the rhythmical-musical intelligence, every participant finds his/her aim in a suitable rhythm and appropriate melody (Gerjolj 2011).

3.6 Gestalt-pedagogical work with the body aids holistic development

The term „ego", which has already been described by Sigmund Freud, was later integrated into various forms of therapy, one of which is psycho-somatic physiotherapy. „It is seen as the manifestation of one´s own identity within the body"(Bader-Johannson 2000, 114f.).

Research in bio-genetics (Lowen 1976), resulted in physical exercise becoming an essential component in the goals of Gestalt therapy and Gestalt pedagogy. The body is the subject of every perception in life, particularly of our own self-perception. Organisms perceive their own self, and trust their body to self-regulate. Organism can again become more balanced by „playing through" problems (Petzold 1994, 1996).

CONCLUSION: Moveor ergo sum – I move myself, therefore I am.

A good combination of E-learning and social phases, which serve to enhance communication and corporeal learning, is a positive educational aim.
All kind of activities help each person to find something for him/her-self. Daily activities help to maintain physical condition and also psychical. All societies should take care for healthy children and adults. First of all with opportunities to less expensive activities and with stimulation of healthy products etc. Parents are the first teachers, second is the school and other institutions – all should assist in developing identity through motion.

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THE CURRENT STATUS AND PROSPECTS OF DISTANCE LEARNING AND E-LEARNING IN THE HUNGARIAN MILITARY HIGHER EDUCATION

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Abstract: *E-learning is increasingly becoming an important element of the creation, acquisition and transmission of knowledge. The Bologna Process and the changes related to bachelor and master degree programs increase the amount of examinations but decrease the contact lessons at universities. Teachers and students are together looking for new solutions for arising problems, most of them apply web2.0 technologies. New approaches for new ways of evaluations, supported by the internet are from a one-way information distribution channel to a two-way communication channel. In the eLearning content, the essential feature is that the students are also acting as content creators and in practice the students are no longer pure customers, but they are actively influencing the learning progress. This article is about the results of e-learning methods used in the Hungarian military higher education.*

Keywords:
E-learning, military higher education, Cloud Learning, LMS system, Moodle, general system of promotion, distance learning.

INTRODUCTION

E-learning is increasingly becoming an important element of the creation, acquisition and transmission of knowledge. The importance of eLearning content will grow especially in the sector of higher education and training, as well as in the professional further education. Evaluations of skills and competences are in the foreground of military higher educational progress. The Bologna Process and the changes related to bachelor and master degree programs increase the amount of examinations, but decrease the contact lessons at universities. This problem requires new solutions, a significant part apply web2.0 technologies. Web 2.0 technologies place great emphasis on user generated content, content sharing and collaborative work, all of which add significant value to distance learning processes. New approaches for new ways of evaluations supported by the internet are from a one-way information distribution channel to a two-way communication channel. Within the e-Learning content, the essential feature is that the learners are also creators of the content and in practice the students are no longer purely customers, but they actively want to influence the learning process. However the methods of the teaching process are mostly traditional, the accreditation of eLearning courses may be difficult because the different evaluation methods do not fit into the learning context.

1. MILITARY HIGHER EDUCATION IN THE ZRÍNYI MIKLÓS NATIONAL DEFENSE UNIVERSITY

Currently the ZMNDU has two faculties, Kossuth Lajos Military Science Faculty and Bolyai Janos Military Technical Faculty. Students can learn 10 master and 11 bachelor programmes in the University on full time and on correspondence sections. Distance learning and e-learning process takes place in 4 different ways in the University. Two of these opportunities are part of regular education and two of them depend on the personality of the instructors.

The first opportunity is based on the uniform study administration system, called Neptun. This system stores data about students, instructors and all participants of educational process. In addition, the system includes distance learning options to it. Figure 1. shows the services of Neptun System, which can be reached by all students with an ID and a password.

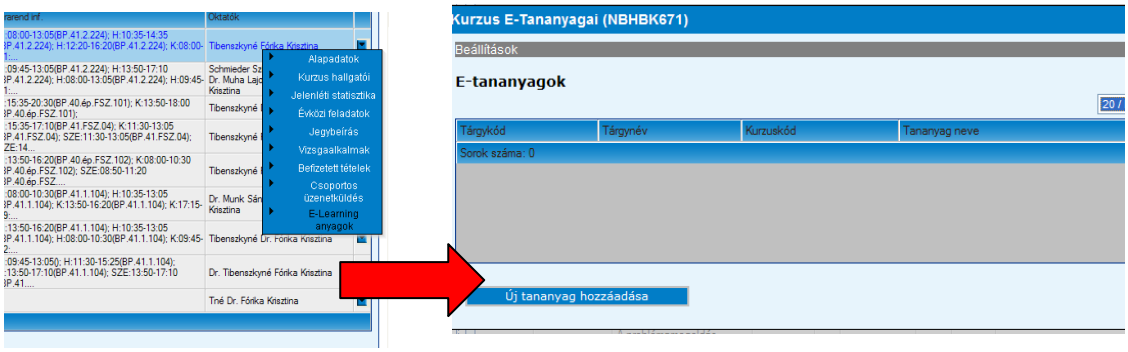

Figure 1. The e-Learning materials in the Neptun System.

If the subject is listed in the system and assigned to that particular student and also there is an available e-learning material, than the student can download the e-book. There are no other ways for e-learning, no tests or questionnaires in the Neptun system. These services available at this system are not suitable for the real distance learning environment.

The second opportunity for students to reach a training material, is the Central Library. At the Library the students can use e-notes, e-books. The database of e-learning materials is a collection, which has been published in the ZMNDU and available for each student after authorization through the internet. (Figure 2.)

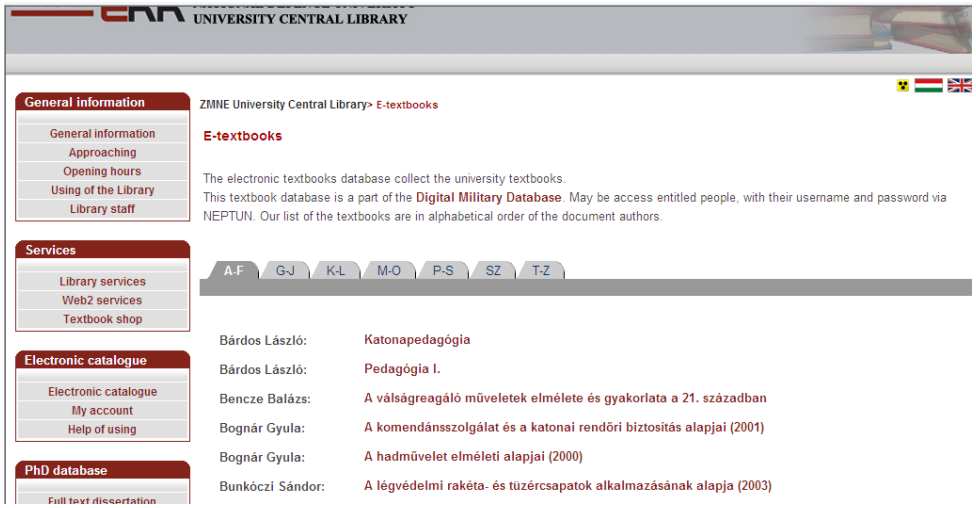

Figure 2. The list of E-textbooks in Central Library of ZMNDU.

Students can browse by author, by title or by abc sequence. This database is connected with the Neptun system and for the registration the students can use their Neptun ID. The options mentioned above are the two methods of the available official tools in e-learning in the Hungarian military higher education.

2. APPLICATIONOF CLOUD LEARNING IN THE EDUCATION

If we want to see clearly what does Cloud Learning terminology mean, we have to discuss the perfect meaning of cloud computing. **Cloud Computing** is a type of internet application that is delivering the on demand IT resources, pay-per-use, providing virtual resources as a service to users over the internet and based on service level agreements. [1] The structure of the cloud computing model consists five layers from the physical hardware to end users. The layers of cloud computing are built up like the stones of a pyramid. The corporation of these layers enables professional and commercial services. These services include admission control, execution management, monitoring and billing services and deployment of applications in the cloud. One of these services is C**onnectivism**, which "is the use of a network with nodes and connections as a central metaphor for learning". [2]

The Cloud Learning is a type of virtual connectivism that enables reaching and sharing documents, pictures, videos, presentations, provides virtual classroom, wikis, blogs, chat, test and other services for the purpose of support the life-long learning. [3]

3. FOCUS ON THE LEARNING MANAGEMENT SYSTEMS

Learning Management Systems (LMS) provide complex tools of e-learning in the world of Cloud Learning. There are some free software beside buyable and rentable systems of great firms – like Microsoft, Oracle, Adobe etc.

The most popular free LMSs are Moodle and Ilias, which are used by many Hungarian educational, business or government organizations and individual teachers.

The advantages of Moodle are: available in several languages, easy to use and enable rich assets of e-learning tools. Supports web standards and different operating systems and reachable through the internet. This system is not supported at ZMNDU. The author, as the teacher of the university sponsores an own Moodle system to support her own courses and teaching process. The system is called Forika Moodle. This system is not on the server of the university, but its operated by an external service provider. In this framework there are three main courses: the computer technology, the Military technology and the Robotics.

Under these main courses, there are twelwe courses, 8 bachelor and 4 master. These courses are accessible for students after registration on the first page in the Forika Moodle. We can see the corse name, the description, the teacher's name and required information. The description is built on a program of the current subject in the military higher education. (Figure 3.)

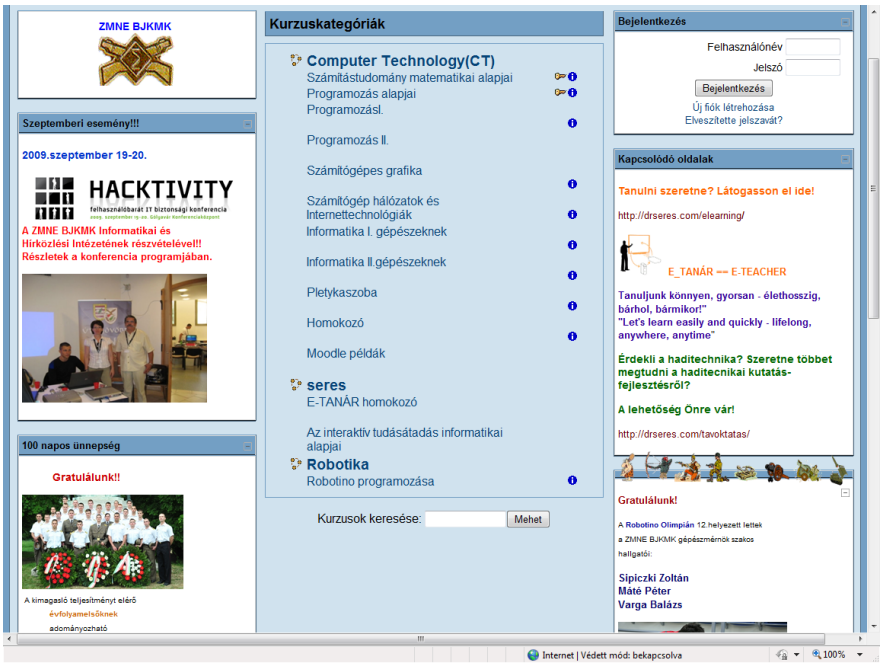

Figure 3. The course wiew in the Forika Moodle system.

The aim of the system is to give more information about the subject, enabling storaging documents, pictures, presentations, tests, etc. Most of the courses consist of a 15 week section. Every section includes presentations of lessons, document formats of the materials, suggested questions, tests, examples, solutions. (figure 4.) These classes could include Wiziq virtual classrom, wiki and glossary workshop or quiz too. This portal could be reached by some of my colleagues and students. Teachers can check the activity of their students and ask for reports about the visited pages of students or called services.

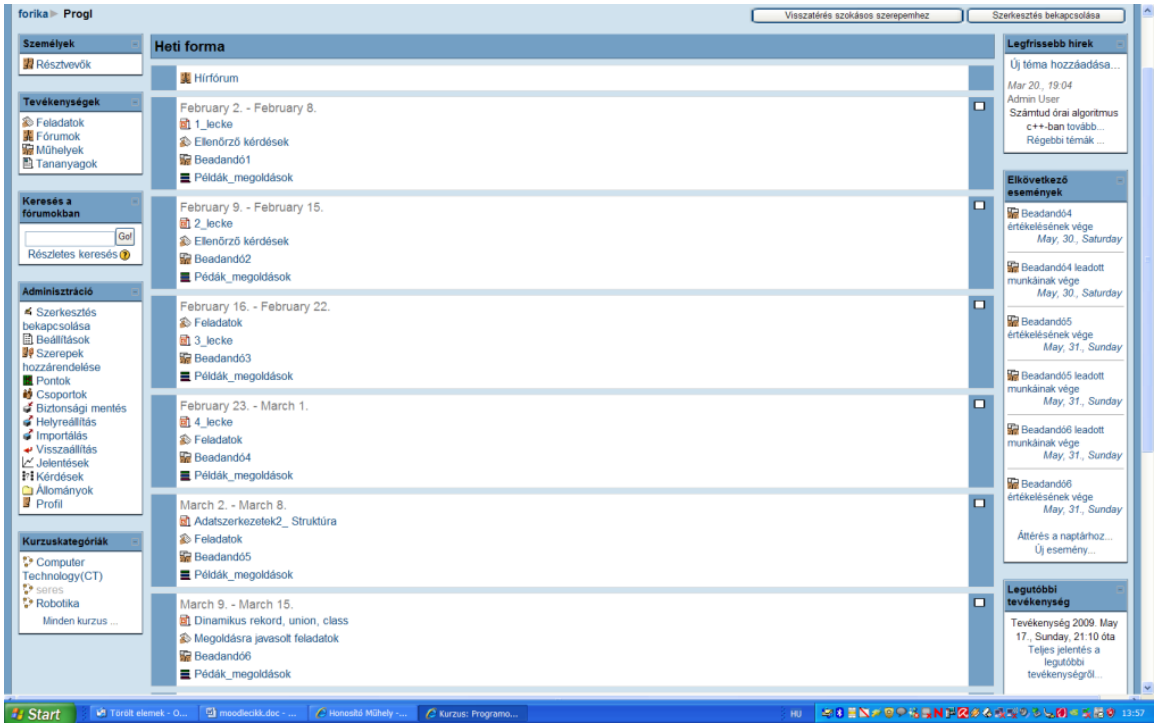

Figure 4. The structure of courses.

4. APPLICATION OF DISTANCE LEARNING IN THE GENERAL SYSTEM OF PROMOTIONS

The General System for the promotion of a professional staff of Hungarian Army ensures that the officers acquire the required knowledge by an organized, systematic way., This option is provided by the Military Training Centre at ZMNDU for the officers. This centre organizes general career distance learning courses every year.

It means that the student receives a DVD on the course opening occasion, which they have to learn and submit a mandatory in e-mail. (figure 5.) The interactive distance learning material contains the general military theoretical knowledge for promotion in areas of tactics, surveying services, chemical weapons etc. The successful theoretical and tactical exam is the condition for the promotion of the first lieutenant, captain or major.[4]

Figure 5. The general military knowledge for career course.

They have to travel to Budapest 4 times, three times for educational purposes and one examination. As a result of international commitments significant part of the stacks serves in foreign military missions.

5. PROSPECTS OF DISTANCE LEARNING

The Digital Innovation and Action Plan focuses for the single governmental IT management, planning, monitoring and control. In 2011, the Government Operating Centre got into shape. The aim of this centre is to provide the operations of high-priority systems only to state owned service providers in addition to a strong control and regulation. The single common network infrastructure can contribute to the reduction of operating costs and complexity of the system as well as new opportunities for information sharing.,A central cloud computing and Cloud Learning service can grow on this basis. These methods of cloud learning could be used by army staff or the soldiers in personal working and missions. The soldiers serving in the missions can have extremely specific demands for learning and further training. The nature of work and the special off-road conditions will further increase the relevance of the e-learning. The soldiers serving in extreme conditions are justifying the maximum use of e-learning tools in the future trainings. Important element of an e-learning course in the area of missionary activities is a use of tools which can be safely used in special off-road conditions. The laptops, notebooks, tablet PCs, specially developed for military applications have these properties. The missions have stable and secure connections to the Internet and Intranet, in addition, containers have a minimum of two, fully operational skype connections. This connection can also be used for LMS systems and Cloud Learning deals.

CONCLUSION

The military higher education has a special role compared to the other higher education systems. One of its duties is to further train the military engineers and scientists to bachelor, and master level. The e-learning is mostly used to share the theoretical knowledge; the students acquire the practical training in military situations. Cloud computing and Cloud Learning are such possibilities that will receive higher emphasis in the near future's education.

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E-LEARNING THROUGH MOODLE IN THE ACR FROM THE ADMINISTRATOR, TUTOR AND STUDENT PERSPECTIVES

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Abstract: *The aim of the paper is to share experiences in implementing e-learning at the University of Defence (UoD) in Brno. It presents organizational and technological aspects of adapting the Moodle Learning Management System to the requirements of military education. It weighs the benefits and downsides of Moodle. Furthermore, the outcomes of a survey concerning the UoD user opinion on Moodle are discussed. The authors propose Moodle as an efficient and cost-effective technological solution for a virtual learning environment in the Armed Forces of the Czech Republic.*

Keywords: e-learning, Learning Management System, Moodle, University of Defence.

INTRODUCTION

New technologies are becoming increasingly popular in work setting, in daily life and in education. Learning Management Systems (LMS), which aim to provide a rich, integrated learning environment where educational content can be delivered interactively, are rapidly gaining ground in the field of higher education, and military education is no exception.

Although the University of Defence (UoD) academic staff had been experimenting with e-learning for several years on a voluntary basis, it was only in February 2010 when the Moodle LMS was adapted to the UoD educational needs. The author of this paper was assigned as the administrator of Moodle and the UoD staff and students were provided access to it by their UoD login and password. Over the year, Moodle has been introduced to the UoD staff, and several lecturers started building their courses in it. In addition to that, in February 2011, the system was converted into the Moodle 2.x version, which is now being verified.

The implementation of the system at the UoD was primarily pursued by English language teachers of the UoD Language Training Centre (LTC), who had been aware of the advantages of using LMS in language training. Due to their previous participation in distance learning courses on distance learning delivered through several LMSs, they had developed technical skills and pedagogically sound practices enabling them to use the Moodle LMS for the benefits of their students. At the moment, they are developing dozens of courses for various language learning purposes in the UoD Moodle LMS.

Drawing from their experience in adapting and implementing Moodle at the UoD, the authors aim to share opinions on using Moodle from the administrator, course creator, tutor and student perspectives. Besides, they attempt to assess the prospects of the Moodle LMS as a virtual learning environment for wider deployment in the Armed Forces of the Czech Republic (ACR).

1. E-LEARNING

There have been many terms to describe the use of technology for learning. One of the well-established terms is e-learning. It refers to the computer and network-enabled transfer of skills and knowledge. The American Society for Training and Development (ASTD) 0 defines e-learning as a broad set of applications and processes which include web-based learning, computer-based learning, virtual classrooms, and digital collaboration. Content is delivered via the Internet, intranet, audio- and videotape, satellite broadcast, interactive TV, and CD-ROM.

In pursuit to design e-leaning for effective open, flexible and distributed environments for learners worldwide, Khan 0 formulates the following definition of e-learning: 'E-learning can be viewed as an innovative approach for delivering well-designed, learner-centred, interactive and facilitated learning environment to anyone, anyplace, anytime by utilizing the attributes and resources by various digital technologies along with other forms of learning materials suited for open, flexible and distributed learning environment.' To create meaningful learning environment, Khan 0] recommends considering and developing eight dimensions: institutional, management, technological, pedagogical, ethical, interface design, resource support and evaluation.

This framework refers to large institutions that have sufficient means and trained personnel to comply with these dimensions. For the needs of small institutions, such as the UoD, a simplified e-learning framework, including only managerial, pedagogical, technological and social dimensions, has been suggested 0. This article aims to contribute to the development of these dimensions by presenting a case study on the implementation of e-learning through Moodle at the UoD.

2. IMPLEMENTATION OF MOODLE AT THE UoD

Establishing a suitable technological platform is one of the essential steps for e-learning implementation in educational organizations. Currently, the most popular and wide spread options are LMSs, software applications or Web-based technology used to plan, implement, and assess specific learning processes. They enable educators to create and deliver content, monitor student participation, and assess student performance. Apart from the tools designed for creating and conducting courses, they also offer communication tools for social interaction, such as forum, chat and messaging. The Advanced Distance Learning group, sponsored by the United States Department of Defense, has created a set of specifications called Shareable Content Object Reference Model (SCORM) to ensure the standardization of LMSs 0.

One of the most important issues in e-learning implementation in an educational organization is a close collaboration of those who are concerned: managers, administrators, authors of course content, tutors and students. It is advisable to monitor their first experiences and opinions, and consequently eliminate frustration which might be connected with difficulties brought about by changes accompanying innovative approaches. The following sub-chapters briefly state the UoD administrator's, course creators', tutors' and students' opinions on e-learning implementation via Moodle.

2.1 The UoD Administrator's Opinion

When selecting an appropriate LMS in an organization, it is important to weigh several aspects. There are numerous guides providing tips of what to take into consideration 0. The guides provide complete details on the various LMS product families in a very extensive way. Some of them present a complete set of packaged solutions for each of the LMS product lines, consisting of pre-defined software and hardware configurations, and full details on recommended options.

One of the vital decisions that has to be made is whether the organization is going to purchase a LMS (a proprietary solution) or whether it is going to adapt a free software platform. In case of purchase, the contractor might provide the customer with access to manage all aspects of training. Then the organization can use an enterprise-level LMS that is hosted, maintained and technically supported by the contractor.

At the UoD, the main criterion for establishing a technological platform was the amount of expenses. Therefore, the solution with an open-source licence has been chosen. One of the advantages of such a solution is that an open-source LMS can be adapted and developed flexibly according to the specific needs of its users. Among other circumstances which influenced the selection of the LMS was the assessment of other universities' experience in using their e-learning solutions. Both authors underwent several training via different LMSs at Czech civilian universities and participated in various discussions on their advantages and disadvantages. Upon mature consideration the Moodle LMS has been selected as a system that meets the requirements to support e-learning at the UoD.

Moodle is suitable for providing courses the organization of which is based on top-down approach; namely the courses which are intended for almost all employees, such as Safety and Security at Work and training in using the Staff Information System. At the UoD one of first courses of this type was the Command Course. It is an obligatory training course designed for all soldiers at the UoD and is conducted regularly. Besides, other courses aimed at reaching a wider target group are under preparation, such as the training for using the Staff Information System, Training for Commanders of Military Vehicles, Security of Classified Information and Safety and Security at Work.

However, the origins of the UoD Moodle are connected with bottom-up approach to creating and managing courses. Most of them are English language courses designed by LTC lecturers as e-learning support to their face-to-face instruction. They have been developed and used on voluntary basis and are tailored to their students needs. At moment, the LTC lecturers have been developing approximately fifty language courses.

The following graph shows access statistics of all UoD academic staff and students over the winter semester in the academic year 2010/2011.

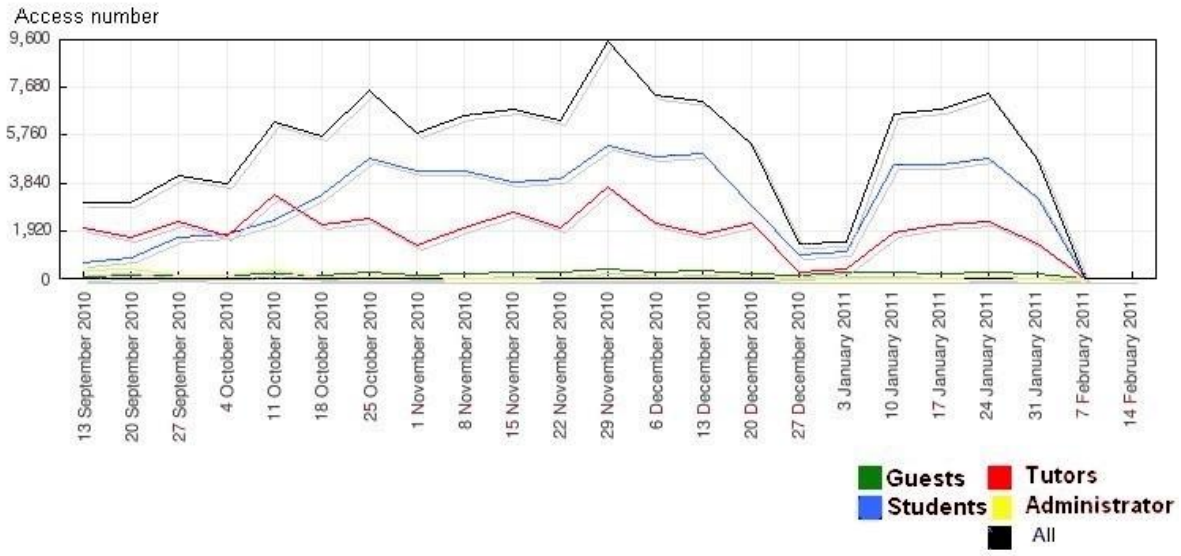

Figure 1. Utilisation of the UoD Moodle by academic staff and students (winter term 2010/11).

The graph illustrates the UoD tutors' and students' engagement in e-learning provided by Moodle. Apart from the Christmas holiday, the access statistics shows their relatively steady interest in utilizing Moodle. There is a sharp drop at the end of the semester when the tutors were recommended to cease developing their courses, since at that time the administrator was converting the system into the Moodle 2.x version.

From the administrator's point of view, the Moodle LMS was implemented at the UoD in due time. The UoD users can draw on the experience of other universities which have been using Moodle for a long time, as well as on the extensive online support provided by wide Moodle community. Most importantly, with a relatively small number of courses in the UoD Moodle in February 2011, it was feasible to deploy Moodle 2.x version, which is compatible with the latest technologies. Thus the UoD users are in the forefront in verifying the latest version of Moodle in the Czech Republic.

2.2 UoD Course Creators and Tutors' Opinion

The pie-chart in Figure 2 shows the outcomes of an opinion survey of thirteen UoD lecturers teaching different subjects, who have been using Moodle for several months.

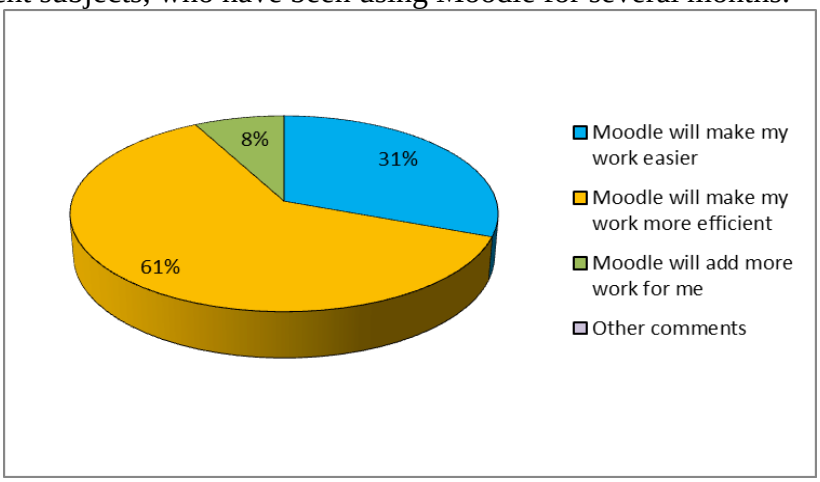

Figure 2. Academic staff's responses to the implementation of Moodle at the UoD.

The survey was conducted in February 2011. The UoD lecturers based their opinion on their initial experience of using Moodle as voluntary course creators and tutors. Although the sample of respondents is small, it can be implied that the overwhelming majority of respondents welcome Moodle as an efficient tool which will facilitate their teaching.

To engage the UoD academic staff in using Moodle, one of the authors used Moodle as a supporting tool for blended learning in the Academic English Course designed for the UoD lecturers. In this course, the UoD academic staff had a chance to examine Moodle from the student perspective; after that they might consider using Moodle in their own specialized courses. The following graph generated by Moodle statistics tool shows the overall activity in Moodle of the tutor and her 'students', who are in this case academic staff. It includes the access of thirteen participants of the course and the tutor within a period of four months, arranged by weeks from September 27th 2010 to January 24th 2011.

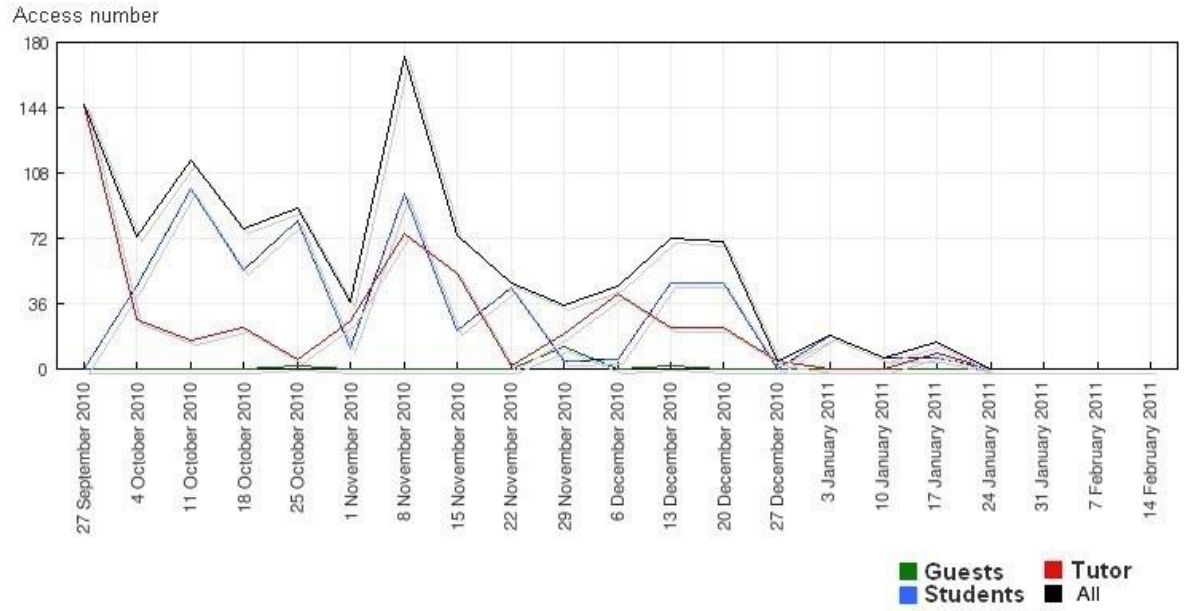

Figure 3. Utilisation of the UoD Moodle by thirteen participants of the Academic English Course and their tutor within a period of four months (winter term 2010/11).

At the beginning of the semester, the tutor had a large number of accesses when preparing her course; later the academic staff's accesses outnumbered them. The 'students' access statistics shows the continuous interest of the UoD academic staff in using Moodle outside the classroom throughout the course, with the exception of the end of November, when their class was cancelled, and the Christmas holiday in December. It is important to state here that they were only recommended to utilize Moodle for their study, so they were using it on voluntary basis. The UoD staff appreciated virtual learning environment and participated in enlarging the e-learning study support for this course by suggesting several web-based materials selected according to their interest, which were added to the bank of study materials. Thus they contributed to maximizing the potential of the learning situation, which is one of the desired aims of blended learning.

2.3 UoD Students' Opinion

Since most of the courses in Moodle are designed to support English language teaching, the respondents of the survey on student opinion on Moodle were participants of English language courses created and conducted by the author. Up to 41 students of Bachelor's study programme were asked to identify with eight statements concerning their experiences with Moodle. Figure 2 illustrates the responses to the critical statement:
'I consider the implementation of Moodle into the English learning instruction _____.'

a) positive
b) quite positive
c) rather negative
d) negative

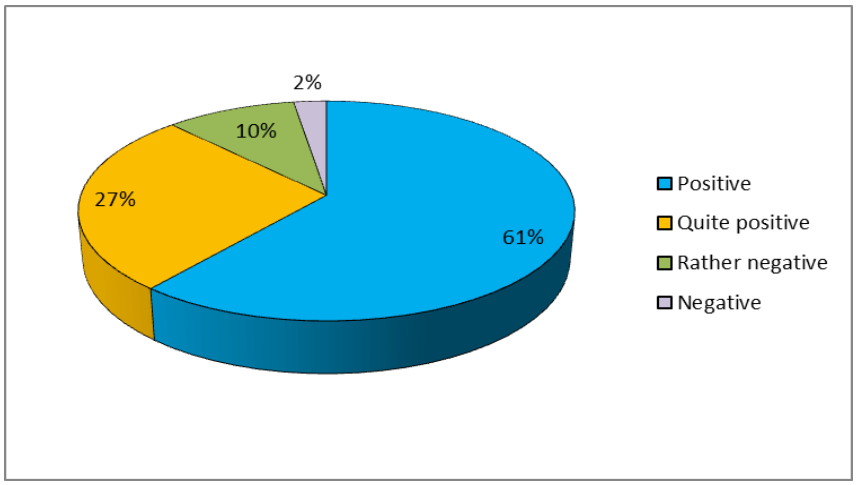

Figure 4. The acceptance of Moodle implementation into English language instruction by 41 UoD students (January 2011).

Up to 36 students selected 'positive' or 'rather positive' options, which constitutes 88% of all responses; four chose 'quite negative' and one 'negative' options. The only student who selected the 'negative' answer explained his approach in an interview in the following way: 'You know, I'm always dissatisfied, so don't take it to your heart…'. The interview with the four students who selected the 'quite negative answer' was very useful, since they clarified their reservations, which led to the optimization of the UoD Moodle interface.

The outcomes of the survey imply that the first stages of the implementation of e-learning through Moodle at the UoD were met with positive acclaim.

3. MOODLE AS A PROSPECTIVE TOOL FOR EDUCATION IN THE ACR

Though the UoD first users of Moodle have expressed positive attitude towards this educational technology, in view of its prospective wide implementation in the ACR, it is advisable to consider its limitations. One of them is the fact that it is web-based technology requiring the connection to the Internet and to a monitor, which could hinder its use at some military installations and on foreign missions. Another downside is the incompatibility of some web browsers with some learning objects which might be posted in Moodle. In addition to that, in case of excessive load, the responses of the system could be delayed. On the other

hand, the Internet technology is under rapid development, therefore it is very probable that these problems will be eliminated soon.

The crucial issue that currently prevents the implementation of Moodle in the whole ACR is a dispute on where it should be run on. The ACR has its own Army Data Network, which is, however, not connected to the Internet. Were Moodle to be run on it, the concept of time flexibility, one of the crucial benefits of e-learning, would be ruined. This problem could be solved by enabling the users the access to the courses in Moodle within their leave of absence intended for their self-study. Through Moodle statistics tools, the superiors could check their inferiors' activities in Moodle, record their progress, and consequently assess their study results, as well as the effectiveness of e-learning.

Despite the above mentioned disadvantages, Moodle constitutes a suitable virtual educational and training environment for the ACR. Due to its adaptability and the technology on which it runs, it is cost-effective. Furthermore, it can be tailored to the demands of the ACR units in terms of user authorization, variety of activities and the selection of its technological platform. The pie-chart below shows the UoD academic staff opinion on possible deployment of Moodle in the ACR. Thirteen respondents answered the question: 'Do you think Moodle is suitable for the deployment in the ACR?'

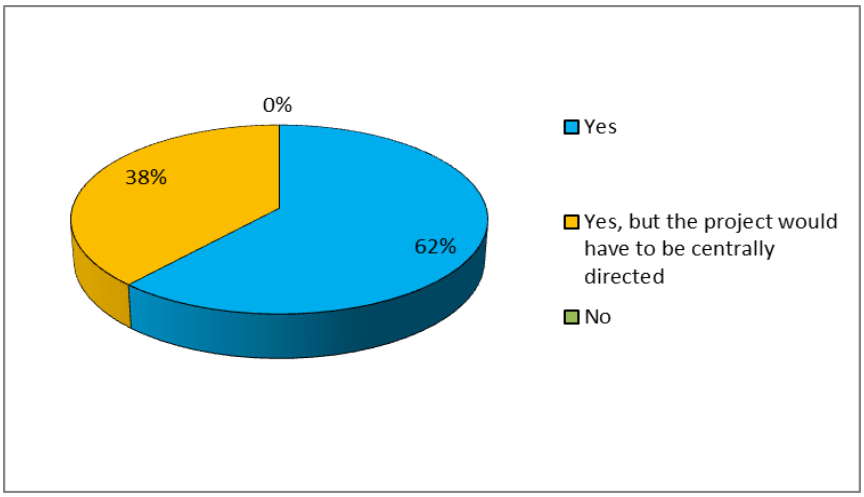

Figure 5. UoD academic staff's opinion on possible deployment of Moodle in the ACR (February 2011).

The answers show that the first users at the UoD are optimistic and perceive Moodle as a possible virtual educational environment in the ACR. In case Moodle gained support from the ACR managers and the project was centrally directed, it would be advisable to the introduce rules for working with the system; for example, to design guidelines for course creation. By unifying and incorporating the demands for the system made by various ACR installations, the ACR would acquire an effective system for education and training at minimal expenses. To couple the technology with pedagogy, it would be vital to provide prospective course designers and tutors with training on e-learning.

4. CONCLUSION

The paper presents the opinions of the first users of the Moodle LMS on the system and on its prospects in the ACR. Although the samples of respondents to the survey are relatively small, their experiences and opinions in pioneering the way towards a possible unified virtual learning environment in the ACR are invaluable. Generally, the first stages of the implementation of e-learning through Moodle at the UoD were met with positive acclaim.

Since the ACR organizes numerous courses for relatively broad target groups on a regular basis, it is worth considering the ways of lowering the cost of them. One of the solutions suggested in the paper is to use the Moodle LMS for creating and delivering course content, monitoring users' participation, assessing their performance and providing communication between them. As Moodle is compatible with other currently used LMSs, it is also possible to import various military courses designed by other NATO member states or their allies, as well as specialized courses being developed at civilian universities all over the world.

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DESIGN OF INTERCONNECTION SERVICE FOR COMMAND AND CONTROL SYSTEMS

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Abstract: *This paper describes conversion process of Czech C2 system unit data to HLA compatible simulator as entity data. The conversion process cannot be based on deterministic algorithm but the look-up conversion tables are more suitable solution. The paper describes construction of the conversion look-up tables. The architecture of the Interconnection service based on SOA is discussed in the paper as well.*

Keywords: HLA, C2, service, SOA, interconnection, distributed simulation.

INTRODUCTION

The connection C2 systems into a distributed simulation is not only important for ground force training where the constructive simulator plays role of opponent and / or friendly units for commanders training at the real C2 system but it is also important for joint training. There is a defence research project with code name "PROPOJENI" that deals with distributed training of air-defence, air-force and ground force units. The real Czech Army C2 system called Ground Forces Command and Control System (GFTCCS) is used for controlling the ground force units in this simulation. For the interconnection of the GFTCCS to distributed simulation the Interconnection service had to be designed.

Together with the design of the service the conversion of the unit data in GFTCCS to entity data in distributed simulation had to be solved.

1. DESIGN OF THE INTERCONNECTION SERVICE

1.1 Architecture

Main purpose of the designed service is to represent units from the GFTCCS in forms of HLA entities. It is basically synchronization of GFTCCS unit information with HLA entity information. The service should detect unit status changes in the real-time and propose these changes to HLA entities that are managed by this service. The important part of this process is a conversion of GFTCCS unit parameters to HLA entities parameters. The conversion must grant that their data and graphics representations will be similar in both systems. The interconnection architecture is depicted on Figure 1.

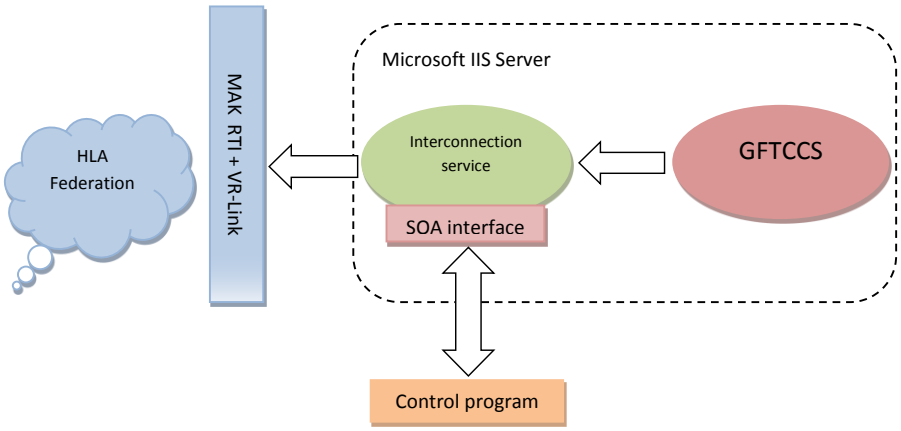


Figure 1. Interconnection service architecture.

The designed service should run in the Microsoft Internet Information Service Server. This service offers simple interface according to Service Oriented Architecture (SOA) standard that would work as a service control interface.

1.2 Interface

The Interconnection service interface published using the SOA standard can be very simple. Its main purpose is just controlling (administrating) the service. The service needs to know address of the GFTCCS gateway service and name of the federation to connect to. These two parameters can be entered in form of text strings. The other functions should include closing the connection and removing the entities from the federation. The last function should be the service status function to get information about number of synchronized objects and its names. The Table 1 contains service function overview.

Function	Description
StartConnection(string OTSAddress, string FedName)	This function starts the service. First parameter is the address of the GFTCCS gateway service (it can be IP address or server name). The second parameter is a federation name that is the service connecting to.
CloseConnection()	This function closes the connection with the GFTCCS system, destroys all synchronized entities and resigns from the federation.
string GetStatus()	This function gets service status information in form of text string. This text string contains number of synchronized entities and its names.

Table 1. Interconnection service functions.

1.3 Design of Service

Basic functionality of the Interconnection service is to get a list of active units in the GFTCCS system, to translate these units into a form of HLA entities and to create these entities in the

connected federation or updating their data. This functionality is executed periodically until this service is stopped.

The basic schema of this functionality is depicted on Figure 2.

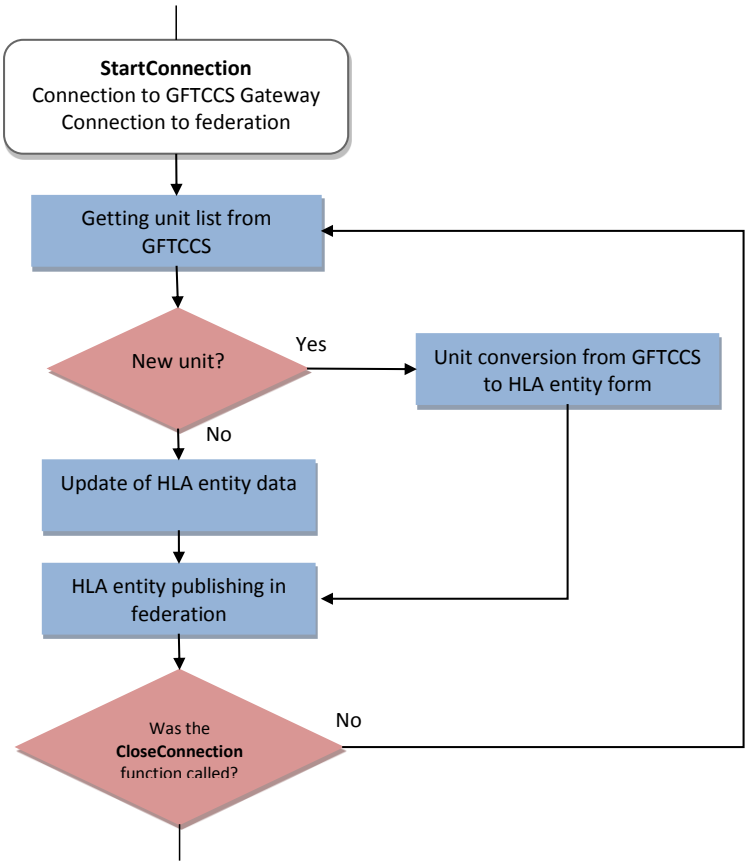


Figure 2. Service functionality scheme.

Design of Interconnection service implementation should be divided into two layers. The layer that communicates with the VR-Link library should be implemented in C/C++ language in form of dynamic linking library. This requirement results directly from architecture of software development kit MÄK VR-Link that is targeted for C/C++ language [3]. The Service Oriented Architecture layer that communicates with the GFTCCS Gateway [2] and provides basic functionality according to Figure 2 can be written in C# language. This programming language supports simple Web Service coding and also supports dynamic linking library calls – the combination of managed and unmanaged code. Basic schema of service implementation is depicted on Figure 3.

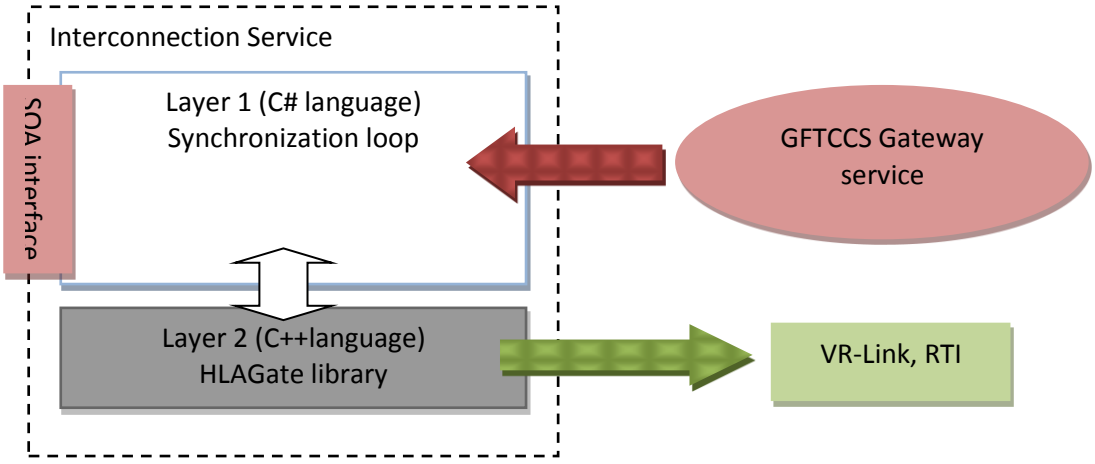


Figure 3. Interconnection service implementation.

The second layer is made of HLAGate library that implements an interface to VR-Link libraries. The HLAGate library encapsulates HLA entities and events management and provides simple interface for first layer.

2. CONVERSION OF GFTCCS UNIT IDENTIFICATION TO HLA ENTITY IDENTIFICATION

2.1 Look-up Tables Construction

Important task to solve is a conversion of tactical unit symbol representation from GFTCCS system to HLA entity representation. In GFTCCS there are tactical symbols represented by NATO APP-6a code (according to STANAG 2019 fourth edition), the US equivalent of this standard is MIL-STD-2525A [1]. In HLA domain is the entity identified by seven numeric constants. The meaning of these constant comes from DIS protocol and it is explained in Table 2.

Position	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Meaning	type	domain	country	category	subcategory	specific attribute	extra attribute

Table 2. DIS Constants in HLA entity.

Official meaning of the constants are not standardized but the interpretation of MÄK VR-Link and MÄK RTI can be taken as a reference. During the conversion process it is necessary to decode the APP-6a tactical symbol code and convert it to HLA Entity constants. This conversion process cannot be implemented by simple algorithm due to numbers of various combinations in APP-6a code. This conversion process should be implemented by look-up tables. Using these tables the APP-6a code characters can be converted into constants in according positions in HLA entity identification. The conversion process scope does not need to cover all possible combinations; the variation of used unit identifications depends on used database in GFTCCS system. The simulators connected into the HLA federation should have predefined graphical symbol representation to used identifiers. Using the look-up tables gives us the opportunity to modify the conversion according to used unit database in GFTCCS and

representation of units in HLA federation. The look-up tables are stored in a text file representation (xml format) at the Interconnection service.

It is important to know that HLA entities are primary focused on single weapon, vehicle, airplane, ammunition and soldier representation so the look-up tables are designed for virtual and constructive simulators. GFTCCS unit support is made by using aggregated entities. The aggregated entities – aggregates in HLA, represents the high –level units from GFTCCS. The aggregate in HLA has the first number set on the value 11.

Unit code according to APP-6a standard contains 15 characters. The position of the character identifies attribute group and the character identifies category. The basic overview is in Table 3.

Position	**1**	**2**	**3**	**4**	**5-10**	**11,12**	**13,14**	**15**
Meaning	Coding scheme	Affiliation	Battle dimension	Status	Unit type	Size	Country	Order of battle

Table 3. APP-6a coding scheme.

The APP-6a standard defines character tables and its meaning, the conversion mechanism should be based on this tables. The basic conversion of character position in APP-6a unit code and the HLA entity identification is in Table 4.

APP-6a		**HLA**	
Position	Meaning	Position	Meaning
1	coding scheme		should be „S“ (warfighting)
2	affiliation		should be „F“ (friendly), GFTCCS supports only position of friendly troops
3	battle dimension	2	domain
4	status		should be „P“ (present), unit is present at the position
5-10	unit type	5	sub category
11,12	size	4	category
13,14	country	3	country
15	order of battle		should be „G“ (ground), GFTCCS supports only ground units

Table 4. Basic APP-6a to HLA conversion table.

Not filled rows have no direct equivalent; they are just tested during conversion process if they fall into supported list of values.

Position 3 (battle dimension) determinates type of force (ground, air, marine) of the unit. The GFTCCS is a ground force system so the characted “G” is expected. The output value of the transformation would be 1 (DtPlatformDomainLand).

Position 5-10 (unit type) allows defining various types of units in APP-6a code. During the conversion process the main focus would be placed on ground forces (characters “U” and “C” on positions 5 and 6). The conversion to HLA entity types shows the Table 5. The positions marked with the asterix symbol (“*”) can contain any character.

APP-6a code on positions 5-10	sub category in HLA on position 5	unit type
UCF- **UC FM**** **UCFS****	7	artillery
UCA- **UCAT**** **UCAW****	2	armored units
UCI- **UCIL**** **UCIM**** **UCIO**** **UCIA****	3	infantry
UCIZ**	4	mechanized units

Table 5. Conversion table for positions 5-10.

On positions 11 and 12 the APP-6a code defines size of the unit. This unit size can be converted to category position in HLA aggregated unit. The conversion table is the Table 7.

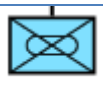
APP-6a code on positions 11 a 12	HLA category on position 4	unit size
***B**	13	squad
***D**	3	platoon
***C**	4	battery
***E**	5	company
***F**	6	battalion
***H**	8	brigade

Table 6. Conversion table for unit size.

The positions 13 and 14 represents in APP-6a code the nationality of the units. The country code is defined according to USA standard FIPS 10-4 (Federal Information Processing Standard). In this standard is the Czech Republic country code defined by characters “UZ”. We can expect that in the Czech GFTCCS are defined only Czech units, so we can assign value 52 to HLA entities. This value represents the Czech Republic in the HLA (DIS) country code table.

2.2 Examples

APP-6a code	SFGPUCIZ---D—G
symbol	
description	mechanized platoon
HLA identification	11:1:52:3:4:0:0

APP-6a code	SFGPUCIZ---E—G
symbol	
description	mechanized company
HLA identification	11:1:52:5:4:0:0

CONCLUSION

The interconnection service acts like a gateway between “live” C2 system and simulator. This interconnection gate is used for connection the GFTCCS system into to distributed simulation of air protection forces and air forces so these systems are fed from live ground forces data source. This solution allows using current C2 system for complex joint training. There are limitations in conversion process between C2 units and HLA entities but the look-up tables are based on units that are currently used in Czech C2 system so due to this built-in restriction all units fall into supported range for conversion. For interconnecting with different C2 system the look-up tables should be modified. The look-up tables are stored in text XML format so they are easily editable for this purpose.

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DESIGN OF LIBRARY FOR DISTRIBUTED SIMULATION INTERCONNECTION BASED ON HLA STANDARD

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Abstract: *The paper deals with design of a library that works as an interface layer for interconnection an application to HLA based distributed simulation. The paper discusses basic principles of simulation data (entities) exchange and principles of event handling. The library also contains the visualization part of remote entities.*

Keywords: HLA, simulation, visualization, distributed.

INTRODUCTION

Emerging technologies of application development tools, programming languages and open source visualization engines allows relatively easy and fast development of application that are not based on a commercial image generator thus there is not a native support for distributed simulation interconnection. If there is a need to connect the application to distributed simulation, this kind of interconnection layer must be added.

At our department we have several applications that we wanted to connect into distributed simulation so there was a need for simple library that would encapsulates the difficult part of distributed simulation interconnection and offers just a high-level simple interface for the application.

Due to requirement to connect with the VR Forces, VR Vantage and VBS2 simulators the proposed library should support the HLA standard for distributed simulation [1].

1. HLAGATE LIBRARY DESIGN

1.1 Choosing the Back-end

The requirement of HLA support brought up a question what RTI and support libraries to use. After considering open source RTI solutions there was made a decision to use commercial libraries MÄK VR-Link and commercial MÄK RTI. This decision was based on several contributing factors. The first one was that MÄK VR-Link libraries support HLA standard version 1.3 (used in USA) and IEEE 1516 version (used in Europe) [2]. Also there is a support for old DIS standard and emerging TENA standard. The other factor was that these libraries and RTI are widely used in many commercial products from reputable manufactures so the interconnection with these products should be seamless.

1.2 Implementation

The library is implemented as a standard dynamic linked library. It encapsulates the VR-Link libraries and publishes its interface as C++ function calls in a header file. It can be easily added to an application, only requirement is that the VR-Link libraries must be installed at the computer.

1.3 Architecture

The HLAGate library creates a new thread after being initialized. This thread creates communication objects of the VR-Link library tools and tries to connect to a RTI. If the connection is successful the critical section objects and object for simulated time handling are created. The thread enters a loop. Inside the loop the state of remote entities is get from the connected federation and state of our local simulated entities is published. Parallel to this thread the library provides functions for getting the state of remote entities and for creating, deleting or state changes of local entities. These functions are synchronized in the library using the critical section objects to prevent data integrity errors or dead-locks (see Figure 1).

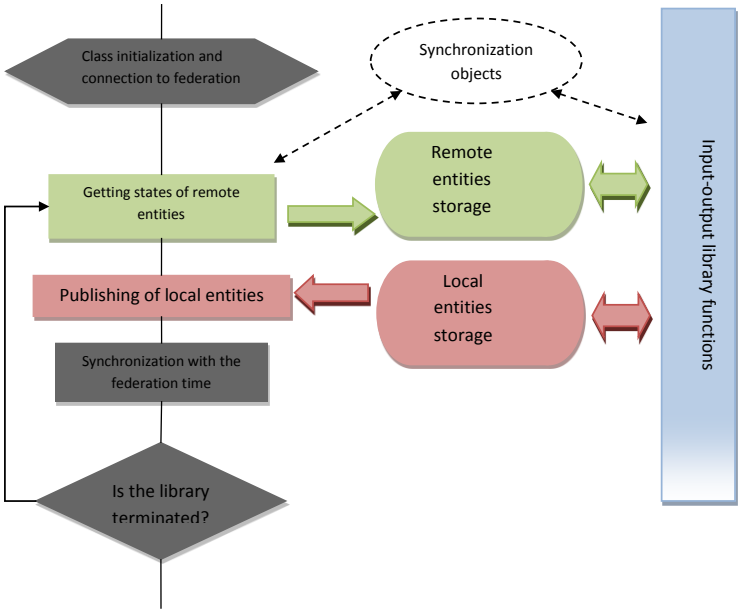

Figure 1. Library architecture schema.

One of the most important tasks of the HLAGate library is coordinates conversion of the remote and local entities. VR-Link libraries use geocentric coordinates as standard coordinate system. Most of the applications working with geographic data use WGS-84 coordinate system. The HLAGate library converts coordinates of remote and local entities between these coordinate systems.

1.4 Event Handling

The HLAGate library handles all events that happen during the federation execution. Two important event types to handle are fire event and detonation event. The fire event is triggered when an entity fires (even if the entity is not aiming to anybody). The detonation event is triggered when an explosion occurs (mine, bomb, missile detonation, ammunition hit the

ground or target, and so on). Sometimes these two events are in relation. For example when a missile is fired the fire event is triggered and when the missile hit the ground the detonation event is triggered. The HLAGate library handles these events and in case that the event interferes with a local entity (owned entity) the attributes for the entity in local entity storage are set (see Figure 2). An application using the HLAGate library can read these attributes and react on it. From these attributes can be read type of ammunition that the entity was hit by, hit characteristic (direct, near, far) and so on. From these attributed the entity damage can be calculated and can be sent back to federation as the local entity damage state.

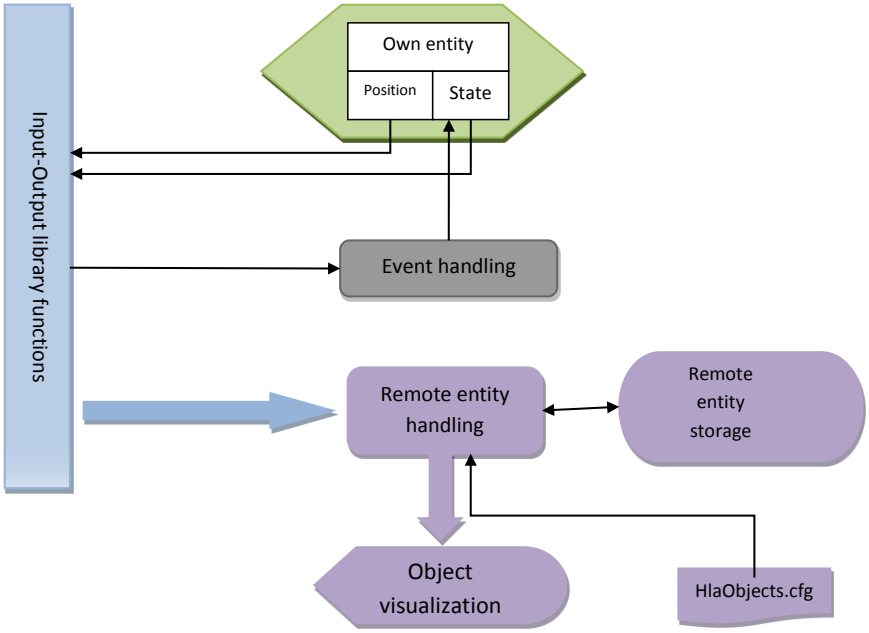

Figure 2. Event handling.

1.5 Owned Entities Handling

The HLAGate library contains function to create and manage own entities in the federation. The owned entities are stored in the database of local entities (local entity storage). The HLAGate library owns these entities in the federation so the application using the HLAGate library can set the entity information (position, orientation, and so on) in every frame. The HLAGate library handles all information to federation in asynchronous manner (synchronized to simulation time) and converts the coordinates system.

2. ENTITY VISUALIZATION

2.1 Visualization of remote entities

Information about remote entities is retrieved from federation using the HLAGate library functions every frame. This information is compared with the database of the remote entities (stored in remote entities data storage). This database contains graphical representation of remote entities. The key attribute for comparison is the entity global ID. This identification is unique for every entity in the federation. If the entity is not found in the database, a new remote entity object is created, its data structure is filled by the new entity data and it is added

into database. The graphical representation of the remote entity is created by the entity type value. The entity type is an identifier that comes from the DIS protocol heritage. In HLA is used for hierarchy based entity type identification. It contains information about nationality of the unit, force type of the unit, type of the unit and so on. This information is based on standardized look-up tables. The entity type identifier is used for choosing graphical representation of the entity. In the configuration file HlaObjects.cfg (Figure 3) are information about textures, spatial data files and auxiliary objects stored. Before connecting to a simulation, the information about used units (entities) are added into this file (if they are not already in, entity structure is described in Table 1). If there is a unit that is not in this file, the default graphical representation is used – the first object in this file.

```
{
 type=3:3:3:3:3:2:0
 dir=data\apache
 file=apache.x
 SymbolTexture=data\symbols\tank.bmp
 LineTexture=data\symbol_to_ground_line.bmp
 BillboardTexture=data\label.bmp
 arrowdir=data\sipka-neutral
 arrowfile=sipka.x
}
//*** Attack helicopter US
{
 type=2O:2:225:2O:1:0:0
 dir=data\apache
 file=apache.x
 SymbolTexture=data\symbols\vrtulnik.png
 LineTexture=data\symbol_to_ground_line.bmp
 BillboardTexture=data\label.bmp
 arrowdir=data\sipka-modra
 arrowfile=sipka.x
}
//*** tank US
{
 type=1:1:225:1:1:3:0
 dir=data\apache
 file=apache.x
 SymbolTexture=data\symbols\tank.bmp
 LineTexture=data\symbol_to_ground_line.bmp
 BillboardTexture=data\label.bmp
 arrowdir=data\sipka-modra
 arrowfile=sipka.x
}
```

Figure 3. HlaObjects.cfg file example.

Attribute	Description
type	identifier of the entity type in HLA (DIS)
dir	folder where is the 3D representation of the entity stored
file	file with the 3D representation of the entity (in DirectX format)
SymbolTexture	texture file that will be mapped onto the entity symbol in 3D, usually unit symbol in APP-6a code
LineTexture	texture file that will be used for the line connecting entity name and ground position of the entity
BillboardTexture	texture file that will be used as a background for 3D text name of the entity
Arrowdir	folder where the 3D representation of the arrow symbol is stored
Arrowfile	3D arrow symbol file (in DirectX format)

Table 1. HlaObjects.cfg file attributes description.

The found or created object from the database of remote entities is placed on the entity position. Its position and orientation is periodically updated according of the retrieved data from the federation.

2.2 Ground Unit Graphical Representation

The ground forces entities representing ground forces units are visualized in form of 3D objects according of the data in the configuration file. The 3D representation is placed on the terrain (ground). The altitude entity information is not used because there can be a difference in a local terrain databases in the entity owner simulator and our application terrain database. The surface of the 3D object is covered by unit symbol texture. From this 3D object there is a line up to the billboard object with the name of the entity placed on. This billboard object is always oriented towards the user and it is scaled according to the distance of the object as the 3D unit object. This billboard object helps better localize the unit in the vegetation covered areas or urban areas. To help better identify the unit from longer distances there is a 2D text field added to the unit object with the unit name, speed and distance from the user (see Figure 4).

The vector of movement is depicted by the 3D arrow object that is placed on the unit position and oriented according to unit vector of movement.

Figure 4. Ground forces unit visualization.

2.3 Air Force Unit Graphical Representation

The air force entities representing air force units are visualized in form of 3D objects according of the data in the configuration file. This 3D object is placed in the 3D space according to position and altitude of the entity. From this object there is a line down to terrain (projection of entity position on the ground terrain). At this position the 3D arrow object is placed oriented according of the entity vector of movement. In this direction there are arrows placed representing predicted trajectory of the object, the predicted length of the trajectory depends on the speed of the entity. The trajectory transparency is increased from the entity position towards the predicted positions. This style of predicted trajectory visualization is important for fast moving entities (jet airplanes or missiles)(see Figure 5).

Above the 3D object representing the entity there is a billboard object placed containing entity name and oriented towards the user (observer). This billboard objects changes its size together with the 3D object according to distance from the user. To help better identify the unit from

longer distances there is a 2D text field added to the unit object with the unit name, speed, altitude and distance from the user.

Figure 5. Air force unit visualization.

CONCLUSION

The HLAGate library is a versatile tool for interconnection of an application to distributed simulation based on HLA standard. The library encapsulates VR Link libraries and all others low-level functions that are necessary to handle remote and local entities and event handling in distributed simulation. Also the library solves coordinate transformation and local to simulation time conversion.

LITERATURE

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ASYNCHRONOUS MODEL OF DISTANCE LEARNING IN SEGMENTS OF WIRELESS NETWORKS

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Abstract: *The paper presents a new approach to provide asynchronous distance learning by using CMS (Contents Management System) application. The attempt to evaluate the proposed solution in practice proved that the distance learning provides additional solutions, complementary to the traditional learning model, such as static, dynamic and streaming forms of educational materials. The proposed solution allows to define different groups of users with different levels of access to data. The application works in a dispersed network environment that consists of WWW server based on HTML, PHP, XML, Java and database functionality with PHP scripts supported. Authors focused on the contents management and its usability in the existing network systems. The testing procedure for the application was successfully executed. The information describing the affiliation of the user to network operator was also collected, including the technology used to access the informational assets.*

Keywords: distance education, web applications, wireless networks, e-learning, content management.

INTRODUCTION

In the era of an on-going globalization, the traditional models of learning might not respond sufficiently to the demand of the society. The direct interactions between student and teacher are becoming challenged by the new forms of learning, based on modern IT technology. The economic, health or life-event driven decisions of individuals might put in jeopardy the traditional learning process. Many young people decides to look for job opportunities abroad, leaving their home-based universities and on multiple occasions giving up their on-going education. The students of the non-stationary programs are particularly prone to skip their classes during academic semester and to come back at its end to pass final exams. According to a research survey among 70 students, 11 of them admitted to follow such a pattern. Distance learning with its methodical and merit aspects of the knowledge transmission provides an opportunity to respond to the increasing needs of mobile society, assuring an equal access to education. Advanced IT infrastructure that includes wireless technologies provides the dispersed environment for educational process. The wireless technologies, thanks to their elasticity and flexibility, allow a real-time distance access to knowledge base as well as interpersonal interactions. There is a multitude of different techniques and forms of network accessible informational assets, providing a large number of available models of distance learning to choose. Different models should be used for on-line and off-line applications.

The presented paper provides an application of e-learning software, which complements the traditional educational teaching model. The system, based on the CMS (Contents Management System) technology, allows an access to static, dynamic and streamed data. An

asynchronous model was chosen as one of popularly accepted approach by virtual universities.
Particular attention was made towards contents management functions and the usability of the system in dispersed environment. Empirical implementation was conducted by testing the model on traditional university campus through a local wireless network.
The reports include crucial aspects of the wireless network access: type of the connections, time of active use, location of origin of the access, number of downloads and format of the accessed materials.
The first chapter describes models of IT-based distance learning. The second chapter presents tools and elements of the system, with focus on the contents management applications and management of communication, which makes up the core of distance learning system. The last chapter discusses the functionality and applicability of the system in different segments of the wireless network.

1. MODELS OF DISTANCE LEARNING

The models of distance learning are diversified, being constantly modified to better respond to the on-going challenges. There has been also noted an increased number of applications supporting distance learning. One major group is Web-Based Training, which comprises of all internet based solutions. WBT applications can be further grouped into Synchronous Learning and Asynchronous Learning.
The first type is a real-time approach, when learning process is made in a form of a videoconference, with all participants being actively involved in the process at the same time.
The second model is based on pre-arranged materials, stored on a server as a learning asset for a distance access. The learning process is not constraint with time, giving possibility to individually manage the length of time and frequency of engagement in the learning process. Both models combine the informational technologies, the multitude of applications with the traditional learning methods. There exists a set of professional e-learning applications provided by commercial enterprises, such as WBTExpress4 or Lotus Learning Space, as well as open code solutions, developed by internet community such as Modular Object-Oriented Dynamic Learning Environment. The systems might have their own knowledge base, accessed and managed by PHP user's interface.

2. ELEMENTS OF THE EDUCATIONAL SYSTEM

The presented e-learning application is a database system, which includes tools for Learning Content Management System (LCSM), Life Communication System (LCS) and partially also Learning Management System (LMS). The LCMS manages the learning assets, presents their contents and learning programs, LMS administers access to the contents, while LCS administers the communication with users, monitoring the access and exchange of communication with the users. The tools are defined in separate modules and components, providing fast and reliable presentation of the information, exchange of data and management. The design of the system provides a user-friendly access and usability, with secure authorization and reliable, allowing it to work correctly with multiple interpreters (Internet Explorer, Firefox, Mozilla).
There four basic groups of users were defined:

- Administrators with full control of the system,
- Authors (teachers) with capability to insert and remove teaching scenarios,

- Users registered in the system (students),
- Non-registered users with restricted access to some of the features, such as real-time resources

System works in a dispersed network environment, consisting of WWW server providing HTML, PHP, XML and Java scripts, PHP database server and a regular web browser at the user's side.

2.1 Contents Management

The contents management is organized through a module which allows access to the learning assets for each individual subject of study. The materials are either general or specific. The general, such as class schedule or academic year plan, are related to the organization of the learning process. The specific materials, such as syllabus or lecture plan, provide information related to a given subject. The lectures are presented in a form of a video movie and multimedia presentations in formats PPT, PPS, OPD, additional materials are available in formats DOC, PDF, ODT, XLS.

The contents are grouped in multiple categories, relevant to areas of study (Figure 1). Each category consists of following sections:

- Program of Study,
- Syllabus
- Teaching Materials
- News
- Gallery

All sections related to „Teaching Materials" are created in static form. This category is a core element of the system, collecting and providing access to learning materials in the network.

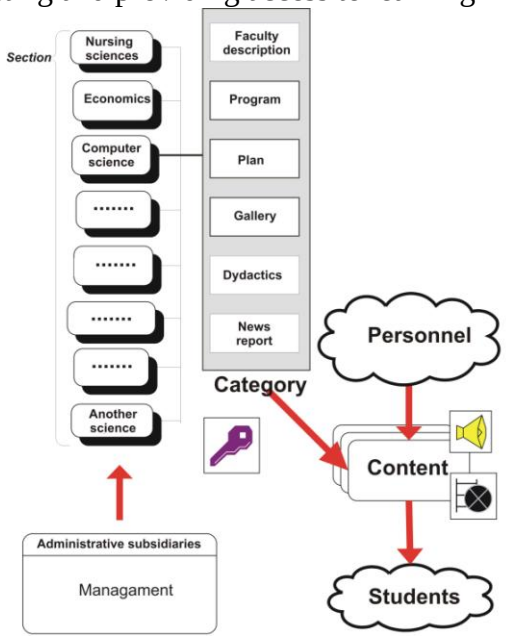

Figure 1. The Division of Contents into Categories.

The system is designed in a way that selection of category and then section leads to full menu of subjects available within the category (Mathematician, Mobile nets, Neuronal nets, etc).

The subjects aligned with teacher activate link to internal mail system allowing students and teachers to make two-way message exchange. Additionally, users are able to plug-in Skype communicator to additionally enhance communication features of the system. If there is no additional information available for a given subject, it means that the subject is inactive or teacher has not provided any learning materials.

The publication of the learning documents in specific formats is available from subject level of the contents structure. To illustrate the mechanism of contents management, contents related to the subject „Mobile Systems" has been shown below (Figure 2).

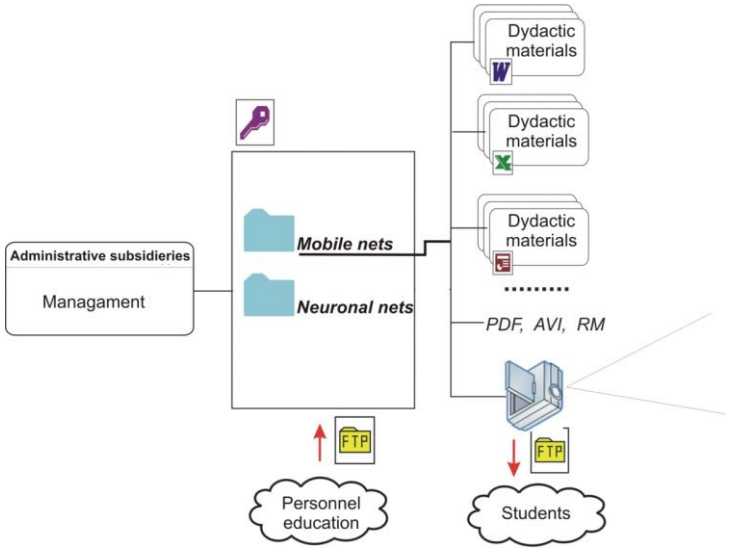

Figure 2. Management of Learning Documents.

The learning documents represent a condensed knowledge, transformed into digitally stored assets of information. The video lectures require additional software: to record and prepare files. The empirical part of the exercise was tested using the following software packages: CamStudio, Magix Movie, Video Cam Server with video recording devices. The replay of the video files was made using AllVideos Plugin (plugin_jw_allvideos), which allows to stream the video-files, securing the video-stream from being stored on the local machine and thus controlling the access to the files solely to the authorized users. The video files were primarily distributed directly using *.RM (4KB) file, which includes a definition of location of the file in the system (procedure 1). The indirect file allows video-streaming and exchange on a high level standard: RTSP (*Real Time Streaming Protocol*) and PNM (*Progressive Networks Protocol*).

Procedure 1. Access to resources protocol rpt, pnm
rtsp://148.81.117.3:554/kryptologia/kryptologia_cz1.rm?cloakport=8080,554,7070 *--stop--* *pnm://148.81.117.3:7070/kryptologia/kryptologia_cz1.rm?cloakport=8080,554,7070*

The original video recording was created as a 132 MB AVI file. Then, the access to the original file was restricted through an indirect file, which contains information on the actual location of the AVI file and thus accessing the access through FLV format. The additional compression allowed limit the size of a file to 35 MB and thus providing opportunity to more efficiently use the available wireless network infrastructure. The lectures in a form of

multimedia presentation are stored as documents in database. The component from the author's perspective is illustrated on Figure 3.

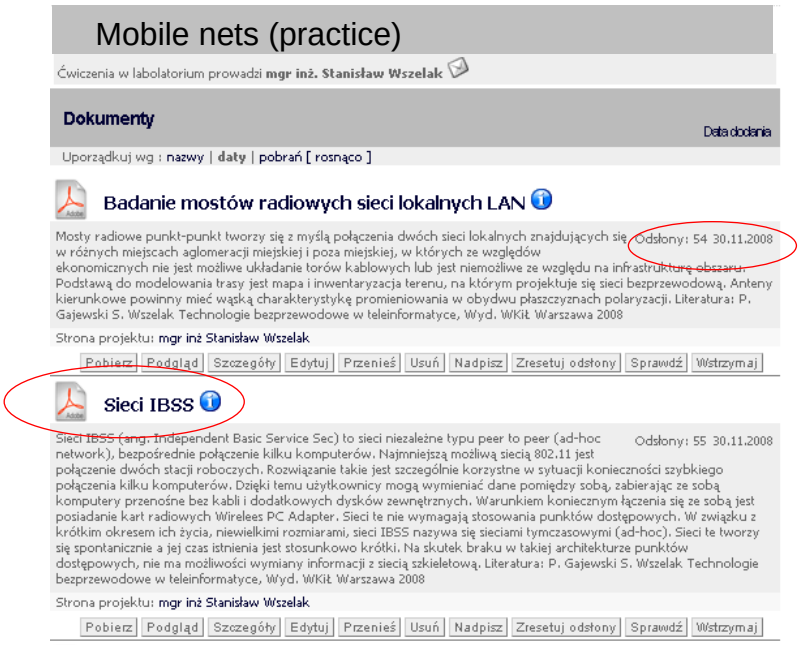

Figure 3. The Learning Documents within Section.

The component was designed using the PHP functions and procedures. For a faster navigation and management of learning document functional buttons were provided: *download, remove, pause, etc.*

2.2 Management of Communication

The communication between the users is feasible through an internal message service. It allows a 'virtual office hours', necessary in an active learning process. The email addresses are stored in the database, providing secure and confidential exchange of communication among the registered users of the system. The mail component is based on PHP and XML files, providing reliable flow of information with a user friendly interface.
The mail module provides a mail inbox, trash to remove unwanted correspondence and „compose mail" button, which opens a message form.

3. USABILITY OF LEARNING SYSTEM WIRELESS NETWORK

The usability of the distance learning system was tested based on the number of users. The following parameters were analyzed:

- type of connection used,
- usage time,
- origin domain of the user,
- number of downloads of documents.

In the analyzed period, there were 20 155 openings by registered and non-registered users. 200 authorized users have registered in the system, including 7 lecturers.

Especially significant feature reflecting the usability of the system are statistics regarding the number of downloaded documents and visits to web pages of subjects. The list of the most popular download is presented in Table 1.

Title	Number of downloads
Algorithms	59
Nets IBSS	56
Nets WLAN	44

Table 1. The list of the most Popular Documents.

The origin of the connections was also analyzed (Figure 4), where significant part of connections was initiated by anonymous users. The registered users accessed the service solely from the territory of Poland.

Czas	UserName	Identyfikator Strefy	Kraj/Domena	ip	NS-lookup	Stron		System Operacyj
2009-02-05 20:31:04	Administrator	pl	Poland	87.205.50.125	87-205-50-125.adsl.inetia.pl	3	PathInfo	Windows XP
2009-02-05 20:19:57	Not logged in	pl	Poland	93.105.114.27	93.105.114.27	7	PathInfo	Windows XP
2009-02-05 20:07:15	Not logged in	pl	Poland	77.253.153.173	77-253-153-173.adsl.inetia.pl	1	PathInfo	Windows XP
2009-02-05 19:57:12	Not logged in	pl	Poland	212.244.164.175	212.244.164.175	21	PathInfo	Windows XP
2009-02-05 19:50:36	Not logged in	pl	Poland	83.8.68.213	abqa213.neoplus.adsl.tpnet.pl	1	PathInfo	Windows XP
2009-02-05 19:45:35	Not logged in	pl	Poland	83.30.9.18	bxp18.neoplus.adsl.tpnet.pl	1	PathInfo	Windows XP
2009-02-05 19:41:11	Not logged in	pl	Poland	78.154.91.208	xdsl.208.c91.petrotel.pl	16	PathInfo	Windows XP
2009-02-05 19:29:19	Not logged in	pl	Poland	77.91.41.174	user41-174.satfilm.net.pl	16	PathInfo	Windows Vista
2009-02-05 19:14:29	anna pępek	pl	Poland	83.18.86.211	axi211.internetdsl.tpnet.pl	36	PathInfo	Windows XP
2009-02-05 19:10:49	Not logged in	us	United States	65.55.109.70	65.55.109.70	1	PathInfo	Windows 2003
2009-02-05 19:00:02	Not logged in	pl	Poland	79.186.163.35	aegh35.neoplus.adsl.tpnet.pl	3	PathInfo	Windows Vista
2009-02-05 18:56:44	Not logged in	mx	Mexico	132.248.117.152	cultura.cultural.unam.mx	2	PathInfo	
2009-02-05 18:34:44	Not logged in	pl	Poland	83.8.72.93	abqe93.neoplus.adsl.tpnet.pl	1	PathInfo	Windows XP
2009-02-05 18:18:01	Stanisław Wszelak	pl	Poland	83.8.72.93	abqe93.neoplus.adsl.tpnet.pl	19	PathInfo	Windows XP
2009-02-05 18:11:23	Kamil Kacprzyk	pl	Poland	79.186.204.212	aehw212.neoplus.adsl.tpnet.pl	14	PathInfo	Windows XP

Figure 4. The List of Origin of Connections.

Classifying the visits by nationality of origin circa 70% consist of domestic traffic (Figure 5). Significant number of connections from USA might be explained by users that are neither students nor teachers, but were linked to the website through search engines.

Flaga	Kod	Wizyt	Procentowo	Kraj/Domena
	pl	1827	71.4%	Poland
	us	637	24.9%	United States
		65	2.5%	Unknown
	ie	5	0.2%	Ireland
	mx	5	0.2%	Mexico
	nl	4	0.2%	Netherlands
	kr	4	0.2%	Korea, Republic of
	de	3	0.1%	Germany
	uk	3	0.1%	United Kingdom
	cn	1	0%	China
	ua	1	0%	Ukraine
	cz	1	0%	Czech Republic
	ru	1	0%	Russian Federation
	ca	1	0%	Canada
		2558		14 Countries

Figure 5. The List of Origin of Connections (by Country).

An interesting information is contained in the statistics of Internet Service Providers for individual users and the amount of time users spend browsing the learning system. Based on

the Internet Service Providers, it is feasible to assess the type of connection being used. The data presented in Table 2 and Table 3 shows that a dominating technology is a broad band internet access in the DSL technology. Provided by three key ISPs: Telekomunikacja Polska, Netia and Sat Film.

	Type of connection	Visitors	Average time of connection	% of new visitors
1.	DSL	1145	00:07:06	41,75%
2.	Unknow	931	00:04:22	50,38%
3.	Cable	73	00:02:41	72,60%
4.	DialUp	21	00:03:59	61,90%
5.	T1	7	00:01:28	100,00%
6.	ISDN	1	00:04:24	0,00%

Table 2. Type of Internet Connection.

	Type of connection	Visitors	Average time of connection	% of new visitors
1.	Neostrada plus	588	00:03:44	46,60%
2.	Sat film sp. z o o	432	00:04:46	41,44%
3.	Netia SA	338	00:15:35	22,49%
4.	Static ip	159	00:03:03	61,01%
6.	Sat film	112	00:03:32	39,29%
7.	P.W. marton	29	00:02:25	24,14%
8.	Ptc	33	00:08:07	60,61%
9.	R-link sp z o o	28	00:06:19	53,57%
10.	FK.i.prof-net	27	00:04:20	14,81%
11.	Multimedia Polska	20	00:03:56	85,00%

Table 3. Internet Service Provider.

The weekly structure of visitors exhibit interesting differences (Figure 6). Sunday and Monday were the weekdays when the website was the most popular. Sunday is the day for in-class lectures for non-stationary students, requiring an access to learning materials during the day, while Monday is the first day following in-class activities, and thus many students are motivated to fill up gaps in their knowledge of the subjects.

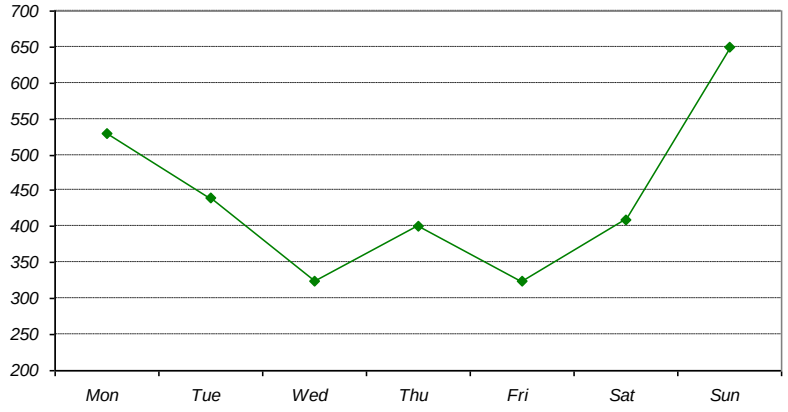

Figure 6. Average number of visits per weekday.

It has been acknowledged on the Figure 7 that one day was particularly popular when 1719 visits were counted. After a detailed analysis of the documents being accessed on-line, it turned out that it was a day when the results of final exams were published.

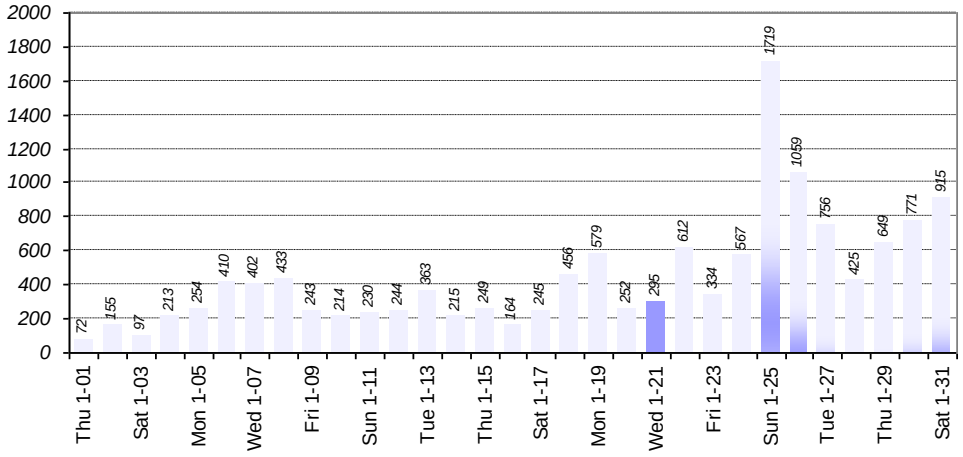

Figure 7. The number of all visits.

The following Figure 8 presents a list of unique visitors. It does not seem to provide any specific conclusions.

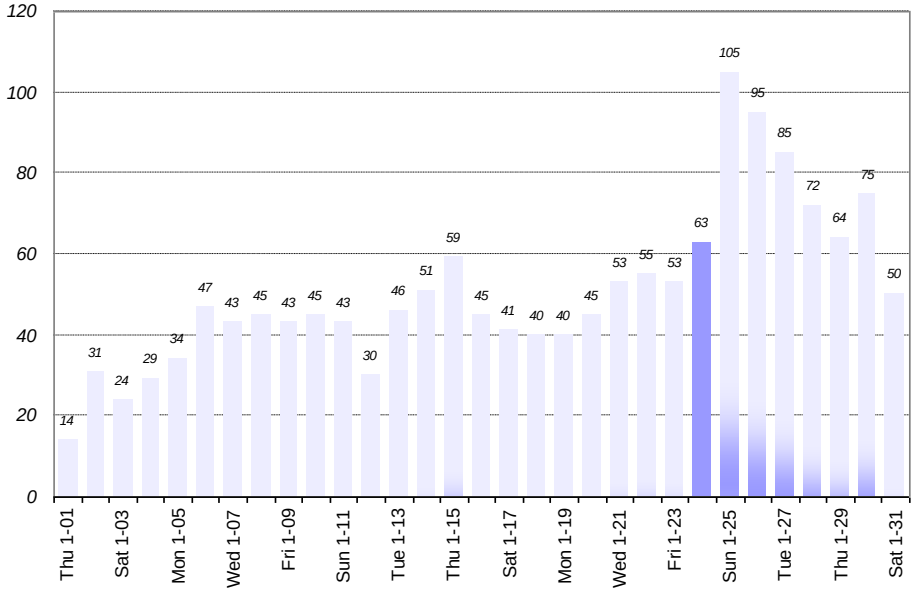

Figure 8. The number of all visits by unique visitors.

The statistics of an average time users spend browsing the website show significant differentiation (Figure 9). The shortest average time users were browsing the website was noted on January 3 with just above 2 minutes of access per user, while the longest was January 18, when about 11 minutes people spend on average browsing the website. When there are no video materials available, this amount of time is considered as sufficient to search and download the contents.

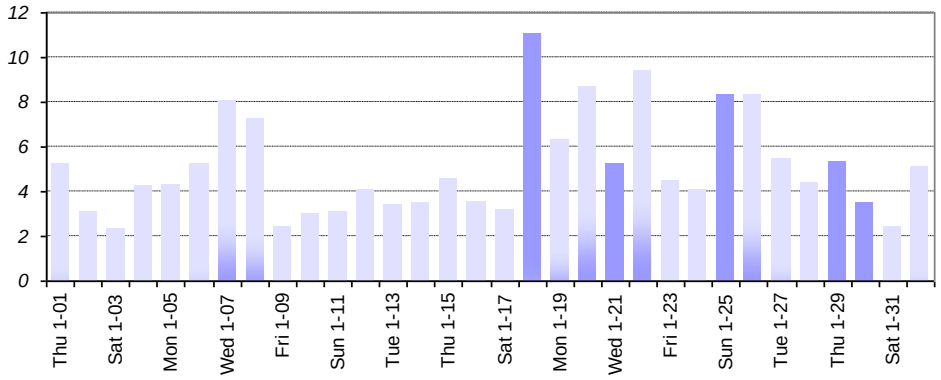

Figure 9. Average time spend by users on browsing the website.

CONCLUSION

The on-line learning based on wireless and multimedia technologies is the fastest way to reach out the knowledge, since it provides practically an instant access to very large number of students, regardless of their location and time-zone. The new term being coined: „m-learning" stands for mobile learning. The educational process performed through local network and internet has multiple advantages: increases the quality of education, improves self-discipline and self-assessment. The major impediments seem to lie on the supply side, with senior lecturers being resistant to get involved in using the new technologies.

The organization and structure of applications to be used for e-learning depends significantly on the type of knowledge and subject specifics. Different functionalities of the system are necessary for natural sciences, while others for social sciences.

The technical aspects of server configuration, security measures and efficient flow of data requires further consideration, which extends much beyond the proposed framework of this paper. However, correct and informed decisions regarding configuration of the system, imposed constraints on some of its functions and data transmission provides a secure and reliable environment to communicate the knowledge effectively, depending on the end-users own capability of the system.

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SOCIAL NETWORK WITH A BUILT-IN LEARNING COMPONENT FOR EMERGENCY COMMUNICATION EXCHANGE

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Abstract: *Today the professionalism of the military and government agencies is subject to profound changes in view of the complex nature of events such as terrorism, environmental and territorial disasters, international conflicts etc. This paper proposes the use of a social network to promote social mobility education by involving a network of people, government and military agencies over a vast territory. The goal is designing a geo-referenced social platform that connects these users with each other by entrusting them the task to report emergencies through real time comments, photos and videos following the participatory knowledge concept under web 2.0 spirit so they can learn from each other.*

Keywords: social network; learning; knowledge management; emergency.

INTRODUCTION

Social Networking Sites (SNs) are becoming extremely popular and can be employed in a variety of contexts. The success gained by SN such as MySpace, Facebook and Twitter has become, in recent times, an object of interest for large critical literature as far as concerned the educational potential of these. In the collective imagination these SN are often compared to a loss of time, actually they can be a useful advantage for learning purposes and knowledge management, of course with appropriate modifications.

These environments themselves may provide users with an opportunity to enlarge their knowledge just in terms of learning thanks to their intrinsic characteristics i.e. finding and sharing resources (useful pictures, articles, audio or video, etc...) on web.
At any time and from any place, every registered user of a SN can provide information thus making a contribution about the topic under discussion on the net and eventually solving a problem.

This kind of behaviour is essential within the SN activity and it is a way for encouraging the collaborative construction of knowledge that directly affects the user involved in the interaction and, indirectly, the entire community.

The transfer of information becomes knowledge and the discussion around a piece of information is a way of learning. Just thinking of Vygotsky words: "what may occur is that students grow into the intellectual life of those around them and they develop knowledge by these interactions" [1].

Since knowledge represents an essential resource in today's society, it is therefore noteworthy to underline how important is the concept of its management. The knowledge management (KM) attracts the attention to underlying ethical issues involved in the production and the use

of knowledge as a power source. Within the military and government setting there is a growing interest in applying technology towards the knowledge management particularly for problem solving purposes in critical situations.

The problem of managing and exchanging vast amount of information rapidly, especially in emergency situations created great difficulties also in traditional knowledge management systems. Nowadays, SNs are widely employed within several organisations and play an important role not only for the knowledge management, but also for the knowledge distribution.

Education is the most important channel for the distribution of knowledge, though it is very important to find innovative ways to produce and share knowledge. The use of SN in education may be one technique for addressing this matter.

The knowledge management though ICT tools and web 2.0 is a new way of learning and e-learning as well, because it allows for providing additional valuable resources in order to reach objectives efficiently. In other words it would allow for learning twice: new technological instruments and contents from different information sources.

1. RELATED WORK

Authors in [2] defined :"SNs as web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share connection, and view and traverse their list of connection and those made by others within the system." A SN simulates the social communication in the real world. Each individual can be both the provider and consumer of information shared in the community.

Current technologies in the SN field prompt educators to analyze knowledge in relation to the aspects of social interaction for facilitating learning [3].

SNs are being used for several reasons and their popularity and number have increased significantly recently [4].

The importance of the social aspects and the connections between people and objects is discussed by McLeod [5] who states that sharing is a fundamental human activity:
"The most important word on the internet is not "Search" but "Share". We use Social Objects to share ourselves with other people"

From the educational perspective, the most important point to consider is not the information itself, but the discussion threads generated around it that activate the learning process.

Tools such as wikis are just being used to support such community aspects in E-Learning [6].
In [7] the authors describe a SN as "a set of people (or organizations or other social entities) connected by a set of social relationships, such as friendship, co-working or information exchange".

Many authors stress the importance of networks for knowledge sharing. This concept is analyzed by Kanter when stating that those organizations able to develop networks both

internal and external to their structures are supposed also to be able to deal with knowledge more effectively [8].

"Knowledge flows along existing pathways in organisations. If we want to understand how to improve the flow of knowledge, we need to understand those pathways." [9]

The knowledge management through mass collaboration tools during both expected emergency situations as well as extreme events is an issue of considerable interest in recent literature [10].

It's not surprising that SNs are predicted to be used more by online emergency communities "It's sharing and connecting in a time of crisis when it matters the most" [4]

In [11] the importance of data produced by SN users is discussed. In particular the authors define three kinds of data characteristics of a SN: the user profile data, the social graph and the traffic data. In this context particular importance is given to group activities typical of virtual communities. In [12] the authors define a 4-tier framework aimed at merging data from the remote sensor network and SNs. The target is the possibility of monitoring particular physical phenomena without any human intervention. The opportunity to realize a human based remote sensor network is also illustrated in [13]. The social interaction between human remote sensors is based on social networking technologies. [14] explains how to integrate geographical information on SN generated data. This solution is based on the availability of well known technologies such as GPS, GSM etc.

2. PROBLEM OVERVIEW

The search for a modern mode of training being job-oriented and more flexible than the traditional one has led to the definition of new e-learning opportunities in relation to the innovative communication tools in line with web 2.0

The goal of Government Organizations and Armed Forces is creating a training system geared to enhancing the skills of employees.

The government and military stakeholders work in publicly supported organizations that are strongly hierarchical in character and the management of information flow is often subjected to internal and external constraints. These constraints are also resulted from the different responsibilities of the specific roles covered by the workers of military or government agencies. Thus, these practices are in conflict with the open structure of web 2.0 SN sites, but they could be overcome by creating a pro-active network of control agencies capable of interfacing with a wide variety of data bases.

Today, information technology applied to an efficient method of training could reach the achievement of "interoperability" among people, military and government organizations and of course volunteer agencies, both on daily basis and emergency situations. This interoperability is essential for all questions related to global issues for public safety and security, but it should be ensured also by a technological interoperability through conventional technical measures.

In the framework of the security activities performed by the stakeholders belonging to government or military agencies the management of relevant information during emergency situations plays a fundamental and crucial role.

In this regard it is clear how web 2.0 and therefore SNs can be advantageous for making mass collaboration useful to organizations thus giving the possibility to all net users and organizations to collaborate for a common cause.

SNs can be considered as links from people to other people, groups or information objects. Getting in touch with other persons allows for learning not only what is looked for, but also other things just by the opportunity of asking and discussing with other people. SNs are based on relationships established through computer environments following the concept of communities of practice [15] .Communities of practice in turn, serve as a base for knowledge management [16].

Knowledge availability is a factor of paramount importance especially in critic situations such as environmental disasters, civil disorders, terrorism threats etc, as to allow the stabilization of crises. Knowledge management systems such as social network websites can be really useful to handle information in unexpected situations.

The proposed method considers the information transfer as learning resource at various levels.

In emergency situations, the rapid exchange of relevant information is crucial, that's why it is so important that all task forces must keep pace with society's changes especially in the field of communication systems. Innovation and learning are the key words to describe the communication transformation in the Internet age. E-learning has changed its traditional meaning expanding its scope of application to knowledge management systems

In this regard, the SN trend could offer interesting knowledge management solutions: just thinking of Twitter that was a powerful information communication tool during Iran's period of civil unrest. In fact SNs constitute a virtual environment for distribution and sharing of ideas. If this produces the risk of sharing information threatening public safety, on the other hand it represents a means to control this phenomena. In particular the integration of solution for semantic analysis and classification of information can be used by stakeholders for analyzing and controlling anomalous situations. SNs play the role of brokers among users sharing their opinions. This makes it possible to get a clear impression of the public opinion.

We aim at a web based collaborative platform able to support task forces about social issues while stimulating shared knowledge creation within an "architecture of participation" [17] and facilitating the learning of new technologies.

Our SN loses its qualification as a simple channel of information, turning itself just into the news and its users, while providing the data, become knowledge creators and managers as well. When users indicate or better signal the early onset of emergency to the organizations in charge, generate a sort of "social alarm" that running on the network provides information to all relevant communities of practices.

This social alarm can be used to summon assistance in an emergency case, but it can be also a way to generate useful information and therefore shared knowledge within the community.

The Task Forces are always charged with timely communication, coordination and cooperation in response to emergency situations of various kinds and social networks can be seen as a successful undertaking to face this kind of problems connected to knowledge management and represent an interesting opportunity to acquire and provide those resources being necessary to support emergency preparedness.

3. PROPOSED SYSTEM

The proposed system is built following the principles of user-generated content, collaboration, interactivity and collective knowledge. The first step of our work concerned the customization of the OpenSource software Mahara®. Mahara® is a project developed for the e-portfolio service, licensed with the GNU policy. Starting from the original Mahara® source code, a system aimed at realizing a social network for managing relevant information in emergency situations was designed. The cooperation of users in critical situations would allow for giving a relevant qualitative feedback to the various stakeholders, operators, military/government agencies, public administrations, volunteer associations and so on. A multi-interface technology was developed to motivate users in adopting the proposed system. The goal was making this instrument accessible also to unskilled users, trying to reduce the phenomenon of digital divide. In addition to the classical web form - well-known for Internet surfers - the set of choices here consists of the key digital communicational technologies: email, SMS, MMS.

The web-based interface is characterized by two access layers, necessary to manage and receive the published information: guest access and authenticated access. The first allows for visualizing only the public information (i.e., the user indications and their localization); a registered user can publish new indications and can attend group activities supported by the SN. The authenticated users can: manage their profiles; control their remote physical space allocations (upload/modify documents and images); create new virtual communities without a supervised subscription; attend favourite virtual social activities (read/write on forum topics, download documents, attend in live mode, etc.); require and manage friendships; upload and localize images and related comments about an emergency onto the geo-referenced map; add comments and evaluate the signals posted by other users. This system must be administrated by the user with all privileges, e.g. the administrator account. In addition to the simple user privileges it is possible to: create new virtual social activities with or without a supervised subscription; manage the signals posted by users (modify/delete comments, images and/or its localization); attend and manage every virtual social activity; instantiate new events on streaming live; manage user profiles; evaluate the social network statistics.

4. DESIGN FRAMEWORK

The proposed design framework is client-server architecture. The server side is based on four modules. The architecture is shown in figure 1. There are two modules: signalling module and alert module that collaborate to obtain and evaluate user indications and handle the notifications for the stakeholders. These modules share information with the social networking module. The live streaming module allows for instantiating live audio/video flow about events administrated by stakeholders. The SN module is the interface between the community and the information management system. The Community Information Manager is the set of modules that manages the community shared information and generate alerts and

other additional values. The client side permits the community to access the interface provided by the SN module (i.e. guest users, citizens, service administrator, and stakeholders).

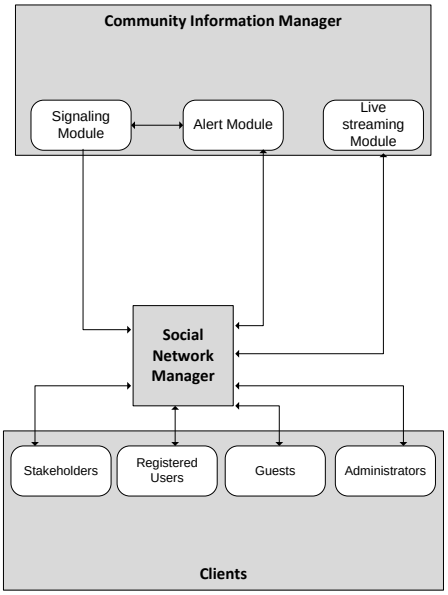

Figure 1. SN architecture.

The server side consists of a set of submodules: the Signaling Module, the Alert Module and the Live Streaming Module. The SN Manager is the interface between the Client side and the Community Information Manager. The client side has four different user roles: guest (this one can only view the published information); authenticated (this one can activetly partecipate to the virtual community); tutor (this one supervises local subcommunities and examines the user signals); administer (this one manages the whole SN system and its users).

CONCLUSION

In this paper, moving from consideration about the wide use that SNs have today, an innovative application of a this technology is proposed. In particular design of a georeferenced SN that allows ordinary people to communicate with task forces and vice versa when they are caught up in emergency conditions is discussed. The proposed method is based on a previous prototypal system tested for monitoring environmental emergency [18], but it can be customized according to specific requirements. The development of such a system in advance of emergencies is thought not only for reducing the complications of the traditional communication systems whose data may be significantly degraded in case of emergency, but also for providing a useful knowledge management system for the activity coordination of task forces and proposing an innovative learning tool as well. It can be seen as a learning platform too, because it allows for analyzing the discussions of users about the single emergency cases and therefore understanding under which conditions they occurred and the measures employed to fix the problems in order to learn from them.

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MAK PRODUCTS TO SUPPORT OF COMMOM OPERATIONAL PICTURE IN TRAINING ENVIRONMENT

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Abstract: *The article deals with a design of joint training environment in the Czech Armed Forces. The overall solution is based on MAK Products and High Level Architecture distributed environment. Ground Force Tactical Command and Control System and VR Forces Simulator are connected to create integrated training environment. The first part is aimed on introduction of individual entities of integrated distributed environment individual components. The second part explains how MAK products: VR Forces, VR Link Developer and VR Link Runtime had to be changed to create the integrated environment. Last part contains the results of the implemented first prototype.*

Keywords: Common Operational Picture, Distributed Environment, High Level Architecture.

INTRODUCTION

The high cost of virtual simulator acquisition and maintenance leads to push the army to use simulators and training facilities in more effective way. One of the main approaches is to create distributed training environment that enables to reuse existing simulators in one big connected exercise. The Czech Armed Forces uses Distributed Interactive Simulation (DIS) [1] protocol to implement distributed training facilities. Distributed simulation creates new features in the training capabilities [2]:

- Increasing number of trainees in multilevel exercise.
- Individual branches joined together in one exercise.
- Unit disaggregation in the training area.

Completed project in the Czech Armed Forces with the code name "DISIM" was aimed to design, implement and evaluate the High Level Architecture (HLA) approach in the Czech distributive training environment [3][4].

Based on the experience from the DISIM project we developed first training prototype that interconnect the command and control system for ground forces and air forces constructive simulator. The main components in the design of distributive environment are:

- Ground Forces Tactical Command and Control System (GFTCCS). System is used at the operational level to support brigade and bellow commander to make decision. GFTCCS uses BVIS application to show the current situation at the battlefield in two dimensions and 3D VR application to show the real time situation in three dimensions [5].
- Constructive VR Forces simulator [6].

The architecture of distributed environment is showed on the Figure 1. The MAK company product was used to implement HLA into training environment. Common operational picture (COP) is created on both sides of this architecture.

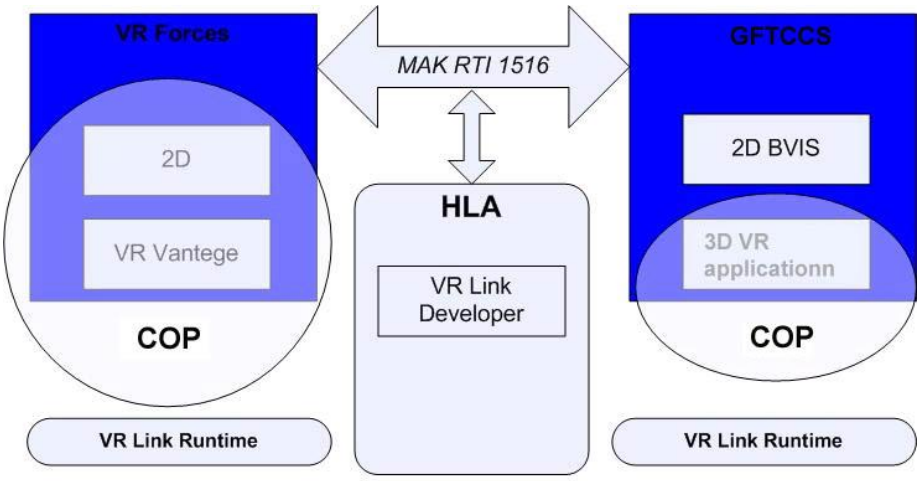

Figure 1. Architecture of distributed training environment.

The next chapter shows how the MAK product has to be used and modified to design and implement fully operational training environment.

1. VR FORCES

The common operational picture is created both on the VR Forces Simulator, as well as on the 3D VR application. VR Forces analysis is made with emphasis on the display of entities that exist in the GFTCCS and were not generated using VR Forces.

Entities in the environment of VR Forces are divided into local and external group. Local entities are created in an environment of constructive simulator and external entities are created and controlled by other application. An external entity cannot be managed by constructive simulator. An entity can be created as a simple or aggregated type. Simple example of an entity is a tank, BMP, aircraft, individual, etc. Examples of aggregated entity are squad, platoon, company, etc. The entity is identified by fundamental attributes:

- Name - the unique identifier of an entity in the environment of VR Forces. It consists of a preset abbreviation along with the whole number, which is automatically increased by creation of local entities (BVP2-1, BVP2-2, etc.).
- Echelon ID - unique identifier for the description of the object hierarchy.
- Object ID - identifier of an entity that is created automatically in simulator environment, operator cannot change this identifier.

Entity type identifier is equal to DIS codebook. This codebook contains a complete list of identifiers (seven digits), which correspond to each hierarchically sorted objects which can be situated on the battlefield. The DIS codebook was adopted as a rule for the object identification even when using the HLA architecture. For example the string String 1-1-225-1-1-3-0 indentifies entity as M1 Abrahams tank.

If entity is created by an external application, it is necessary to create its identifier on the side of external application to be recognizable by VR Forces simulator. This simulator must have information in advance about entity (hierarchical classification, graphic symbol, and 3D model). Other features are created and controlled mainly by the external application.

VR Forces Entity Editor should be used to prepare of all features mentioned above. The editor contains a set of predefined entities and their properties in a file with the LMS ending. This file can be extended by new simulation entities, based on the original pre-defined entities. From the perspective of GFTCCS is necessary to prepare the entities that correspond to entities of units and forces database, which is stored in the DB LTDB. In this case, the following properties must be modified:

- Graphical symbol in accordance with APP6a.
- Equipment of friendly and enemy units.
- Physical attributes of entities.
- Entity type.
- Entity type with its DIS hierarchy.

From the perspective of the integration of VR Forces Simulator, the current set of simulated entities must be extended by the entities of the units located on the GFTCCS side.

The common operational picture created on the VR Forces Simulator side must also be placed on maps that will correspond with the map data on the GFTCCS side. VR Forces Simulator must be able to read maps and digital data from sources that are available in command and control system. GFTCCS creates a digital map in 3D model based on the digital model area (DMU), digital elevation model (DRM) and satellite images, which is then stored as the native DirectX. On the VR Forces Simulator side is a native 3D model with (.MTD) file. VR Forces Simulator uses the terrain database generator – TBD toll to create the 3D model of terrain.

In the generator of environment is therefore necessary to create a new project (. MTP), and it creates (.MTD) file that already contains a 3D terrain model with raster data, which are mapped to the model surface. Raster data are mainly represented by ortogonalized satellite images of the area of interest. In the case of the first prototype database format DTED2 will be used. Then we will use satellite images in (.JPG) format. It is possible to refine the terrain database using vector data in (shapefile) format.

From the perspective of the integration of VR Forces Simulator, the native MAK terrain model in 3D must be created by using the TBD tool.

2. VR LINK DEVELOPER

The interconnection between constructive simulator and GFTCCS will be based on HLA architecture. There will be therefore created a federation with two federates (VR Forces and 3D VR from GFTCCS). The architecture implementation is based on VR Link Developer. This product provides an application programming interface for creation of local entities, for setting their status and for sending and receiving remote entities and their properties in the entire federation. The implementation steps follows:

- Create (.fed) file prevents the formation of the federation. The file declares the contents of the federation, each federates, entities and their properties which will be broadcast in a distributed environment RTI.
- Compile code in accordance with HLA 1.3 or 1516.
- Class DtExcerciseConn must be used to connect federation.
- Class DtEntityPublisher creates the local entity, with the tick() method publish entity attributes. DtEntityType creates entity with DIS codebook respect.

```
DtExcerciseConn excercise (VrLink);
DtEntityType() tank (1,1,225,1,1,2,0);
DtEntityPublisher tankpublish(tank,&excercise);
```

- Entity state is set up in DtEntityStateRepositiry with setLocation(), setVelocity(), setAcceleration(), setOrientaton(), setSimTime(), setDamageState().

```
DtEntityStateRepository*repository tankpublish.entityStateRep();
repository->setLocation(DtVector(-2999300.0,-3423223.0,4533421.0));
repository->setDamageState(DtDamageSlight);
```

- Getting information about units of other federates is done via DtReflectedEntityList class with location(),velocity(), acceleraton(), orientation(), damageState() method.

For VR Forces Simulator and GFTCCS integration must be the 3D VR application recompiled by using the API of Developer VR Link.

3. VR LINK RUNTIME

VR Link functions library needs a valid license. The license can be obtained in two forms. The first one is license for development (Runtime) and the second on is license for application distribution. The application needs validation license server. The license server can run on a computer used for development or on another computer accessible within the LAN. The license server is delivered in the form of a USB key. The license file contains information about the license file name and the port on which the license is verified.

The application of distributive environment uses two licenses, since it is composed of two federates.

CONCLUSION

Implementation of the common operational picture was based on the High Level Architecture and MAK products. This first prototype is composed of two entities – Czech Command and Control System and VR Forces that contains the current situation at the Recognized Air Picture. At the side of GFTCCS the common operational picture is available in two and three dimensions. The Figure 2 shows the visualized common operational picture of the battlefield in three dimensions.

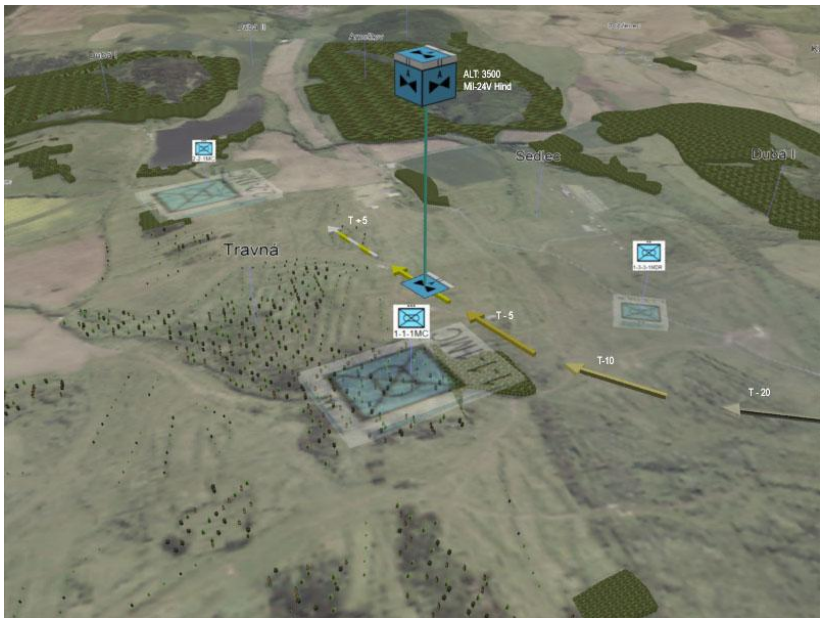

Figure 2. 3D GFTCCS common operational picture.

Common operational picture contains position information about three ground units and about the helicopter. The expected and historical trajectory of the helicopter is visualized as arrows. Each arrow contains the value that corresponds to time difference from the current battlefield time. This integrated real-time application is capable of supporting the commander with decision making process via merged information both from the ground and air domain. It can be mainly used as the training facility. In this particular case, the HLA framework was sufficient pour interconnection between simulation and real domain.

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TECHNICAL AND VISUALIZATION ASPECTS OF COMMON OPERATIONAL PICTURE SOLUTION IN THE CZECH ARMED FORCES

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Abstract: *The article deals with a design of visualization of common operational picture in the Czech Armed Forces. The overall solution is composed of two main entities in High Level Architecture distributed environment. Thus the architecture from modelling and simulation domain was used in the real time system. The first entity is Czech Ground Command and Control System, the second one is VR Forces Simulator. The first part introduces the composition of common picture. The second part shows details of a technical implementation of this two joined systems, the issues of distributed environment are discussed. The last part depicts the design of potential visualization outputs at both parts of connected systems.*

Keywords: Common Operational Picture, distributed environment, High Level Architecture.

INTRODUCTION

A common operational picture (COP) is a single identical display of relevant (operational) information (e.g. position of own units and enemy units, position and status of important infrastructure such as bridges, roads, etc.) shared by more than one commander. COP key objective is to facilitate collaborative planning and assists all level of command to achieve situational awareness [1]. COP is digitally shared and disseminated via tactical data link. COP is provided by command and control system (C2). C2 system is not only the tool to create COP, but it supports the overall mission planning and real time decision making process at the battlefield. C2 can be also viewed as system of system that supports all planning and real time activities at the battlefield. The Czech Army doesn't have any solution that enables to join the recognized air picture (RAP) with ground operational picture to create one common operational picture. The article depicts the design phase of the first prototype of COP that merged air and ground forces information about battlefield. This solution is composed of two main systems:

- Czech C2 system that is capable to product ground operational picture [2].
- VR Forces that is capable to gather data from the real air command and control systems [3].

1. NEW PRESENTATION LAYER OF CZECH C2 SYSTEM

The first intent on building the Czech C2 was in 1997. The system is mainly composed of two parts: Automated Command and Control System (ACCS) and Battlefield Vehicle System (BVS). BVS is use at the squad, platoon and company level. ACCS is aimed at the brigade level. Presentation requirements of these subsystems specified in the design of C2 system correspond to that era. The current presentation layer is still built on the concept of a desktop application that displays the situation on the battlefield in real time. Tactical situation is

visualized on digital maps in two dimensions (2D). As a reaction to new requirements for command and control systems (credibility, high resolution, implemented level of detail, etc.) is an implementation of a new presentation layer of C2 system. This presentation layer enables commander to view the situation on the battlefield in three dimensions (3D). Currently, the new presentation layer can display friendly units covering precise-defined area. The size of these areas is refined based on the positional information obtained by subordinate units or military vehicles [2].

From the interconnection point of view at the Czech C2 side is vital information about the position of individual entities and other tactical attributes that are associated with this entity. It is mainly a code number according to the APP-6A, a graphic symbol corresponding to that code, entity name, combat efficiency, fuel status, direction of movement, speed and ammunition status. Figure 1 depicts a platoon visualized by the new presentation layer. The object covers a space in which it operates, and bar graphs describe the percentage of previously mentioned attributes.

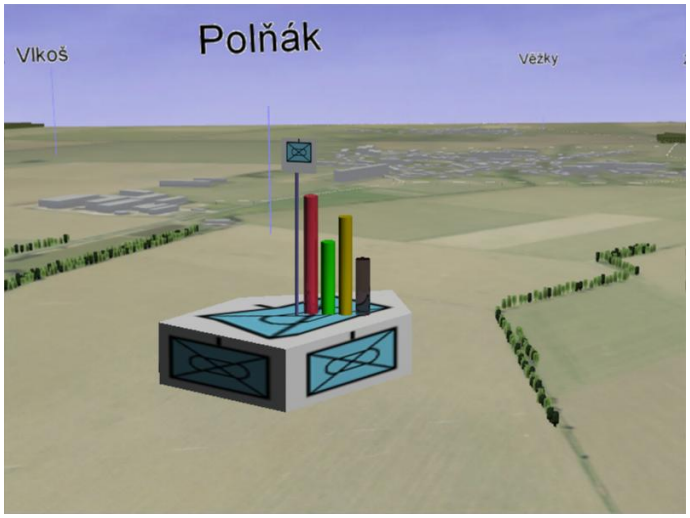

Figure 1. Visualized unit in the new presentation layer.

2. VR FORCES AS TOOL TO GET RECOGNIZED AIR PICTURE

Constructive simulator VR Forces creates a simulation environment using the MAK Technologies company products. This simulator allows addressing the development and modeling scenarios, and organizing and implementation of war games addressing the air defense domain. The simulator uses air defense simulator called Static Fire Distribution Center (SDFC) to control brigade air defense. The simulator is also connected to fire control system simulator RACCOS. These two subsystems are the main container of real data from the air perspective. The VR Forces are used to merge all available data into single RAP.

From the interconnection point of view at the VR Forces side is essential to analyze simulator VR Forces, which artificially created entities of friendly and enemy units. This simulator shows the real battlefield objects obtained by the sensors and sent via SFDC.

3. TECHNICAL ASPECTS OF SYSTEM INTERCONNECTION

Implementation of COP is based on the ability of interconnection between Czech C2 system and VR Forces simulator. It can be done:

- Time synchronization of all subsystems: C2, VR Forces, SFDC, RACCOS. This solution doesn't offer to aggregate units into selected level.
- Czech C2 system with direct inputs of tactical data link: LINK 11B, LINK 16, Low Level Air Picture Interface (LLAPI). It cannot be implemented in the specific Czech environment. The LINK 16 and LLAPI are not still in operational use.
- Implementation of Joint Consultation, Command and Control Information Exchange Data Model (JC3IEDM) model. This could have bridged the gap between ground and air picture. This option is not feasible. Command and control systems of both domains use different standards for storing data.
- Implementation of a new standard for communication between command and control system and simulator domain. Usually based on the standards Coalition- Battle Management Language (C-BML) a Military Scenario Definition Language (MSDL) standards. These standards are relatively new and its implementation could be very costly.
- Interconnection implementation with the standards for distributed environment such as Distributed Interactive Simulation (DIS) [4] and High Level Architecture (HLA) [5]. This variant was chosen as applicable because of research team expertise in this domain and the only solution from the economic point of view.

The last variant was chosen and the only question was to decide which standard will be used. The DIS standard is currently used in the Czech Armed Forces for distributed training. The HLA is planned to supersede DIS in 2011 because of ratification and implementation commitment to NATO signed in 2009. Technical differences between DIS and HLA are mainly:

- DIS is the exact protocol, but the HLA is the architectural approach without explicit implementation details.
- HLA significantly reduces the network load because of declaration mechanism that enables to publish and subscribe only selected features of the simulated entity and because of no broadcasting calls such are in DIS.
- HLA isolates the logic part from the connectivity part of the simulated entity.
- DIS is not designed for interconnection of the simulator with aggregated and non aggregated battlefield entities.

The new presentation layer is currently connected only to BVS. But it is vital to connect the new presentation layer to the ACCS to have all available tactical data. By this connection the tactical overlays can be visualized in 3D as well. The main tactical overlays that must be visualized in 3D were discovered in questionnaire that was disseminated in 2010 to the main users of C2 systems. These tactical overlays are mainly: Forward Line of Own Troops, Forward Edge of Battlefield Activity, Line of Departure, Probable Line of Deployment, Area of Operation, Attack Area, Assembly Area, Engagement Area Fire line and Axes of Advance of Main Attack of Army.

4. VISULAZATION FEATURES OF COMMON OPERATIONAL PICTURE

Visualization of common operational picture is not issue in the 2D domain, but 3D visualization opens new problems. These problems have been solved in the modeling and simulation domain, but not in the real time system area.

4.1 3D Visualization of ground units

Ground entities are displayed as a 3D representation of the object type, which is placed on the surface. Data entity elevation is neglected in this case, since the local terrain database may differ from terrain database used in the VR Forces. 3D object surface is covered with a texture representing the entity tag. This object forms the vertical line with billboard object. The billboard contains the name of the entity object. It serves mainly to identify the position of an object located in the wooded or built-up area. The unit is less identifiable proportionally with the distance, thus the name of the unit, its speed and distance from the observer is visualized close to the object. The direction of unit movement is done by 3D arrow which is placed at the unit as well (as shoved at Figure 2).

Figure 2. Visualized ground unit in the common operational picture.

4.2 3D Visualization of air units

Air entities are displayed as a 3D representation of the object type. This 3D object is placed in space by coordinates and altitude of the entity. In the intersection of the 3D object normal and terrain surface the arrow that shows the direction of movement of the entity is placed. In this respect, depending on the speed of the entity displaying 3D arrows represent the estimated flight path of the entity. This type of visualization is most important for fast-flying aircrafts, which allows seeing expected trajectory in time correlation. 3D object is covered by APP-6a symbol representing the entity. The same data as in the case of ground units is visualized close to the unit (as shoved at Figure 3).

Figure 3. Visualized air unit in the common operational picture.

CONCLUSION

High Level Architecture was used to interconnect two systems: Czech Command and Control system and VR Forces. Both these system have online inputs from the real battlefield. The interconnectivity creates the possibility to design and implement common operational picture that will be available mainly at the Czech C2 system. Design phases of this project has been done, the implementation phase will follow in the mid of 2011.

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TACTICAL DATA ANALYSIS FOR VISUALIZATION IN THREE DIMENSIONS

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Abstract: *Existence of common operational picture is essential for creation of a common decision in command and control systems. Czech C2 system uses "common" (for ground forces only) operational picture from 1997 but only in two dimensions. Three dimensional visualization of operational picture is the key enabler to get common understanding of the battlefield situation in more natural way. The article deals with the results of the first phase of project with code name VISUAL. This project is aimed on the tactical data visualization in 3D. First phase of the project analyze in detail type of data that is available from Czech C2 system and what type of tactical data is suitable for visualization in three dimensions. The first part of article introduces the project and its motivation from military commander perspective. The second part is aimed on the questionnaire that was disseminated in the Czech Armed Forces to get the right answers and ideas about tactical data visualization as:*

- *What type of 3D model should be used to represent the units at the battlefield?*
- *What type of information is essential for commander?*
- *The way of main tactical data representation.*
- *Visualization of unit movement prediction.*
- *The way of tactical overlays visualization in three dimensions.*

The last part informs about potential use of NATO Vector Graphics format to transfer tactical overlays into 3D visualization system.

Keywords: Common Operational Picture, tactical data, analysis, 3D visualization.

INTRODUCTION

A common operational picture (COP) of the battlefield is a key issue in the concept of Network Enabled Capability. COP availability is a prerequisite for joint decision making in command and control systems (C2). Czech C2 system uses "common" (for ground forces only) operational picture since 1997 in two dimensions (2D). Another way to increase the value of information derived from COP is three-dimensional (3D) representation of terrain and tactical data of the battlefield in real time. This feature was highlighted by successful defense research projects with code name VIRTUAL solved in 2007-2008 at the Masaryk University. One of the project outcomes was the software solution capable to display 3D terrain of the battlefield and the position of own units in real time. The position of the units is obtained by applying Service Oriented Architecture (SOA) for integration with the Czech C2 system [1][2]. In 2009 the military requested to incorporate the 3D visualization of the battlefield to the architecture of the Czech C2 system. This requirement covers the project: "Services for 3D visualization of tactical data of Czech C2 system" accepted to be solved in the years 2010-2012 with code name VISUALIZATION. This first phase of this project is focused on analysis of tactical data that are available in Czech C2 system to get the minimum set of information that must be visualized in 3D.

1. CZECH C2 SYSTEM TACTICAL DATA

Czech C2 system stores data about tactical units and entities in databases of individual brigades that are main organizational units from the command and control point of view. Czech C2 system software is divided into two groups of applications. The first is the combat vehicle's information system (CVIS) and the second one is an automated command and control system (ACCS). Connectivity only with the CVIS is not sufficient. All tactical data is available only from ACCS. The most important application - Position localization as a part of ACCS visualizes positional information of units. This application is connected to following information resources:

- PSH database - to retrieve the current position of displayed objects.
- STDB - to identify the characteristics and current states of objects.
- GEO data repository, which contains the raster and vector electronic equivalents of topographical and geographical maps, aerial or satellite pictures and plans of cities and villages.
- Tactical vector data repository, which contains all vector drawings of tactical information, stored in individual layers. We called them tactical overlays.

To classify tactical data, following categories exist in ACCS:

- Main tactical data (unit name, combat efficiency, unit position, velocity, movement vector, altitude).
- Other tactical data (dose of radiation, availability, evaluation of ammunition, persons, fuel and weapons, readiness, operational status (destroyed, damaged, lost), fire regime, NBC equipment, level of training, emissions, deployment.
- Tactical overlays (Lines, Points, Areas, Tasks, Direction, Maneuver- terrain, Maneuver- anti enemy activity, Maneuver – own units, Reconnaissance, Special symbols for particular type of unit.

It is important to clarify that during the real fight the other tactical data need not to be available because of low band connectivity or totally jammed transmission.

2. TACTICAL DATA QUESTIONNAIRE

To set how to display tactical data in a 3D visualization prototype a questionnaire was developed. The questionnaire was disseminated between commanders at the medium level of command. Total number of respondents was 30 within different military branches. For these reasons, the results of the conducted survey can be viewed as significant. For initial setup of 3D visualization is essential to find answers to following questions:

- What type of 3D model should be used to represent the units at the battlefield?
- What type of information is essential for commander?
- The way of main tactical data representation.
- Visualization of unit movement prediction.
- The way of tactical overlays visualization in three dimensions.

The findings resulted from the questionnaire:

- Units should be viewed as a spatial object that most closely describes the area in which the unit and its subordinated units are located.

- 60% respondents believes that it is necessary to show directly "without clicking" key tactical information about the unit.
- The basic tactical data cited in order of importance:
    - Name of unit (symbol as part of the APP-6A).
    - Operational status.
    - Person status.
    - Ammunition status.
    - Direction of movement.
    - Fuel status.
- If a parameter is in percentages, so it is suitable to display it in bar graph form.
- Other available tactical data must be displayed after a "click" on the unit.
- The history of the movement should be showed in the interval of 10h.
- The estimated unit movement should be showed in the interval of 2h in the form of arrows.
- Tactical overlays should use filters corresponding to the groups identified in chapter 1.
- Platoon and the company is adequate level to the brigade command and control process.

3. TACTICAL OVERLAYS TRANSMISSION

The transmission of vector data (tactical overlays) from Czech C2 system into 3D visualization application will be based on NATO Vector Graphics (NVG) protocol [3]. This protocol was created to easy encode and transmit combat information between the command and control systems. The main effort was directed to the transmission of military symbols. NVG data format is an XML document. The document has a prescribed structure that is defined by the XSD file. The content of this document is a set of graphics primitives, from which a tactical situation can be made. Graphics primitives are only a small set and represent only the geometric primitives with a unique structure (e.g. point, line, polyline, polygon, ellipse, etc.). These graphics primitives are then mapped to the NATO symbols according to APP-6A, APP-6B and MIL-STD-2525B. Implementation of NVG was originally inspired by industrial SVG (Scalable Vector Graphics). The primary purpose of NVG format is presentation of battlefield information from multiple sources. This is enabled by viewing them in overlapping layers. To create a comprehensive and detailed view of common operational picture of a particular battlefield situation is then done by a combination of several simpler views. On the other hand, it should be noted that to obtain a real picture of the situation, the individual resources must be secured and their activities must be controlled.

CONCLUSION

The first phase of VISUALIZATION project was done. The tactical data available from Czech C2 system was analyzed. The most important data to visualize in 3D from the commander point of view are: name of unit, operational status, person status, ammunition status, direction of movement status, fuel status. These data must be visualized as 3D bars close to the particular unit. Tactical overlays were analyzed and the most important minimum set of these primitive followed: Forward Line of Own Troops (FLOT), Forward Edge of Battlefield Activity, Line of Departure, Probable Line of Deployment, Area of Operation, Attack Area, Assembly Area, Engagement Area Fire line and Axes of Advance of Main Attack of Army (AAMAA). The Figure 1 shows the tactical situation with tactical overlay in

3D with FLOT and AAMAA. Three units are visualized as 3D objects with mapped APP-6A symbol.

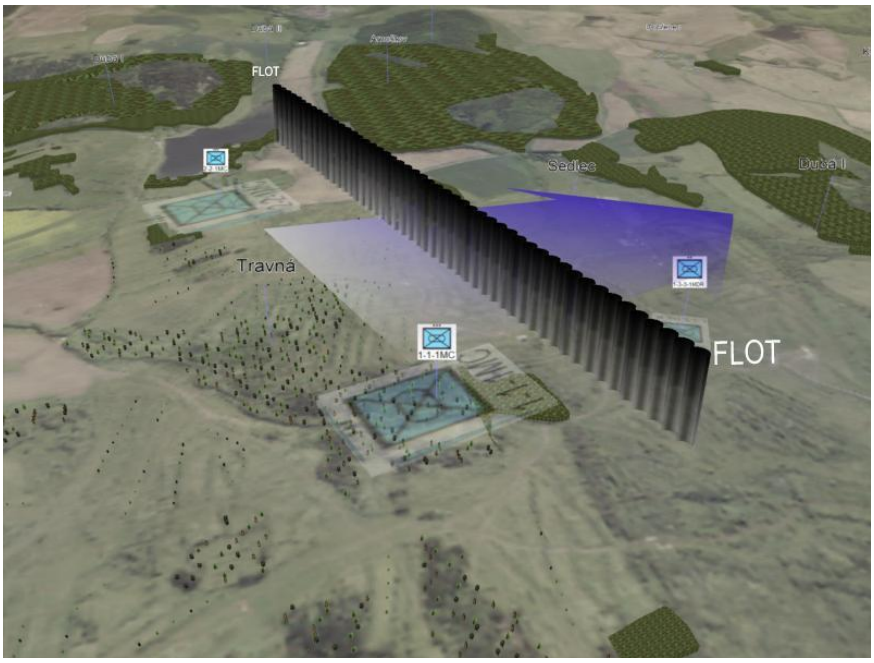

Figure 1. Visualized units and tactical overlays in 3D.

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DISTRIBUTED SIMULATION STANDARDS – WHO WILL WIN?

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Abstract: *This paper deals with current distributed simulation standards recognized by NATO training community as key enablers of contemporary trends like integration of live, virtual and constructive simulation systems, and deeper cooperation to make training for international missions more responsive while saving unnecessary costs for travelling. The Army of the Czech Republic has been involved in the standardization process for a few years but we have not reached full interoperability yet. What are the reasons that High Level Architecture has not become major standard? Besides ACR specific problems, priority changes and limited playground for competition, there are important issues that force simulation systems owners and developers continue seekig for the best solution in networking simulations. Some of these aspects are discussed.*

Keywords: Distributed Interactive Simulation, High Level Architecture, DIS, HLA.

INTRODUCTION

There are several trends in distributed simulation systems contributing to leverage the interoperability of training supporting the overall capability of joint international military operation wherever needed. Developers are focused to fulfill all military customers' needs enabling to create complex scenarios ranging from full-scale operations to natural disaster relief, supporting dynamic task force structure, increasing the realism for the trained audience. Better trained troops with new effective equipment and more precisely tailored support can accomplish their mission possibly with less personnel than before, and military response of NATO and EU is expected in more troubled regions so deeper cooperation of multi-national units and thus common training is necessary. The Army of the Czech Republic (ACR) has been engaged in long-term international training programs both with neighbors, and leading NATO members such as USA and GBR. Then, one might wonder why the ACR has not implemented yet the standard for distributed simulation, High Level Architecture that has gained support of NATO Modeling and Simulation Group, made its way through NATO Standardization Agency to become NATO STANAG, and seems to be a successful ancestor of legacy standard Distributed Interactive Simulation, which was in 2010 even removed from the NATO STANAG list. There was considerable effort to resolve basic interoperability issues among different NATO training systems "once and forever" by one standard – HLA. Let's see what says to this effort Karen Walker, executive director of the Training and Simulation Journal in 2011 [1]:

"We all publicly proclaim that it's to the benefit of us all to pursue open architecture systems and a single, common operating standard for all our products so that they are interchangeable, interoperable and upgradeable at the drop of a hat, no matter who wants to use them or why. Entire agencies, communities, conferences and conference sessions were dedicated to repeating this mantra through the last decade. Let's call it the Simulation Script for Oneness. Let's start the new decade with a new concept. A good beginning would be to air some truths and realities about the limits and drawbacks of the quest for Oneness. This would facilitate a more honest debate that could prove more productive. It can hardly be less productive than

the Oneness efforts, the results of which can be counted in dozens of different "common" standards. To paraphrase one speaker I heard last year, the great thing about common standards is there's so many to choose from. … Standard for one application or service is not necessarily useful or helpful for another. Forcing it to be so only adds cost and effort, the exact opposite of what the Oneness goal is supposed to achieve. If everything devolves into one, where's the incentive for competitive behavior, cost control and innovation? Sometimes, more does mean more."
So, the answer whether to push to promote HLA or take another look at what are the choices is not simple. Let's have a closer look at the situation, drivers and circumstances, and possible the way ahead for interoperability of distributed simulations, pertaining currently to constructive and virtual systems in use in the ACR.

1. HISTORY

We are not going to map complete history of networked simulation protocols because the first steps in training using Computer Assisted Exercises (CAX) compliant with international standards were made in the Czech Republic in 1999. Tactical simulator ModSAF became our first system accredited for commander and staff training. Despite standard Distributed Interactive Simulation was already expected to be replaced sooner or later with emerging High Level Architecture due to its limitations when trying to network existing national training systems internationally via WAN. There was no simulation system in the ACR compliant with the Aggregate Level Simulation Protocol (ALSP). The interoperability between virtual and constructive simulation was an important issue while Live-Virtual-Constructive (LVC) integration, as well as interface between C2 systems and simulators was for some years not required. On the other hand, the interoperability of our tactical level system with a theater level system widely used by NATO community to enable plug-and-play training of NATO Response Forces (NRF) in real scale (Czech tactical unit be a part of larger multi-national contingent) was really lucrative. Meanwhile, the difficult issues of integrating dissimilar operational and tactical level systems were resolved for simulation systems JTLS (Joint Theater-Level Simulation) and JCATS (Joint Conflict And Tactical Simulation). These two became official NATO Training Federation, and it was not expected to diversify and support number of other simulators for NATO organized exercises. Of course, this does not mean push to unify equipment in national training facilities.

2. NETWORKED SIMULATION STANDARDS

The discussion in this chapter should clarify some technical issues between biggest players in legacy simulation systems – DIS and HLA.

Standard HLA [2] is more general, and, literally more high-level than precedent DIS [3] or ALSP. Such higher abstraction is better suited for future growth and development but it brings new requirements, and is by no means easy plug-and-play solution. Implementation of IEEE Std 1516-2000 or newer releases does not grant interoperability itself.

2.1 Simulation Complexity

Standard DIS is well designed to support loosely coupled training exercises on local area networks, and became very successful. Its shortcomings became apparent when increasing

number of simulated entities, and/or increasing dynamics of interactions. Delivering data important for interaction simulation in time puts different requirements on PDU frequency. Typical dynamics intervals necessary for real-time interactions are in Figure 1.

Although it is possible in DIS system to set tick frequency for scheduler to poll simulated entities in optimal intervals to maintain causality within complete distributed system there is no guarantee that all individual workstation will receive PDUs in time and in right order. There is no provision for latency leveling in DIS system using wide area networks (WAN). This fact can influence causality of DIS simulation, it could even affect the fair fight principle.

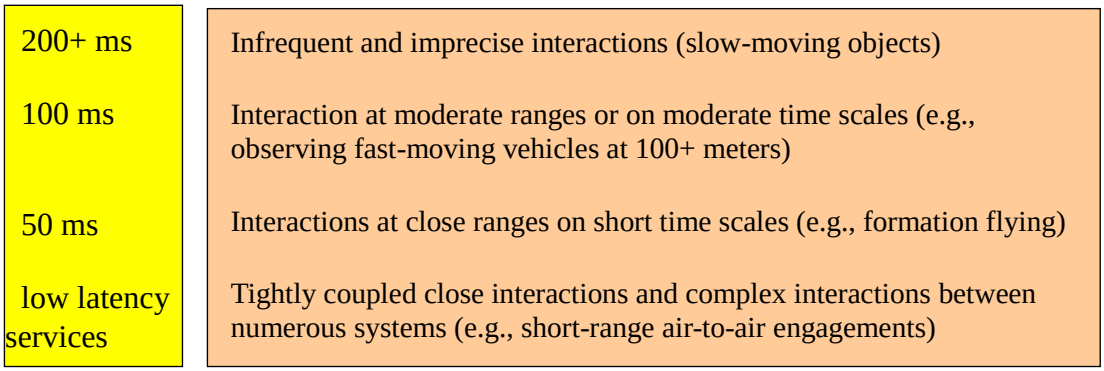

Figure 1. Typical dynamics requirements.

One of basic limitations of DIS is the non intelligent broadcasting scheme that would not scale to support large exercises on WAN. HLA federation design can be optimized for global state consistency or real-time performance. More control of network traffic plus another layer filtering PDUs between any two federates (Real Time Infrastructure - RTI) means more overhead so it does limit the system performance. Time Management slows down the simulation but does not invalidate it. Federation Object Model (FOM) can be as simple as possible (RPR-FOM) allowing simple DIS federates to take part in simulation, up to very complex one (world divided into areas of interest to facilitate Data Distribution Management, sharing object ownership – Ownership Management, and object/interaction specific consistency rules). HLA Data Distribution Management together with the Publishing/Subscription mechanism are the solution avoiding congestion in network flooded due to high number of simulated entities or high dynamics of their interactions.

More degrees of freedom during HLA federation design phase have its reverse side; different FOM requires adequate changes in Simulation Object Models (SOM) of all federates. Federation design is relatively simple and fast comparing to integration of heterogeneous DIS systems.

2.2 Abstraction Level

Both standards cannot be directly compared without respecting area covered. DIS is a protocol assuring (relatively) plug-and-play capability to be interoperable.

HLA does not derive the interoperability from an “HLA protocol”, only a standardized set of services is defined (Table 1). Standard defines only services behavior and how they are invoked, particular services implementation is not standardized. Of course, no interoperability

would be possible without sharing simulation information via data structures, named and defined in common agreement by all participants.

DIS compliant systems have no such functionalities, or have them implemented in a non-standard way. Consequently, DIS offers simpler, more straightforward way to core data exchange without any help when building heterogeneous system of systems, where participating federates can be complete simulators as well as individual models.

Service	**Functionality**
Federation Management	Create and delete federation executions. Join and resign federates. Control checkpoints, pause, resume, and restart.
Declaration Management	Publish and subscribe to object attributes and interactions.
Object Management	Create and delete object instances. Send object attribute updates and interactions. Create and delete object reflections.
Ownership Management	Transfer ownership of object attributes.
Time Management	Coordinate the advance of simulation time and its relationship to real time.
Data Distribution Management	Support efficient routing of data, usually by space-based interest management.

Table 1. HLA services.

HLA adds very important layer between any two federates – the Real Time Infrastructure – (RTI). RTI is responsible for all data exchange within federation execution so there must be part of HLA interface at each federate. An user can get many different RTIs from commercial vendors, download one from the Internet or build his own. There is potential risk when particular system works well in federation A with RTI A that it may not be fully interoperable in federation B with RTI B.

A federation does not necessarily include all functionalities of its members – federates, federations are designed for a particular purpose. For example, the same federation, designed for WAN connected federates must take into account higher latency and using Time Management services control timing of LAN federates – slow them down or turn on waiting states. It is apparent that such control have an impact on performance. Real-time simulation, preferred in Human-In-the-Loop systems is sacrificed to consistency and scalability.

Another question raises whether all federates are capable of using services, and are these services implemented in the same way? This delimitates use of services within particular federation.

2.3 DIS Evolution

The discussion would be incomplete without mentioning “DIS resurrection”. After years of perceiving that DIS is incapable of keeping pace with new requirements (and still being used for training with legacy systems that would need major investment to become more than core HLA interoperability) new version of DIS (version 7) is about to be released [4].

The Simulation Interoperability Standards Organization (SISO) has the Distributed Interactive Simulation Product Support Group (PSG) to support DIS products such as the IEEE 1278 series of standards.

DIS shortcomings are resolved:

- Uses simulation management PDUs
- Specifies use of reliable communications
- Simulate the use of electronic warfare, computer network attack, military deception, etc.
    - Influence or disrupt decision making
    - Predicted effects are transmitted
    - Perceived effects are reported
- Supports Non-Real Time (NRT) protocol
- Live Entity Information/Interaction protocol designed for bandwidth-limited range interactions
- Architectural changes to PDUs to conserve bandwidth
- Backward compatible with Version 5/6 PDUs
- Variable Heartbeat Periods provide flexibility and reduce the number of heartbeat updates
- The Transfer Ownership function has been revised to improve its functionality
- Time requirements have been extensively clarified and revised
    - Absolute, relative, simulation time
    - Timestamp usage
    - Time synchronization
- Dead Reckoning annex has been revised to clarify and correct technical details
- Protocol Extensibility is supported, DIS is now more easily customized
- Improves network efficiency by allowing one or more PDUs to be concatenated in an UDP datagram
- New PDUs (Warfare – Directed Energy, Info Operations, extensible Attribute PDU)
- DIS Enumeration Working Group (EWG) supports and maintains a data base of enumerations used by DIS, HLA, TENA, and CTIA federations

Many initiatives were not accepted to version 7, which will be released soon. The PSG started working on version 8.

3. NEW WAY FOR DIS/HLA SIMULATIONS

Distributed simulation is not only matter of choice between DIS and HLA for both solutions have “the same parents”. The reasons why no single solution won are fairly complex to discuss here, but one of early limitations was that HLA was never one single standard. Outsourcing of RTI was an effort to make the floor open for industry, though, it brought new problems with interoperability and licensing, too. More similar solutions exist, for example TENA [5] but interesting new approach offers **Advanced Message Queue Protocol (AMQP)/ ProtocolBuffers** [6]

Both major players, DIS and HLA have their advantages. Let's combine the simplicity of DIS with the flexibility of the FOM while making it open source. We believe that Google's ProtocolBuffers (PB) may be a potential solution to part of the problem. a PB is a way of specifying data to be sent on the network or stored in a file in a binary format. The PB is

actually specified in a simple text file. The file with PB definition is processed by a code generator. The resulting code is used to marshal/unmarshal the data. There are code generators for C++, Java, Python and Ruby.

This provides the ability to be backwards compatible with previous specifications. It is accomplished with the required and optional tags for fields in the specification.

The PB could be used with UDP, TCP, or Multi-cast to push data onto the network. While it's nice to have DIS in the PB format, it's just DIS in a new format. As mentioned above, PB provides an easy way to extend an existing packet with new data while maintaining backwards capability with applications that might not have the new data fields. This same capability could be extended to the FOM for HLA.
However, HLA specifies certain capabilities that need compliance. Data Distribution Management (DDM) is one item that would need to be addressed. DDM allows players to subscribe to data that meets special requirements. PB by itself can't do this. Advanced Message Queue Protocol (AMQP) [7] may be the standard that is needed to fix the problem.

CONCLUSION

This article is a reflexion about distributed simulation standards put in context with standardization process in the ACR. Experience from developers and integrators of simulators, as well as author's own experience is collected to help finding bearing in this topic. Existence of de facto two parallel versions of HLA which is official NATO standard is one aspect. Another aspect is the training federation currently in use in ACR, it still works well in DIS environment, some virtual systems would have to be updated, though, the value added would be questionable. The customer drive is new functionality or cost savings, not just standard compliance. The investment in system we do not own can be devalued by its future evolution. It is by all means desirable to open more our training federation for partners, we must be aware that the integration process is not as simple as implementation of certain STANAG. HLA is still our goal to achieve (at least to support joint training of Ground Forces together with Air Force) but the future when we resolve not only the scale and distance issues is yet to be boiled in competition of various ideas.

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QUESTION OBJECTS – THEIR DESCRIPTION AND USAGE

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Abstract: *The paper deals with the term of "question object" in education. Firstly, the paper contains definitions of the most important terms. Secondly, an anatomy of the selected question object is introduced. Thirdly, some recommendations for the usage of question objects are formulated. The author would like to emphasize the important role of modern ICT in question objects creation and usage.*

Keywords: question object, electronic question, electronic test, electronic self-test, education.

INTRODUCTION

From a general point of view a question object (Q_O) is the most important term of the modern electronic testing. It can be said that electronic tests of high-quality strongly motivate students in all fields of study. Various educational institutions, companies and individuals working in the field of education use various software (e.g. Moodle) to produce electronic tests. The resulting products can often vary greatly from the point of view of the achieved useful value for learners. The Q_Os should be in compliance with the "Shareable Content Object Reference Model" (SCORM).

The main goal of the paper is to support the use of ICT in education in the field of electronic testing and to open this problem domain for wide range of takers. The author presents a possible approach to creating a formal description of the basic concepts of the area in focus. He defines key terms, such as "question object" (Q_O), "question object prototype" (Q_{PT}), "electronic question" (Q) and "electronic test" (ET). As an example of the implementation of a particular Q_O, the type "Multiple Choice Multiple Correct", whose Q_{PT} is implemented in ToolBook II Instructor software [1], [2], is selected. Then a possible Q, which can be randomly generated from the used Q_O, is shown. This Q example also shows a possible approach to graphics of the Qs. Finally, some recommendations are stated.

1. QUESTION OBJECT – CONTENT OF THE TERM

Let's have a look at possible definitions of basic terms. The main term "question object" can be generally described by the following definition 1.

Definition 1:
Question object (**Q_O**) is a structure

$$\mathbf{Q_O = [id, qf, ans, sco, fdb]}, \qquad \mathbf{(1)}$$

where
id is the name of the question object prototype,
qf is the question formulation,
ans are answers,
sco is scoring,

fdb are feedback conditions (feedback can be immediate and delayed).

Definition 2:
Question object prototype (**Q_{PT}**) is a structure

$$\mathbf{Q_{PT} = [nm, sw, f, a,]}, \quad \mathbf{(2)}$$

where
nm is the name of **Q_{PT}**,
sw is software in which **Q_{PT}** is implemented,
f are features of **Q_{PT}**,
a are attributes which user can set.

Definition 3:
Question (**Q**) is a structure

$$\mathbf{Q = [Q_O, as]}, \quad \mathbf{(3)}$$

where
Q_O is a question object,
as is the list of answers which were generated from **Q_O**.

Definition 4:
Electronic test (**ET**) is a structure

$$\mathbf{ET = [idt, g, \{Q\}, stev, nav]}, \quad \mathbf{(4)}$$

where
idt is the identification of this test,
g is the guide for students (users of this test),
{Q} is the set of questions (test items),
stev are rules for the whole test evaluation,
nav is the navigation used in this test.

2. THE ANATOMY OF SELECTED TYPE OF QUESTION OBJECT

One of the most useful **Q_{PT}** can be the "Multiple Choice" which is implemented in ToolBook Instructor authoring software [1], [2]. Let's have a look at Fig.1. It can serve as an example of a **Q** which was generated from **Q_O** where **Q_{PT}** Multiple Choice implemented in ToolBook Instructor authoring software was used.

Table 1 contains so called "rough draft (idea) of question object". This description can be prepared by everyone who is capable to make it – guarantee of the subject, teachers of the subject, students. It can serve as base information for the selected question object setting.

Suitable type of electronic question object	**Multiple Choice/Multiple Correct**
Usage (subject, study group)	**Computer technology and programming** **21-3UoD**
Identification	**T13-06**
Description	User will select 2 true answers from 6 answers which will be displayed on the screen.

Question formulation proposal	What statement(s) you can use for writing data into a text file in MS Visual Basic?
Correct answer (answers) proposal	Print # Write #
Incorrect answer (answers) proposal	Draw # Print Write Output Put

Table 1. Rough draft (idea) of question object.

In Fig. 1 a graphic design of a question based on the rough draft (idea) of question object can be seen.

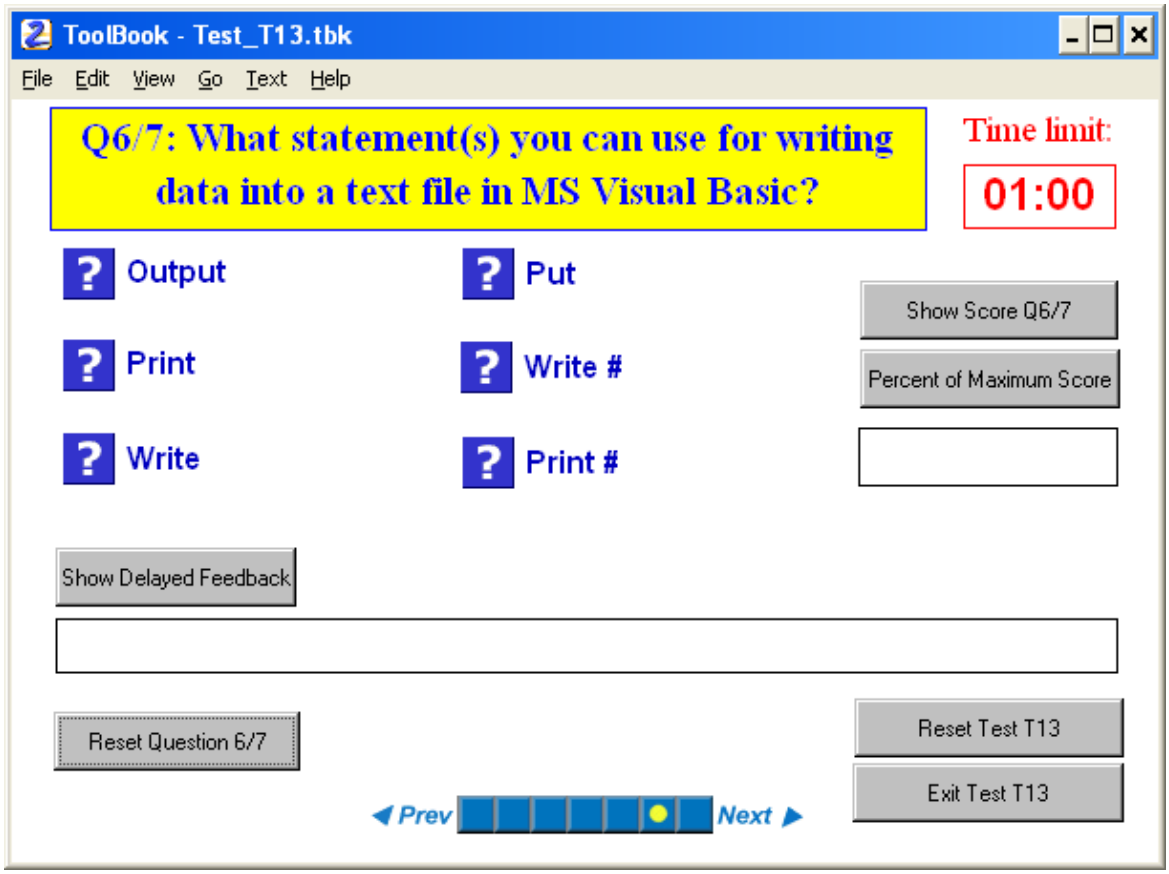

Figure 1. Question design.

The timer object displays the number of seconds that remain to answer this question. The timer should be used in conjunction with questions that have a time limit. After every user's response appropriate immediate feedback is displayed according to the settings in Fig. 5. After the last user's response the delayed feedback defined in Fig. 6 can be displayed.

It is possible to display score of this question and score of the whole self-test. Number of points or percentage expression can be used. User can reset question or reset the whole test (self-test). Navigation is solved with appropriate navigation object.

Settings of five tabs of ToolBook Instructor Multiple choice question object is shown in Fig. 2, Fig. 3, Fig. 4, Fig. 5 and Fig. 6.

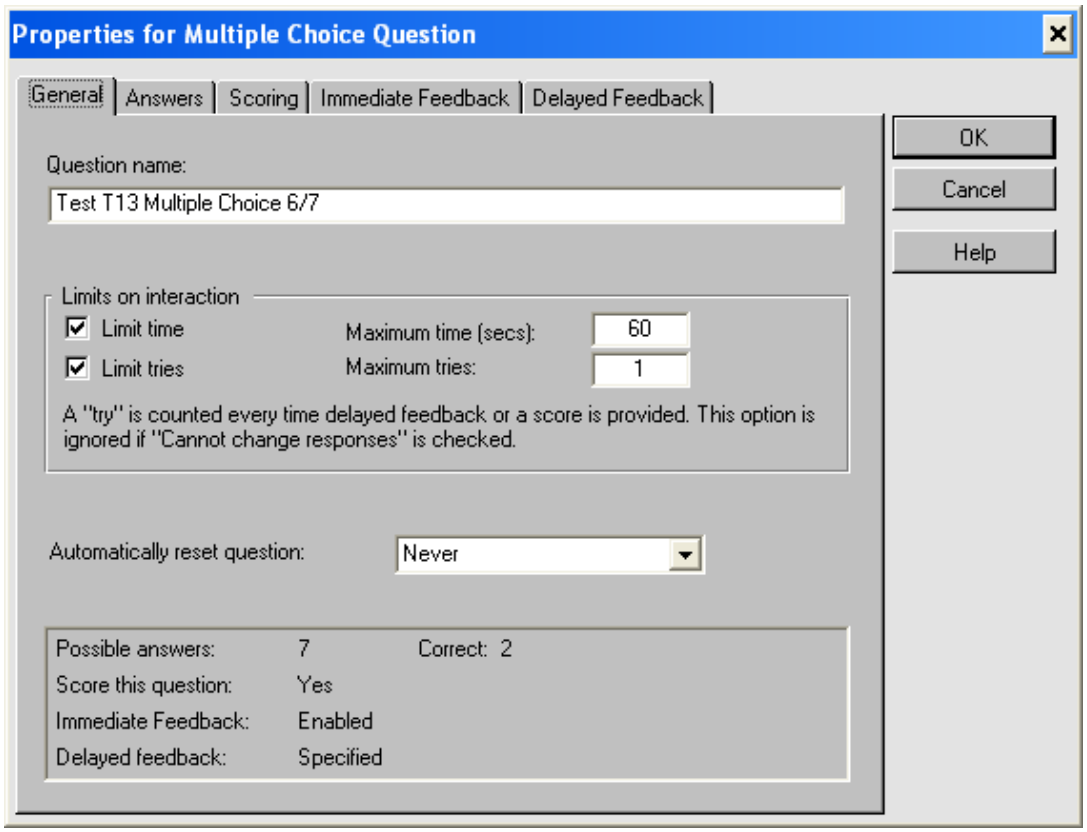

Figure 2. Setting of Question Object – Tab General.

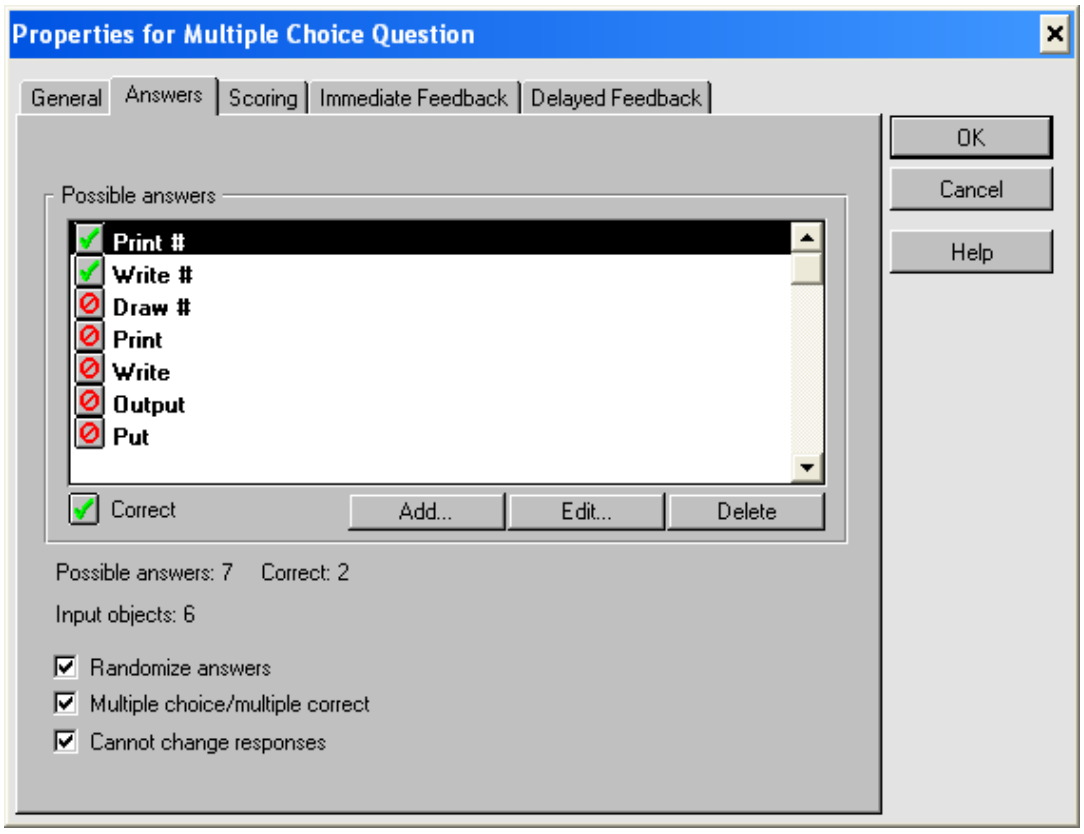

Figure 3. Setting of Question Object – Tab Answers.

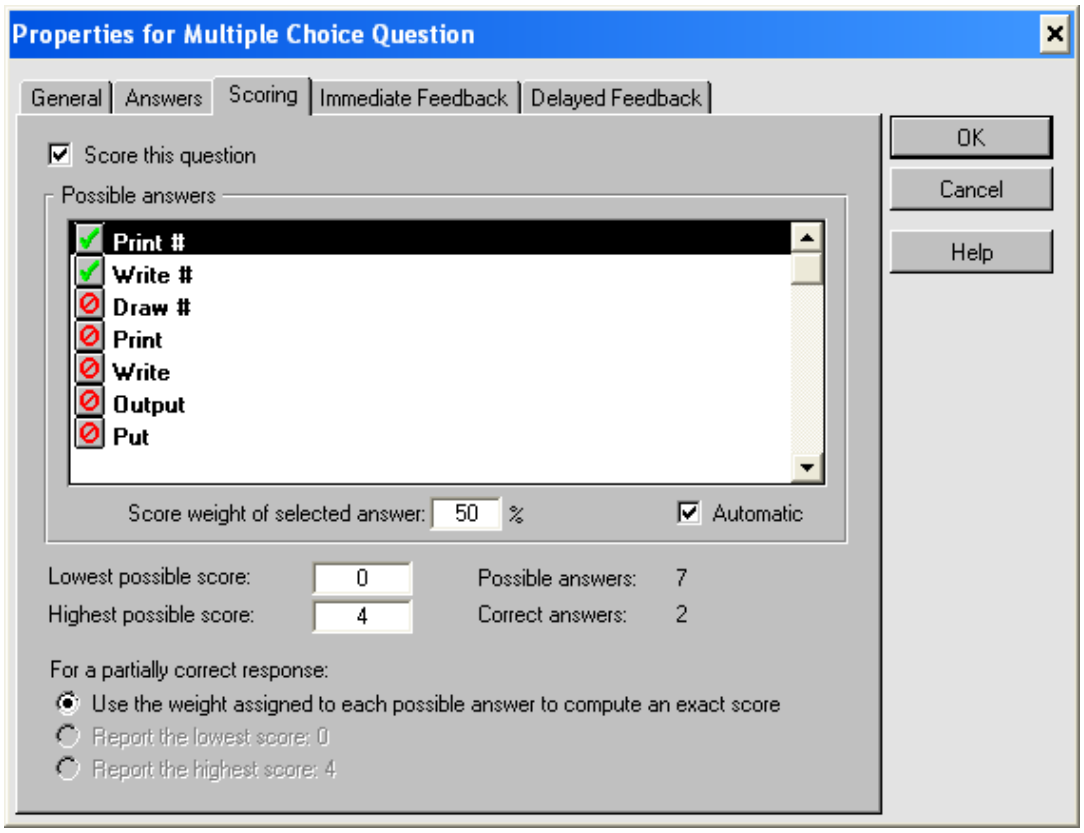

Figure 4. Setting of Question Object – Tab Scoring.

Feedback for a question object can be immediate or delayed. Settings of the feedback can be seen in Fig. 5 and Fig. 6.

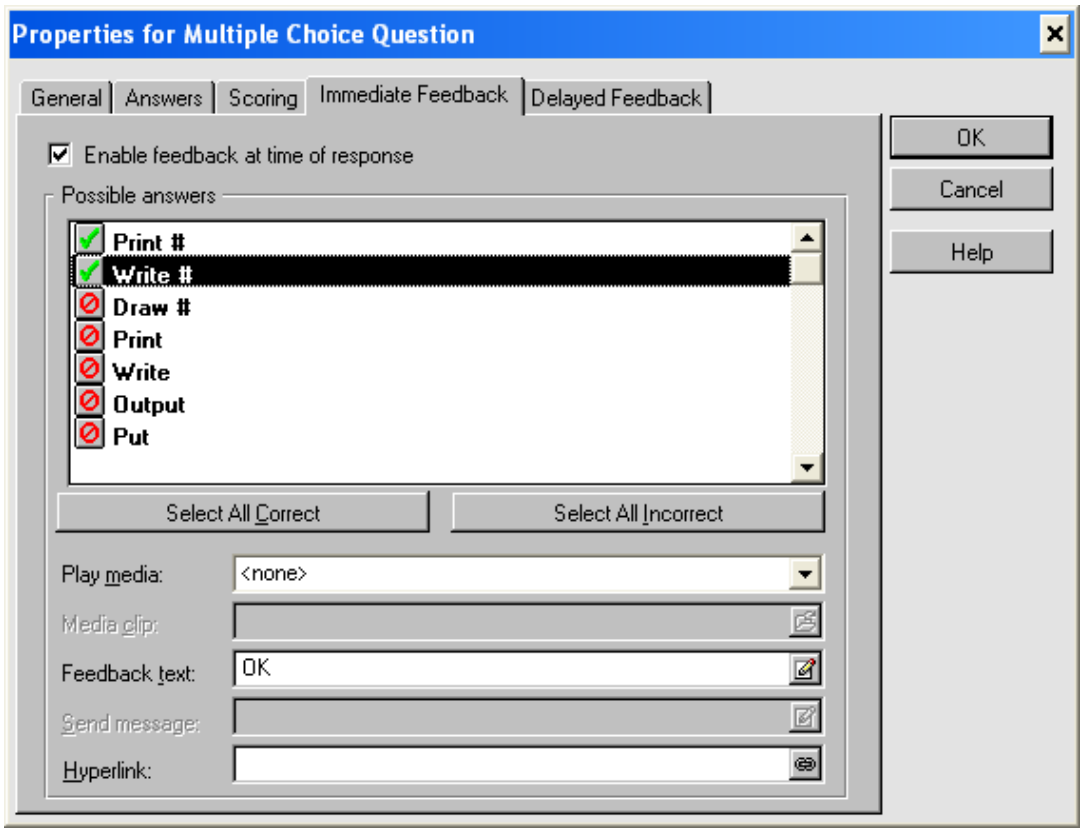

Figure 5. Setting of Question Object – Tab Immediate Feedback.

ToolBook Instructor provides several types of feedback that user can specify for question objects. For example, user can play a sound or media file, display text, navigate to another page, and navigate to a URL (a Web address). It is possible to combine these methods and use more than one type of feedback in response to the user's choice. Delayed feedback is useful for providing feedback on multiple-choice/multiple-correct questions where we want a student to select several correct answers and then click a button to receive feedback on the selected set of answers.

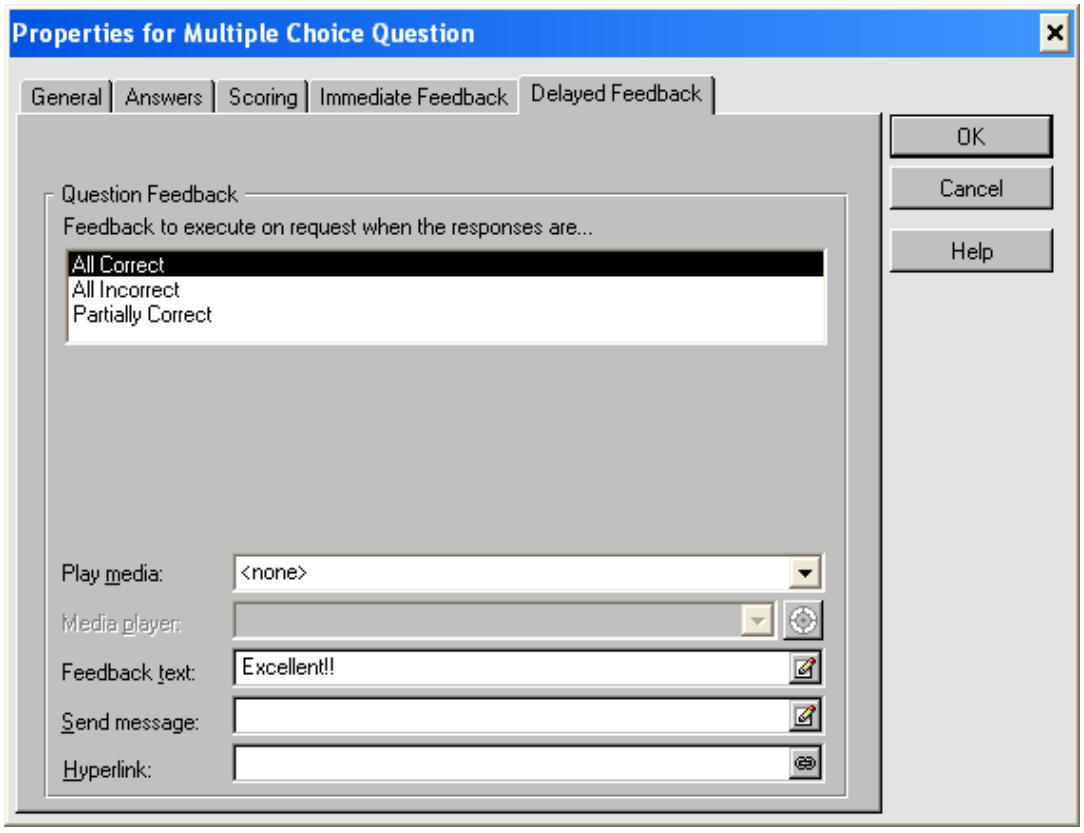

Figure 6. Setting of Question Object – Tab Delayed Feedback.

3. USAGE OF QUESTION OBJECTS

The creation of good electronic tests based on sophisticated question objects is often a more demanding work than the creation of good study texts. This difficult work is sometimes an underestimated work. Contribution of these activities to the expected study results of students can be very significant. So, the topic of electronic questions as the items of electronic tests (self-tests) require more attention. The recommendations for electronic tests (self-tests) further development are as follows:

- Electronic tests (self-tests) should be the necessary supplement of study materials.
- Electronic self-tests should be used without monitoring the students.
- List of available Q_{PT} should be prepared and known by academic staff.
- University departments should have a contact and responsible person for the electronic question objects creation and usage. This person should be interested in both theory and also practical usage of electronic question objects.
- Close cooperation with students is the key for the high-quality tests (self-tests) creation and usage.

The author would like to emphasize the fact that contemporary tests (self-tests) should be created with the support of modern technologies. The creation of good self-tests is often a more demanding work than the study texts preparation. Electronic tests (self-tests) can play a key role in all forms of accredited study programmes; they can give a necessary feedback for students and support their study motivation. Suitable tests (self-tests) can bring higher level of attractivity for contemporary subjects.

The example of answering the question, which anatomy was described in previous chapter, is shown in Fig. 8. The rest of the time limit for the user's responses is displayed in the timer object.

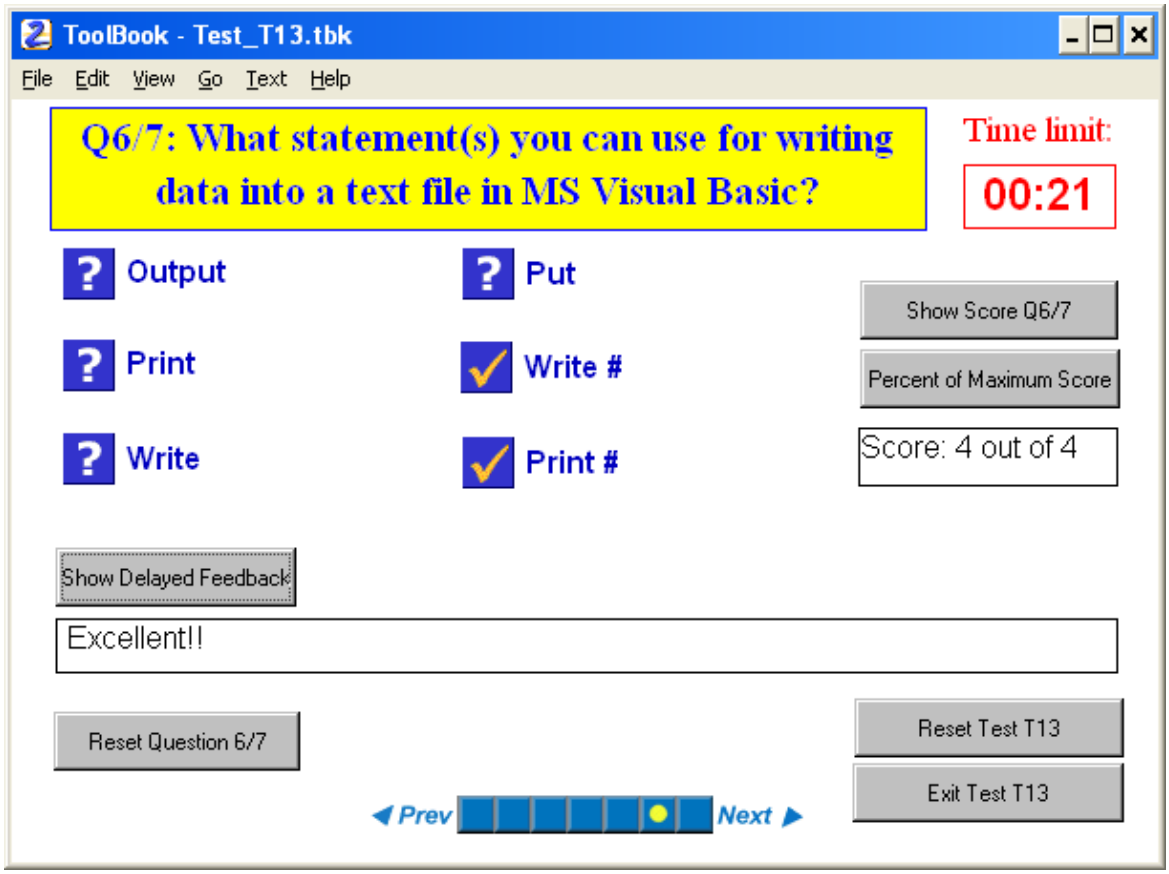

Figure 7. Answering the Question – Final.

CONCLUSION

The electronic testing issue deserves more attention than it has been paid to so far. Design and implementation of high-quality **Q_Os**, based on study texts, is a difficult process, but it is a very useful activity. The creation process of the **Q_Os** should be opened to a wider range of people; the course supervisor's contribution is always irreplaceable. Available high-quality electronic tests (self-tests) undoubtedly strengthen the motivation of learners.

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TEACHING ACTIVITY ANALYSIS FOR OPTIMAL EDUCATION IN THE AREA OF INFORMATION TECHNOLOGIES

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Abstract: *Existing business activities use a wide spectrum of information and data. Information, data, and knowledge create important prerequisites for success in all human activities; therefore, information technology products have a large impact on success in business. Correct knowledge and skills are needed for the optimal usage of installed hardware and software. Education offers various training options via courses with the support of Moodle. Analysis of available menus helps to determine optimal implementation. Petri Nets were selected to analyse a survey as one of the items for communication support between teachers and students on the basis of a classic incidence matrix and set of reachable markings. Realized analysis confirms survey importance with same volume of items to creation as Glossary or Database activities.*

Keywords: Analysis, education, information technology, Petri Nets, teacher activities.

INTRODUCTION

Data, information, and knowledge are well-known terms. Information has a wide spectrum of use. For example, information is a necessary helper for correct decision-making regarding given problems, for orientation in a selected discipline, or for better understanding oneself. Information examines many fields such as the mathematical theory of information, cybernetics, general systems theory, informatics, social communication, semantics, and linguistics. [2] Information is created during data processing by contributing optimal knowledge. Information needs data that has relevant importance. Poor data leads to false interpretations regardless of how good the utilized knowledge is. The same situation occurs in the case of incorrect information or knowledge. All the mentioned terms are very closely linked and they interact.

Current work with data and information requires information technology support. Reasons for this necessity take root in the area of processing methodology, which leads to higher quality, decision speed, and of course, the amount of information. Optimal processing methodology of data and information bring the ability to understand reality and to create interaction in a world where competitive advantage is one of the unique aspects of success. Diversity in the application of information requires a large spectrum of support from information technology products. Users have access to hardware and software sources of various configurations and ways of use by defined roles and needed knowledge.

1. ROLES OF INFORMATION TECHNOLOGY AND KNOWLEDGE

The majority of users have the best experience with Internet and applications for the support of interactive communication and presentation such as mail or video. Users access the Internet with the aim to start an available application or to use some virtual solutions. Regardless of

the degree of active work with information technology products, all users use direct or indirect hardware and software. The primary software is the operating system. Examples include operating systems like Windows, Mac, iOS, and Linux, but we must not forget AIX, Android, FreeBSD, HP-UX, Java ME, NetBSD, OpenBSD, Palm, SunOS, Symbian, and Windows Mobile. Operating systems build creative and dynamic environments for hosting applications. The spectrum of these applications is inexhaustible and every user can select an application based on his or her preferences and interest. Dynamically developing products are database systems with links to Business Intelligence products or Customer Relationships Management. Oracle, MS SQL, My SQL, DB2, InterBase, or Ingres are well-known database systems. All the above-mentioned systems and products more or less offer a user-friendly environment with many functions and menus; however, the best menu is not valid unless the user has enough knowledge to control application. Education helps in this situation.

2. OPTIMAL EDUCATION AND RESPECT FOR CURRENT NEEDS

Quality, speed, diversity, timeliness, clarity, transparency, efficiency, openness, frequency, kindness, confidentiality, optimality and many other aspects are important in the education process. Every one of the aspects has an influence on well-defined degrees of newly acquired knowledge and skills. Individuals, firms, organizations, and societies have special requirements on education. These requirements are confronted with the needs of everyday practice. If Europe achieves a given goal by 2020, there will be a shortage of nearly 12 million workers caused by the different structure of employment and potential qualifying deficits. [5] These occasions influence the qualification and level of education. Overall, demand for knowledge will increase with a positive influence on optimal learning methods.

Target group of students is important for education. The aim is to propose an innovation, which students appreciate, because it is a better solution. [12] To some extent, learning methods formulate a student's preferred activities. [3] Necessary student activities are focused on:

- information transfer in the form of education material, instruction, analysis of case studies and examples;
- practical-operational exercises and tasks; and
- a creative approach to work with literature, information searches, and analysis of results.

Information support of these activities is often based on implemented information systems. Just as information technology products have an influence on users, an implemented education system has a positive or negative influence on students and their activities. The desired properties are effectiveness, easy handling and user-friendliness, contextual "help" support, adaptability to different users, and stability of the main features. [6] These properties must reflect a teacher's options while creating the course. Traditional distance study courses usually have a sequence of learning resources and activities already assigned by the lecturer. [9]

Many courses use the Moodle education system [10] as a base environment for the support of teacher activities. The Moodle system offers an interface for teachers and students in the form web sites. A classical approach to obtain the necessary materials, videos, tests, and other information is available through web links. The teacher uses "Add teaching materials" and "Add an activity" menus to add teaching material or activities. A wide range of options exists with items such as Chat, Database, Forum, Glossary, Lesson, List of questions, Link to file or web, SCORM, Survey, Test, or Wiki. Most items are used in building Link to file or web, or Test.

3. ANALYSIS OF SELECTED TEACHING ACTIVITIES

An application of various items is useful for diversifying teaching and access to educational materials in various forms. Students choose from offered information sources based on preferences and dispositions. A suitable tool in analyzing the possibilities offered by Moodle is Petri Nets. The benefit of realized simulation is the description of state changes in a system with transitions. For correct analysis of real situations, object access is used. A created class of objects is defined by attributes and accessible methods. Net Objects are Transition, Place, and Arc. Places are displayed as circles; transitions are displayed as black rectangles. These objects are drawn using the mouse after selecting the given instrument. Places represent an accessible application screen, and transitions are ways to change through the menu, commands, or buttons. Places and transitions are linked via oriented edges.

Petri Nets are defined as $N = (S^{\otimes}, T, \delta_0, \delta_1)$, where $S^{\otimes}$ is a free commutative monoid of states, T is the set of transitions, $\delta_0, \delta_1: T \rightarrow S^{\otimes}$ give the source and target of each transition. [1] Classic analysis of Petri Nets for models is realized by matrix representation with incidence matrix and set of reachable markings. The definition incidence matrix is $C = O^T\text{-}I^T$. [7] Benefit is easily demonstrated by offered activities and their confrontation. The following rows show a practical application analysis with Petri Nets for creating a survey as one of the available activities of the Moodle for the course "Database Systems." The model describes the given reality is displayed in Figure 1.

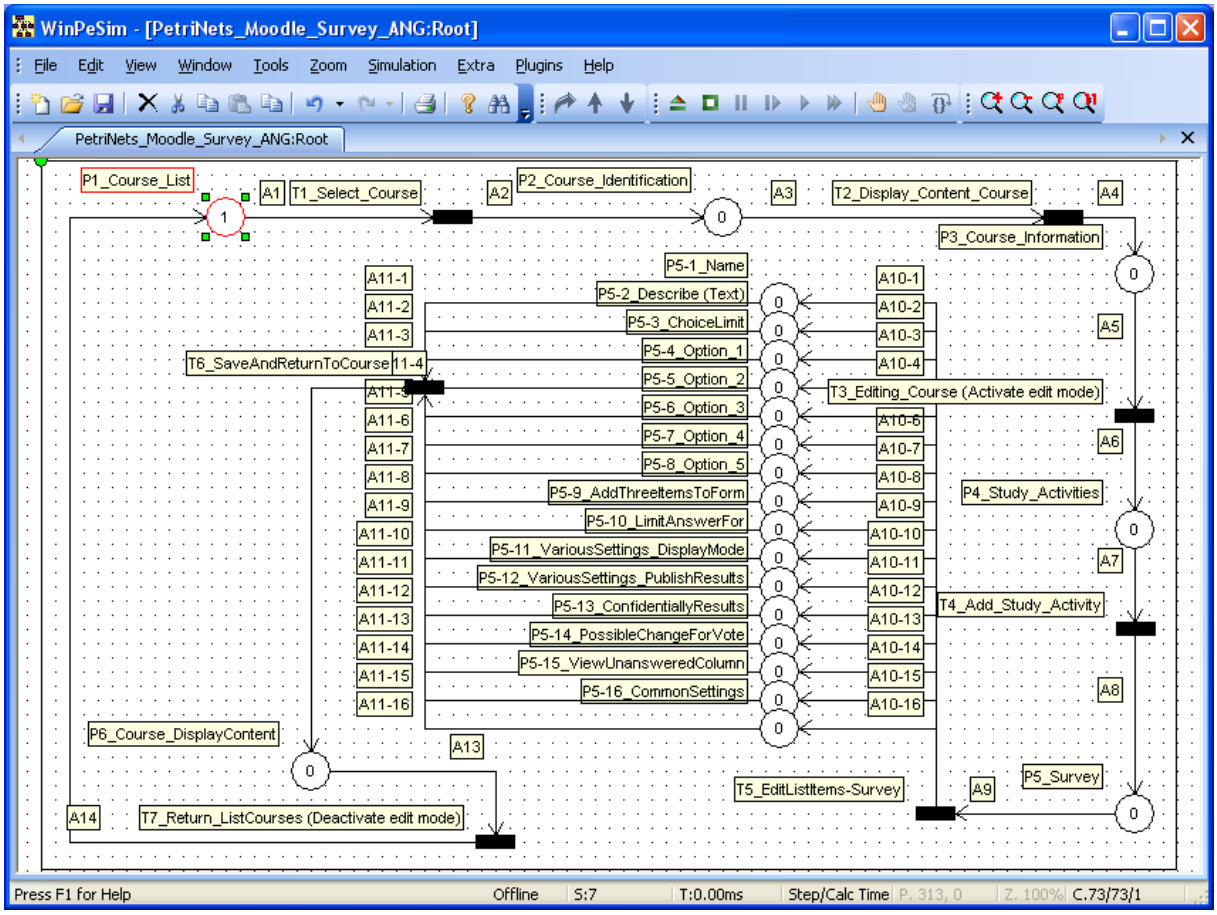

Figure 1. Method simulation for creating a survey in Moodle.
(source: self-created model in simulating program HPSim [11])

The start point is place Course_List (P1). This place displays the screen with registered courses of tutor. The next route leads through the transition Select_Course (T1) to place Course_Identification (P2). The transition rests in the selection of a course by the mouse and the scroll-bar. Place P2 displays on the screen a visually marked record of the course. Next steps are intuitive. Model build follows defined places:

- Course_List (P1) – displays a list of registered courses.
- Course_Identification (P2) – displays a visually marked name of the specified course.
- Course_Information (P3) – displays specified groups of information, materials, and activities for editing.
- Study_Activities (P4) – accesses offered activities.
- Survey (P5) – accesses needed information about survey.
- Name (P5-1), …, CommonSettings (P5-16) – accesses items for creation of survey.
- Course_DisplayContent (P6) – displays actual information about the course.

Needed transitions of the defined model are:

- Select_Course (T1) – searches specified course (specified via scroll bar).
- Display_Content_Course (T2) – selects needed information about selected course (selects course by mouse).
- Editing_Course (T3) – specifies the edit mode of needed information, materials, and activities of a course (button Activate edit mode).
- Add_Study_Activity (T4) – specifies the menu for the creation of a survey, list of questions, database, chats, forums, glossaries, tests, Wikis, SCORM, and lessons (menu Add an activity).
- EditListItems-Survey (T5) – accessible registered items for survey creation.
- SaveAndReturnToCourse (T6) – confirms registered information created by edit process (button Save and Return to Course).
- Return_ListCourses (T7) – displays all registered courses of teacher for next course select (button Deactivate edit mode to end the editing, select next course via mouse and scroll bar).

The validity of the defined model is verified by starting the given simulation. A route cycle is built from place P1 via specified transitions and places. Places P5-1, P5-2, to P5-16 illustrate items for survey editing. The edit mode ends by confirming the "Deactivate edit mode" button. This activity is represented by transition T7. The next route returns to place P1. After creating the survey, the teacher and students select a survey as a link from the course web site. They must only confirm the required web link. The survey window is displayed with all options and students choose the preferred variant. The current selection is displayed, like information of results, which are available. Teachers can download the answers in a ODS, Excel, or text format.
The created model is a good starting point for further professional analysis. This analysis is used in a standard way with an incidence matrix and set of reachable markings. To illustrate the incidence matrix and the reachable markings, please see Table 1.

	Incidence matrix							**t1→M1**	**t2→M2**	**t3→M3**	**t4→M4**	**t5→M5**	**t6→M6**	**t7→M0**
	t1	**t2**	**t3**	**t4**	**t5**	**t6**	**t7**	**M0**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
p1	-1	0	0	0	0	0	1	1	0	0	0	0	0	0
p2	1	-1	0	0	0	0	0	0	1	0	0	0	0	0
p3	0	1	-1	0	0	0	0	0	0	1	0	0	0	0
p4	0	0	1	-1	0	0	0	0	0	0	1	0	0	0

	Incidence matrix							t1→M1	t2→M2	t3→M3	t4→M4	t5→M5	t6→M6	t7→M0
	t1	**t2**	**t3**	**t4**	**t5**	**t6**	**t7**	**M0**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**
p5	0	0	0	1	-1	0	0	0	0	0	0	1	0	0
p5-1	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-2	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-3	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-4	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-5	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-6	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-7	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-8	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-9	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-10	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-11	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-12	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-13	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-14	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-15	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p5-16	0	0	0	0	1	-1	0	0	0	0	0	0	1	0
p6	0	0	0	0	0	1	-1	0	0	0	0	0	0	1

Table 1. An analysis for a model with an incidence matrix and reachable markings.

Accordingly, we consider the analysis of other teacher activities from Moodle such as Glossary, or Database. Both activities involve approximately the same volume of work. There are fourteen to sixteen items that define a given activity. A submitted analysis better simulates the process that a teacher must execute. The start of activities, number of transitions, or the spectrum of items for specification is also seen instantaneously. Moodle analysis is dedicated study like "Moodle is the number one between CMS/LMS" [4], or "Using Moodle to support e-learning Software Project Management course" [8]. The first study specifies Moodle benefits with links to top tools for learning. Moodle was on first place in category Course authoring & management. The second study describes the experience with the system using Moodle to support teaching. Moodle was used to distribution study materials, needed sources, questions, and tests with surveys. Several surveys were realized during semester. Students expressed to character available materials and course management. Development of course and creating links to additional activities required approximately 10 hours. Author evaluated very intuitive and natural navigation from the teacher and the student perspective.

CONCLUSION

Educational systems help in the implementation of such activities that support communication between teachers and students. A survey from Moodle allows students and teachers to get a response on a given topic by choosing one option from a selection. Useful items are "Possible Change for Vote" or "Publish Results". The first item allows students to change their decision based on new experiences, knowledge, or skills. The second item offers the following options: "Display results to students after the conclusion of survey," "Always display the results of students," or "Do not show result to students." The last option is counterproductive. Students must have access to their own opinions and preferences. The teacher can set an expiration date, show results anonymously, or showing student names by

default. The general benefit of the survey is gaining the student's opinion (where it is necessary to think) and the teacher's feedback in connection with course comprehension. Both have a positive influence on the interaction in teaching. Realized analysis helps to better Moodle implementation in practice with aim to clarify method creation and increase interest about survey as item to support communication between teachers and students.

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SELECTED NETWORK EMULATORS COMPARISON

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Abstract: *As networking systems continue to evolve in complexity, new curricula and educational tools are emerging to facilitate teaching and learning about networking technology. There are many network systems emulators, which can help to speed up students' learning process. Two of those emulators were selected to compare their features.*

Keywords: network, emulator, Cisco.

INTRODUCTION

When teaching the technically oriented disciplines, in this case, computer networks, students can not do without practical works with devices. If a large number of students are studying especially in the form of e-learning, it appears to be a problem to provide access to real appliances. Therefore, simulation tools have been developed that allow real devices to replace the part.

To support Cisco Networking Academy program, the Packet Tracer simulation program has been developed. It runs on Windows or Linux operating environments and allows students to create a simulated network with a virtually unlimited number of devices. In addition, you can also implement a distributed simulation system, which can be compound of network created in Packet Tracers in several interconnected computers, of real networks or of a composition of both. It is useful not to target the only product, but also consider its competitors.

1. PACKET TRACER

Cisco Packet Tracer is a powerful network simulation program that allows to experiment with network behaviour. As an integral part of the Networking Academy comprehensive learning experience, Packet Tracer provides simulation, visualization, authoring, assessment, and collaboration capabilities to facilitate the teaching and learning of complex technology concepts.

Packet Tracer supplements physical equipment in the classroom by allowing students to create a network with an almost unlimited number of devices, encouraging practice, discovery, and troubleshooting. Packet Tracer complements the Networking Academy curricula, allowing instructors to easily teach and demonstrate complex technical concepts and networking systems design. Instructors can customize individual or multi-user activities, providing hands-on lessons for students that offer value and relevance in their classrooms. Students can build, configure, and troubleshoot networks using virtual equipment and simulated connections, alone or in collaboration with other students. Some of student activities are depicted on following figures (Figure 1 – network configured by student, Figure 2 – part of student activity log including timestamps, and Figure 3 – part of global student evaluation based on points earned from particular tasks).

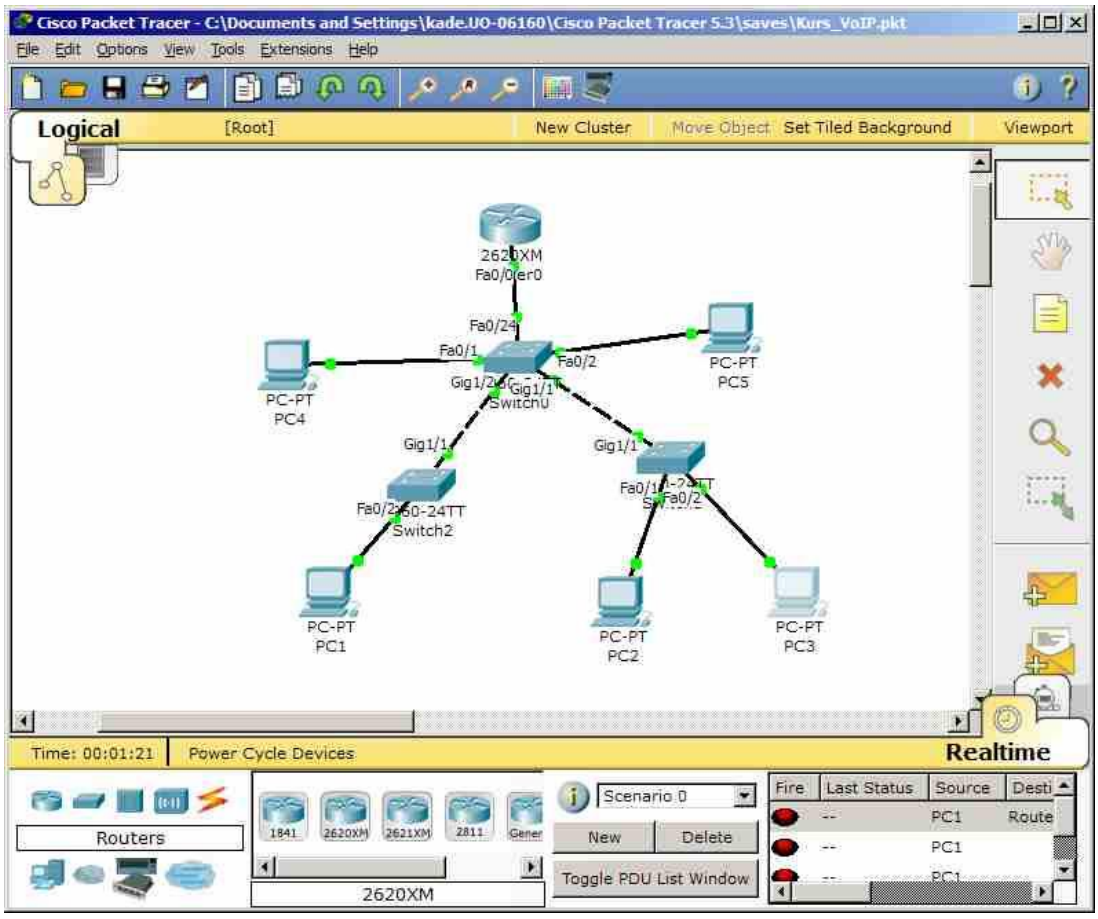

Figure 1. Configured network.

1.1 PACKET TRACER KEY FEATURES

Cisco Packet Tracer has two workspaces - logical and physical.

- The logical workspace allows users to build logical network topologies by placing, connecting, and clustering virtual network devices.
- The physical workspace provides a graphical physical dimension of the logical network, giving a sense of scale and placement in how network devices such as routers, switches, and hosts would look in a real environment. The physical view also provides geographic representations of networks, including multiple cities, buildings, and wiring closets.

1.2 PACKET TRACER MODES

Cisco Packet Tracer provides two operating modes to visualize the behaviour of a network: real-time mode and simulation mode.

- In real-time mode the network behaves as real devices do, with immediate real-time response for all network activities. The real-time mode gives students a viable alternative to real equipment and allows them to gain configuration practice before working with real equipment.
- In simulation mode the user can see and control time intervals, the inner workings of data transfer, and the propagation of data across a network. This helps students understand the fundamental concepts behind network operations.

Combined Student Log

Timestamp	Device	Prompt	Command
Sat 18. Dec 16:10:44 2010	W-Branch2	Router>	show ip int br
Sat 18. Dec 16:11:22 2010	W-Branch2	Router>	enable
Sat 18. Dec 16:11:27 2010	W-Branch2	Router#	conf t
Sat 18. Dec 16:11:36 2010	W-Branch2	Router(config)#	hostname WB2
Sat 18. Dec 16:12:50 2010	W-Branch2	WB2(config)#	enable secret class
Sat 18. Dec 16:13:04 2010	W-Branch2	WB2(config)#	line console 0
Sat 18. Dec 16:13:18 2010	W-Branch2	WB2(config-line)#	password cisco
Sat 18. Dec 16:13:22 2010	W-Branch2	WB2(config-line)#	login
Sat 18. Dec 16:13:24 2010	W-Branch2	WB2(config-line)#	exit
Sat 18. Dec 16:13:38 2010	W-Branch2	WB2(config)#	line vty 0 4
Sat 18. Dec 16:13:44 2010	W-Branch2	WB2(config-line)#	password cisco
Sat 18. Dec 16:13:46 2010	W-Branch2	WB2(config-line)#	login

Figure 2. Student activity log (part).

General Information

Assessment = ERouting PT Practice SBA
Form = ERouting OSPF PT Practice SBA FormA
User ID = 7034048
Scored Date = Sat Dec 18 17:56:04 GMT+00:00 2010

The time shown is Greenwich Mean Time (GMT). Subtract or add the appropriate number of hours to adjust to your local time to GMT, visit http://www.timeanddate.com/worldclock/search.html.

Feedback

Based on your performance on this assessment, this table reports your preparedness for taking a hands-on skills exam coveri expert opinion of the knowledge and skills needed to successfully perform these networking tasks on a repeatable basis.

Performance Components	Proficiency Estimates			
	None	Novice	Partial	Proficient
Device Connection				✔
Basic Device Configuration				✔
IP Address Configuration				✔
Static and Default Route Configuration		✔		
Basic OSPF Configuration				✔
OSPF Modification		✔		
Default Route Propagation				✔

See Terminology section for an explanation of terms.

The following feedback summarizes why you received less than proficient on any of the estimates:

- Although you correctly configured the default route, you did not correctly configure the static route.
- You correctly implemented some of the modifications to the default OSPF configuration.

Figure 3. Example of student global evaluation (clipping).

1.2.1 MODULAR DEVICES

Graphical representations visually simulate hardware and offer the ability to insert interface cards into modular routers and switches, which then become part of the simulation.

Each of the simulated devices run slightly different IOS versions (12.1(22) and 12.2(25) switches, 12.2(28) and 12.4(15) routers) which are bound with the pertinent Packet Tracer version (or supported simulated hardware). The main emulated appliances are switches 2950-24, 2950T-24, 2960-24TT and 1841, 2620XM, 2621XM, 2811 routers.

1.2.2 MULTIUSER FUNCTIONALITY

Cisco Packet Tracer is a network-capable application, with a multi-user peer-to-peer mode that allows collaborative construction of virtual networks over a real network. The multi-user feature enables collaborative and competitive interactions, providing the option to progress from individual to social learning and features opportunities for collaboration, competition, remote instructor-student interactions, social networking, and gaming.

2. GRAPHICAL NETWORK SIMULATOR GNS3

GNS3 is a Graphical Network Simulator that allows to emulate a complex networks. It can be used as a tool for preparing for Cisco certifications such as CCNA and CCNP. It is able, similarly like VMWare or Virtual PC to emulate various operating systems in a virtual environment. GNS3 allows the same type of emulation using Cisco Internetwork Operating Systems. GNS3 is in fact a graphical front end to a product called Dynagen, which core is a Dynamips program. Dynagen runs on top of Dynamips to create a more user friendly, text-based environment.

2.1 GNS3 FEATURES

GNS3 allows the emulation of Cisco IOSs on Windows or Linux based computer. Emulation is possible for several router platforms and PIX firewalls. Using an EtherSwitch card in a router, switching platforms may also be emulated to the degree of the card's supported functionality. Usual router simulators are limited to the commands that the developer chooses to include and the accuracy of that representation is only as good as the one makes it. With GNS3 an authentic Cisco IOS is run, so it will be seen exactly what the IOS produces and the access to any command or parameter supported by the IOS will be guaranteed. In addition, GNS3 is an open source, free program for use by anybody; however, due to licensing restrictions, it is necessary to provide own Cisco IOSs to use with GNS3. Also, GNS3 is not real router as its throughput is limited up to around 1,000 packets per second in a virtual environment, while normal router will provide a hundred to a thousand times greater performance.

The GNS3 window (Figure 4) is divided into four panes by default.

- The left-most pane lists the types of nodes available. There are router icons for the various platforms, a PIX firewall, Ethernet switch, ATM bridge, ATM switch, Frame Relay switch, and Cloud. Other node types may be added as explained later.
- The right-most pane will provide a topology summary that will be better understood when we built more complex topologies.
- The middle section contains two panes.
    - The top pane is your work area where a topology may be graphically built.
    - The bottom pane, called the Console, shows Dynagen at work. Dynagen, as you recall, is the text-based front end to Dynamips, the core emulator being used. Learning how to use Dynagen is like learning how to use DOS the first

time, so we will not get into that here. However, we will use a very few simple but useful commands in the Dynagen pane.

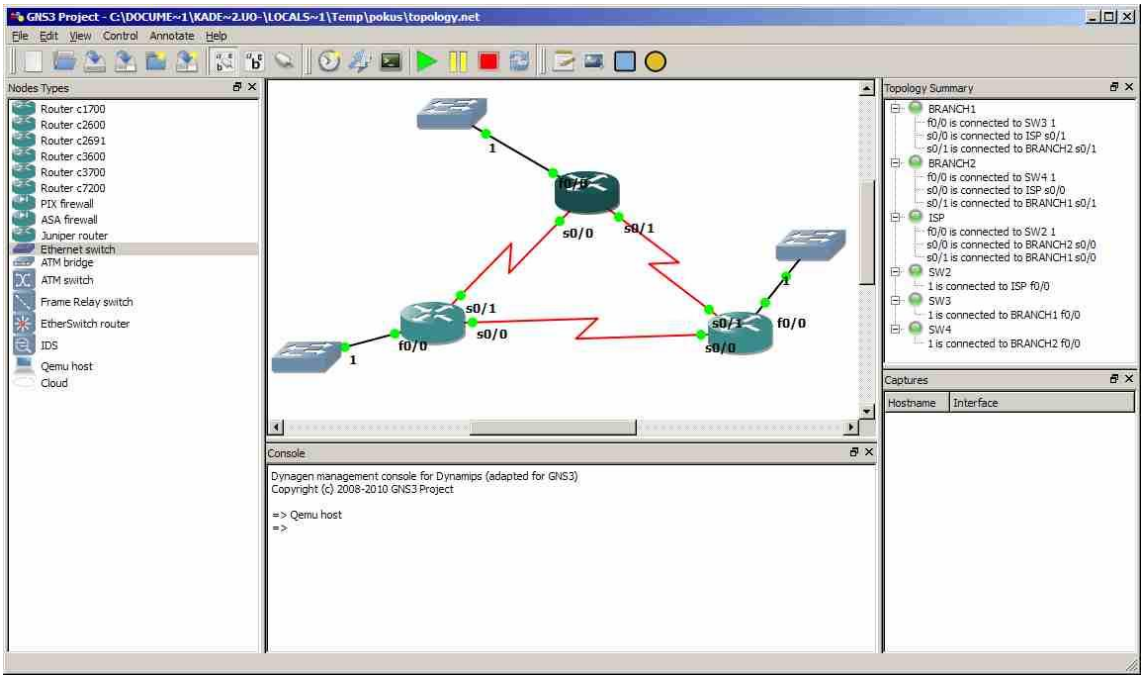

Figure 4. GNS3 main window.

3. NETWORK EMULATOR COMPARISON

Feature	Packet Tracer	GNS3
Tested version	5.3.0.0088	0.7.3
Availability	Cisco Networking Academy students only	GPL2
Price	Free (Only for CNA students)	Free
Binary code	Yes	Yes
Source code	No	Yes
Supported OS	Windows, Linux	Windows, Linux
API	Yes	Yes
Other needed software	None	Dynamips/Dynagen (free)
Genuine IOS for any device family		
Simulated IOS	Internal part of pertinent Packet Tracer	External – user have to provide
Simulated switches	2950-24, 2950T-24, 2960-24TT, generic	Generic
Simulated routers	1841, 2620XM, 2621XM, 2811, generic	1700, 2600, 2691, 3600, 3700, 7200
Other simulated devices	Generic hub, generic access point.	PIX and ASA firewalls Juniper router ATM bridge/switch Intrusion Detection System

CONCLUSION

Both tested products satisfied basics and medium needs. These products can help during exam preparation, but also to set a model of the network during planning process. There are not important differences between both products from user point of view. Of course, their realisation and background are very various.

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SECURITY ASPECTS OF THE PERSPECTIVE COMPUTER NETWORKS

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Abstract: *This paper is focused on chosen security aspects of the perspective computer networks with the protocol IP version 6. Necessary theoretical information, which is required for fully understanding of task, is given at the very beginning. Security mechanisms included in the protocol are described. These mechanisms can provide data protection, but can not protect hosts against the attacks. For this purpose is necessary to implement other security systems. Firewalls are well known but except them intrusion detection systems are recommended to use. These systems are simply trying to detect the signs of a network intruder before damage is done, a service denied, or data lost. Main available intrusion detection methods are described in this paper.*

Keywords: IPv6, IDS, IPSec.

INTRODUCTION

Internet Assigned Numbers Authority (IANA) ran out of available blocks of IPv4 addresses in early March 2011. Free addresses should remain approximately to the middle of the year 2012 [12] in Europe. There will be no collapse of the Internet after that date, but it is now clear that Internet service providers will have to take actions leading to ensure the connectivity of new customers.

Mechanisms based on Network Address Translation (NAT) offers no solution in this situation, because they have some limitations of usable services and cause serious issues in the applications [14, 15]. Right solution is the transition to Internet Protocol version 6 (IPv6), which provides a sufficiently dimensioned address space in comparison with its predecessor and not only that. IPv6 standard provides basic security features, which in IPv4 had to be additionally implemented.

However, even in IPv6 a network is necessary to deploy additional hardware resources to ensure higher security. Besides well-known devices such as firewalls, is possible to run other systems. One of them is Intrusion Detection System (IDS).

1. IPv6 FEATURES

The IPv6 is discussed by experts since the nineties. Its draft came as a activity of the Internet Architecture Board within the Internet Engineering Task Force and had to solve awaited lack of IPv4 addresses and add functionality. The Request for Comments (RFC) 1883 [6] which defines IPv6 was published in 1995. It was replaced with RFC 2460 [8] three years later. This RFC describes the basic IPv6 protocols and services. New version of IP protocol is supported in main operating systems since 1998.

IPv6 is not based on IPv4, it is entirely new set of protocols. The following list summarizes the key features of the IPv6 [3, 4]:

- **Large address space.** IPv6 has 128-bit addresses, compared to 32-bit addresses in IPv4. 128-bit address can express over $3{,}4 * 10^{38}$ possible combinations, this provides $5{,}7 * 10^{28}$ addresses for each person in the world. IPv4 provides only two addresses for every third person. With a much larger number of available addresses NAT is no longer necessary.
- **Stateless address configuration.** IPv6 host can be configured automatically with addresses derived from prefixes advertised by local routers. Otherwise, it can use stateful configuration (in presence of DHCPv6) or address can be set manually.
- **Multicast.** Multicast is included in basic IPv6 specification, unlike IPv4, where it was introduced later. A multicast message is transmitted to the selected multiple recipients who are in the appropriate multicast group. The sender has to generate only a single data stream.
- **Link-local address.** Hosts on the same link can configure themselves automatically with link-local addresses. These addresses are derived from MAC addresses of the interface and are always available. So communication with hosts on the same link is possible immediately. This simplifies configuration.
- **Jumbograms.** Payload length in IPv4 is limited to 64 kB. IPv6 allows exchanging packets with payload up to 4 GB. However, the support for jumbograms requires a redesign of transport layer protocols.
- **Security**. Internet Protocol Security (IPSec) is an integral part of IPv6 protocol suite. Unlike IPv4, where it is only optional.
- **No header checksum.** IPv6 packet does not contain a checksum. Protocol relies on error checking at the link layer.

2. IPv6 SECURITY

IPv6 features bring improvements that provide better network security. Large address space makes some basic reconnaissance techniques such as port scanning very time consuming. Scanning IPv6 /64 range (assuming one address per second) would take approximately $584 * 10^9$ years. It is obvious that methods used in IPv4 can not be fully applied. On the other hand, the new protocol also raises new security challenges and opportunities for attackers. For example acceleration of obtaining active IPv6 addresses can be done with multicast misuse [16], attacking DNS or DHCPv6.

2.1 IPSec

IPSec is one of the IPv6 features which are ensuring higher security at the network layer. It is also known in IPv4, but not from the beginning and it is optional. Developers did not deal with security at the time when IPv4 was designed. There were few network users and they were considered as trusted. Security was implemented directly in application code if necessary. After a massive expansion of IPv4 there was a need for additional security at the network layer. And that is why IPSec was defined. But there were performance and interoperability issues in some cases, which prevented further expansion with IPv4 protocol. IPSec is mandatory for all nodes in IPv6 from the beginning.

IPSec can be defined as a set of cryptographic protocols that are used for securing data communication and key exchange. It is described in RFC 2401 [7], RFC 4301 [9]. It consists

of Authentication Header (AH) and Encapsulating Security Payload (ESP). AH provides data integrity, data authentication and replay protection for entire IPv6 packet. The ESP provides data integrity, data authentication, data confidentiality, and replay protection for the ESP encapsulated payload. The protocol typically used to negotiate IPSec security settings for unicast communication is the Internet Key Exchange (IKE) protocol. To keep track of all protocol and encryption algorithm agreements, IPSec uses the Security Parameter Index (SPI) field in both the AH and ESP headers. SPI field identifies what group of security parameters the sender is using to secure communication. Then sender communicates this SPI to his communication partner establishing a Security Association (SA). From then until that SA expires, whenever a node wishes to communicate with the other using the same SA, it must use the same SPI to specify it.

It is very important to mention that mandatory IPSec support does not really mean that all IPv6 communications will be encrypted with IPSec. RFC 2460 [8] mandates IPSec for every IPv6 capable host, but does not mandate IPSec usage. Global usage of IPSec is not possible because cryptographic functions need additional computer resources which are not available in every IPv6 capable host. Scalability is also an issue because every system must have a way to trust all other systems it will communicate with. But there is not a global key distribution mechanism for all systems.

Traffic traversing the network that uses IPSec could not be monitored by intrusion detection systems (IDS) [16]. Other network management systems would also not be able to determine the protocols being used within the encrypted payload of the IPSec packets. Therefore, IPSec is not recommended for use within an organization but is rather intended to be used between sites joined by the Internet or for remote access users.

3. INTRUSION DETECTION SYSTEMS

Security mechanisms described in previous paragraphs are undoubtedly benefits of IPv6 protocol. We can reliably protect transmitted data with them. On the other hand, protocol itself can not protect end hosts from being attacked. It is necessary to realize that all hosts have global IP addresses and are directly accessible from anywhere. Malicious traffic and attacks can be detected with intrusion detection systems (IDS) and intrusion prevention systems (IPS) which become very popular additions to defense strategy. Historically IDS only detected incidents, but in recent years, IPS can prevent from attacks. Detection systems are like a protocol analyzers which are passively watching packets in network. Prevention systems are typically implemented in traffic path. This inline design allows the prevention system to block incoming connections when attack is detected.

The main principle of network intrusion detection is a deep packet inspection and alerting when traffic matches malicious patterns. Each IDS/IPS solution may be using different detection methods. Some are looking for the attack signature in IPv6 packet, while others monitor unusual activity that may indicate a pending attack. Signature based IDS/IPS identifies attack via pattern matching. This can comprise either a single packet that matches a regular expression, or more complex patterns requiring a sequence of matches in a particular order. Disadvantage of this method is inability to detect new kinds of attack, slow response when using many signatures and tendency to generate false-positive alerts.

Rule based IDS/IPS brings together different attack indicators and thus creating attack conditions. According these conditions alerts are generated. Rules bring the possibility use conditions and signatures together, which can distinguish between attack and legitimate traffic. Key feature of this method is ability to detect new variants of known attack.

Anomaly detection based IDS/IPS works by analyzing descriptors of the data rather than the data itself. A baseline of normal is established and anything falling outside this baseline is tagged and alerted as an anomaly. Advantage of this method is the ability to detect new unknown attacks. However, if the attacker does not deviate from normal, alert will not be raised.

3.1 Open source IDS/IPS

Many IDS/IPS solutions are presented in the market. There are hardware appliances from major producers like Cisco, Enterasys and Sourcefire. In addition to them, open source products Snort [17] and Suricata [18] are available and free to use under the General Public License. Snort is one of the IDS/IPS which is implemented in the Czech army IPv4 computer network and used by CIRC (Computer Incident Response Capability).

I have chosen both open source products for vulnerability tests in IPv4 and IPv6 environment. Malicious activity was simulated with Tenable Nessus. The main objective was to compare how Snort 2.9.0.4 and Suricata 1.0.2 react on attacks with the same rule set. Both IP protocol were tested because especially during transition to IPv6, dual stack will be used and IDS/IPS sensors must be able to parse both protocol packets. Moreover IDS/IPS need to be powerful enough to process through all the IPv6 headers and optional headers. This increases the CPU demands.

Attack were targeted to the Linux server with both Snort and Suricata installed. Percentage ratio of generated alerts in IPv4 and IPv6 was test output for comparison of the systems. Snort is considered to be de facto standard in IPv4 intrusion detection, but the test confirmed its limitations in IPv6. New version of IP is only partially supported because not all detection pre-processors are IPv6 capable. That is the reason why only 63 % of simulated IPv6 attacks were recognized. Other limitation is single threaded program architecture in today's multi core processors environment. Suricata is a multithreaded and provides graphics card acceleration in the form of CUDA (Computer Unified Device Architecture). Other feature is full IPv6 support which led to 92 % of recognized IPv6 attacks. During the test Snort had a lower system overhead than Suricata. However, Suricata is more accurate in IPv6 environments and scalable through increased performance when running on multi-core processor.

According to vulnerability test Suricata is doing better job in IPv6 intrusion detection and should be implemented to the networks where IPv6 is considered. Detection rules use the same definition format as Snort rules, even output is similar. So it is possible to use Snort tools for monitoring Suricata alerts. But for the simplification of Suricata implementation it is necessary to create lightweight Linux distribution with all important components and initial configuration scripts included. That will allow deploying a complete IDS/IPS system out of the box in few minutes, even for security beginners with minimal Linux experience. This Linux distribution can be used also in conditions of Czech army computer networks and its creation will be aim of my work in next few months.

CONCLUSION

IPv6 brings back original idea of direct communication between end points, which disappeared from IPv4 due network address translations. IPv6 provides perfect environment for the implementation of new services and additional devices as well as some specific security functions. On the other hand new protocol raises new security challenges which network and security administrators will be facing. For protection of IPv6 networks IDS/IPS can be deployed. Suitable choice is open source IDS/IPS Suricata, which provide comprehensive configuration options and is very flexible. Rules and signatures can be customized or created from scratch. This makes Suricata IDS/IPS adaptive to almost any network environment.

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THE CONCEPT OF COOPERATIVE SIMULATORS

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Abstract: *To explore the characteristics and capabilities of the motor vehicle drivers as the optimal solution is to use interactive (full mission) simulators, which allow induction of both normal and abnormal situations arising on public roads. Needs to increase the credibility of environment simulation is necessary in addition to the model and the image of real environment to simulate a conventional car drivers and road users behavior as well. Mathematical models of the road user behaviors are far from the actual behavior of the current driver in real road traffic. Based on the experience, consultations and the conclusions of the ITEC and the I/ITSEC international conferences, appears as optimal design the external environment model with a number of cooperating entities produce situations like the actual traffic on public roads.*

Keywords: Advanced Distance Training, Virtual Simulators, 3D Visualization system.

INTRODUCTION

Technology is changing the way we live, work, and play. It comes as no surprise that it is also changing the way we train. The advent of the internet is changing just about every facet of our daily lives. The internet is bringing about a paradigm shift in the way people learn. The future is forecasted to grow e-training courses significantly over the next decade. While this paradigm shift is opening up many new business opportunities, it is also causing great concern for traditional training settings. Instructional Designers need to change the way they design instruction. Instructional materials are being designed in terms of reusable objects versus entire training courses or theory lessons.

1. Training of the military and civil driver professionals

There is possible to say, that especially the losses on roads, caused by vehicle accident, which are the daily reality in all the countries of word reach in sum more, than many of rarely appearing catastrophic events (the very rough estimation lead to the figure of more than 200 thousands killed people per year and more). In contrary to mentioned catastrophic events on the appearance the people have no (or only very small) influence, the accidents on roads are caused from 50% and more by faults of human factor. Therefore one sees here the challenge and necessity to try minimize the respective losses as much as possible. Along with this paradigm shift there is a strong focus in the training producers toward establishing “open” standards that would enable the distribution of learning over the Internet and World Wide Web. In fact the Advanced Distributed Training (ADT) initiative was established in 1997 to examine these issues. Before this time, there were several groups establishing such standards, including The Aviation Industry for Computer Based Training Council (AICC), and the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE).

At the core of all these efforts is the concept of reusable objects. While this concept is new to training, it is not new in other areas. This theory is based on the object-oriented paradigm of computer science. The concept is to build components or objects that can be reused in multiple contexts. The idea is that a producer can go to a list of objects that are already created and simply insert one into their program. These objects are developed one time, tagged and stored, and then used and reused as necessary. However, these objects must interact, so while they are independent entities, they must also be able to be combined with other objects in order to form a meaningful concept. Therefore, there is a need for a common definition of objects and properties, so that objects may be used interchangeably.

All of these developments have stirred a great debate in the "e-training " market concerning labeling these objects. Terms such as "Instructional Objects", and "Training Objects" have started to appear in a significant number of "e-training" publications. There is, however, no common definition of these terms; and to make matters worse, there is no common context in which these terms are used.

2 Virtual driving simulators

Driving simulators represent a very important tool, which give us a wide range of possible applications. They are successfully used for several decades especially in research and automotive industry for optimization and testing the car abilities and their furnishing by sets and alliances of driver assistance systems. They are also used for long time for driver training. Originally, they were being dominantly developed to help drivers to reach necessary basic driving skills. Then, they were mainly used for training of professional drivers of special vehicles to adapt on demanding situations. However, soon not only freshman but also skilled drivers were trained on simulators for improvement the safety and efficiency of their driving. This is important especially for professional drivers, namely of trucks.

We can find first steps of these activities already in the fifties of the twenty century e.g. by VW, BMW and Ford. Their blossoming appears in the 1970's. Nowadays, the high quality driving simulators are widely considered as very valid devices for both for training drivers under situations in heavy and demanding conditions, but also for research and investigations concerning the reliability of driver-car interaction, for solving the large variety of human-machine interaction problems (HMI) and car-cockpit and assistance systems optimization. Their theory, methodology of use, design, construction and operation require a very wide range of knowledge, from neurology, psychology, control engineering electronics, informatics, mathematics and mechanical engineering to transportation sciences. *The driving simulators and the driving simulation technology are said to be a "royal discipline" within the scope of the simulation devices.*

The key role of the perfect driving simulator plays visualization system and tools for creation of assets constituting scenarios. Those are mainly modeling of 3D objects and tools for automation of such a process and databases (storages) of modeled objects. Each object in virtual reality is accompanied by a texture or a set of textures. The texture is a picture which simplifies the 3D object creation because the geometry of any real object is very complex and on the other hand it is possible to replace it with a very simple geometry covered by a worked out digital photography. The textures can be of different types; general which are tillable (i.e. repeatable - like grass, road surface etc.) and the unique ones (houses, signs etc.). The amount

of textures over one scenario could be very high but lots of them could be reused on several different pieces of geometry. For that reason it is also very practical to have apart the databases of the terrain, the 3D models (objects) and also of textures.

2.1 Distributed interactive simulation

For training and developing skills of motor vehicle driver as the optimal solution appears to use interactive (full mission) simulator. The interactive simulator allows the induction of both normal and abnormal situations arising on public roads. Needs to increase the credibility of environment simulation is necessary in addition to the model and the image of real environment to simulate a conventional car drivers and road users behavior as well. Mathematical models of the road user behaviors are far from the actual behavior of the current driver in real road traffic. Based on the experience, consultations and the conclusions of the ITEC and the I/ITSEC international conferences, appears as optimal design the external environment model with a number of cooperating entities produce situations like the actual traffic on public roads.

Cooperating objects in the model of the external environment may be model of behaving according to a deterministic algorithm with implemented semi-automatic or heuristic behavior. The behavior of these models is design formerly and their responses can be expected in many cases over a longer practice. For maximum similarity to the normal traffic on public roads should be a cooperative objects set up another simulator (or group of simulators) operated by another driver - operator. This simulator is not necessarily full mission simulator. Regarding the situation of examining the behavior of one driver, simplest handlers known from computer games are sufficient.

The fundamental problem with this solution is to create a realistic model of the external environment, the development of mechanisms for using this environment by cooperative objects and, ultimately, build a credible model of the test vehicle. Plenty of studies, proposed and concrete solutions of simulators were executed. Also, in modeling the external environment was made a number of realizations. Need for cooperation of multiple types of simulators have been implemented in a number of international technology and standards efforts, which resulted in the definition of group of protocols. For the cooperation of independent objects are very often use the Distributed Interactive Simulation protocol (DIS) and more actual High Level Architecture protocol (HLA). For modeling the external environment are arising SEDRIS standards.

The competitor of the DIS is the ALSP protocol, which is not so widespread. Advantages of both ones were taken over and the HLA protocol was achieved as a standard. The development of HLA protocol is very closely follows, but the most widespread protocol is currently DIS. In its favor, unlike HLA, also speaks that it is accepted as standard (standardization process of the HLA proceeds - its notation should bear shortcut IEEE 1516). DIS protocol is aimed at data exchanging and its focus is on working with data (as it organized, how it to send, how it to decode). DIS places no requirements on the internal architecture of simulation software. In development of the simulator the working is focused at lower levels of communication than in HLA. HLA, unlike DIS, disposes of a communication subsystem that is part of its RTI (Runtime Infrastructure). Simulation does not have to worry about how and where to send information. HLA provides the ability to use the services described in the HLA specification and application communicates only with RTI. Both forms of distributed simulation have their advantages and disadvantages. HLA is comfortable (even

if the obligations to be met is a great amount), but DIS operates much more quickly again (no overhead communication between RTI simulators). In the present situation is such that even though there is a more modern version for distributed simulation, DIS is not dead protocol. Twice a year in Orlando, Florida on University of Central Florida held meeting of experts who have continuously improved the DIS protocol and expanding it. See the completion of the IEEE 1278.1a in August 1998. Nevertheless, the DIS protocol options are limited. But there are a number of practical applications and therefore is clear that in the foreseeable future will not be abandoned.

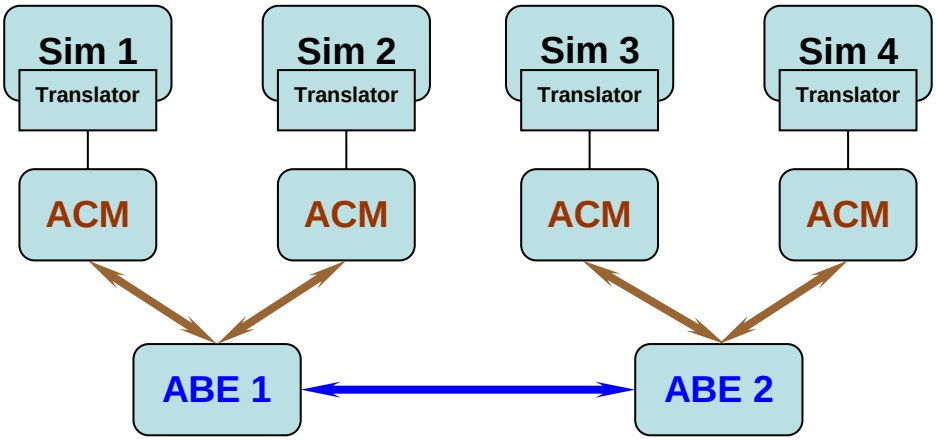

Figure 1. Interconnection scheme by the distributed simulation.

Standardization of the external environment models and its properties with regard to the weather is not quite finished yet. There are many unsolved problems of compatibility of data sources and database of terrain and weather. The lack of standards greatly complicates the development of compatible with other simulation systems.

For the preparation of experimental research can be implemented relatively affordable DIS for the following reasons:

- in the Czech are organizations that have the tools for creating models of cooperating objects,
- creating of terrain databases, models of the external environment and its visualization for vehicle simulators is satisfactorily resolved,
- there is no fundamental problem to extend the existing hardware simulators by interactive extension.

2.2 Visualization system of the virtual driver simulator

Graphical information can be displayed in several ways - as 2D or 3D visualization system.

2.2.1 2D visualization system

Basically is a display one image on a monitor or a projector. You can adjust the resolution and color depth and change the parameters of the virtual camera which presents a virtual environment. More sophisticated method is to use multiple display monitors and one virtual camera. This method of display may be implemented by dividing the output of a graphics accelerator with using special equipment into two or three outputs. These outputs can be

connected to monitors or projectors. The visualization system uses a virtual camera and graphics accelerator output is set at a higher resolution corresponding to the multiple outputs. Another way to view is use of two virtual cameras and two outputs. Each of these cameras send images to your independent graphics output. This output can be further divided up into three outputs. So you can reach the six monitors or projectors. Cameras can be completely independent (for two independent views of the virtual scene) or can be connected together and controlled as a whole (for example, to extend the viewing angle over all outputs).

Figure 2. Configuration of the visualization system on the vehicle simulator Škoda Octavia in the area of Faculty of Military Technology.

2.2.2 3D visualization system

This method is modification of the appearance of the two outputs and two stereoscopic cameras. Stereoscopic view allows to cause the spatial perception for observers. The presentation principle is based to use two cameras watching the virtual scene and located so as to mimic the location of the human eyes. One camera shows the scene from the perspective of the left eye and the second camera from the perspective of the right eye. The output from each camera goes into a separate graphic output from which goes to a special display device capable of stereoscopic views or projection (such as stereo monitor or projector, screen or head set).

To obtain a correct stereoscopic image, which bothered the eyes of the observer is important to properly set the virtual camera. Individual objects must be displayed on the images for the left and right eye moved in a horizontal plane. The size of the shift depends on their distance from the camera (depth of the scene). This size shift is called parallax and stereoscopic depth

perception determines the image. We distinguish four types of parallax - zero, positive, negative and divergent parallax.

Figure 3. Disposition of vehicle simulators Škoda Fabia and Škoda Octavia in the area of Faculty of Military Technology.

In terms of stereoscopic effect when viewing objects in the scene is a significant positive and negative parallax. In a positive parallax depth perception is similar to the real world, objects appear to be located beyond the plane of imaging (eg screen). In view of this landscape is visualized image appears as if the screen was a window into the landscape. Negative parallax causes the displayed objects appear to upstream screen - stand out from the image toward the observer.

Visualization system for implementing stereoscopic pair of identical bound virtual cameras. Set stereoscopic projection is affected by two parameters:

- the distance of virtual cameras,
- cross-angle optical axes virtual cameras (convergence).

The optimal settings for the computer-generated stereoscopic view are when the optical axis of the virtual cameras are parallel to each other. With this setting can be changed the parallax value by changing the virtual cameras distance (mutual displacement). This shift can change the parallax from the positive to the negative and change the stereoscopic view (depth effect). Stereoscopic projection was successfully validated with the 3D projector company Projection Design AS3D, type F10 which offers separate inputs for both left and right eye. The projector uses so-called active DLP projection, which alternately project images for the left and right eye and with active glasses observes stereoscopic image. The galsse are synchronized by an infrared beam and alternately obscure the left and right window in sync with the projector.

3 Research project ME 949 and MESPIN

The above findings are used in project *Analysis of the negative effects on the driver's attention*. The main investigator is Faculty of Transportation Science, Czech Technical University in Prague and cooperators are Defense University and the Masaryk University. The project is designed in the years 2008 - 2011.

3.1 Project goals

The project aims is to develop methods and procedures for the analysis of the effects of internal and external factors on the drivers' attention and validation of one. Second aim is development of methods for drivers training to increase their resistance to decrease attention and optimizing equipment of the transport routes.
To meet the objectives of the project it is necessary to design a virtual car simulator that allows to perform measurements and analysis. Therefore, part of the project is the construction of heavy-simulator on the chassis of the Škoda Octavia car and and light simulator based on the trainer Škoda Fabia car. During construction of these simulators was developed the original visualization system, physical model of the vehicle, the inteconection of both simulators, the system controls and sensors and their connection to the car control unit. An important benefit is the deal with the problem of cocpit microclimate simulation.

CONCLUSION

In this project, the visualization system is used as a tool for visualization simulator Škoda Octavia. For this simulator was used a specific solutions of the video output. To view the driver's view through the windshield was used three projectors that screen on a broken screen. These projectors are connected to one output visualization system with high resolution (3840 to 1024), which is divided into three outputs for projectors, each with 1280 points na1024.
The second output of a visualization system uses three separate virtual camera. One virtual camera displays images behind the vehicle and is connected to a projector that projects the image on the screen located behind the vehicle (the driver it monitore by means of internal mirrors or turning the head through the rear car window). The other two virtual cameras simulate left and right rear-view mirror. These virtual cameras are connected to the LCD screens mounted on the car mirror.

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THE WAY TOWARDS BLENDED LEARNING IN PRACTICE

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Abstract: *It seems that e-learning or the learning management systems are very modern and progressive method how to increase or optimize quality of teaching at all kinds of schools over the world. The main idea of this paper is to describe e-learning environment from the perspective based on our experience from studying at the Czech Technical University in Prague – CVUT (Czech Republic), University of Technology in Brno – VUT (Czech Republic), Helsinki University of Technology - HUT (Finland), ENSIETA (France) and current doctoral studying at the University of Defence in Brno - UNOB (Czech Republic). We can also use multiyear working experience in the company called Mesit pristroje spol. s r.o. in Uherske Hradiste (Czech Republic). This experience can make the relevant information base for subjective evaluation of the suitability and efficiency of every single type of education with emphasis on electronic learning (e-learning) as a part of blended learning implemented in practice.*

Keywords: blended learning, distance learning, electronic learning, e-learning, education.

INTRODUCTION

E-learning is a new and very popular form of education at universities. It is very suitable for modules, where is a rapid progression and where we need to change studying materials very often [1]. We live at the beginning of the 21st century which can be characterized by dynamic development of the communication technology and we can call this period as "the age of the internet". Commercial significance of the internet is from 1993 (18 years), the number of internet users has exponentially increased - it represents a huge communication strength, because *n* users can theoretically create *m* communication groups, whose number can be calculated from the expression (1) - after deduction of one-element combinations and one combination with no element:

$$m = 2^n - n - 1 \qquad (1)$$

Equation (1) is graphically expressed on Figure 1. We can prosper from this progression by adapting modern methodology into education form. It will be much more attractive and with lots of advantages. It was mentioned, that some modules are prepared as e-learning courses for their flexibility. The other point of view is an access to the students. Students want to study by using modern methods of education.

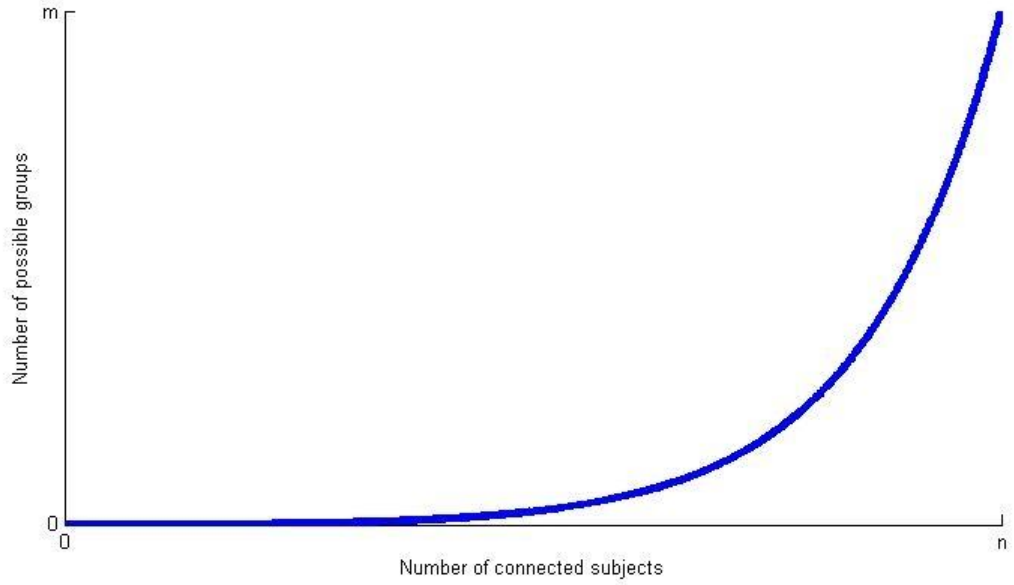

Figure 1. Communication strength of internet.

1. DEVELOPMENT OF THE INTERNET PERCEPTION AND THE E-LEARNING

Base on our personal research and according our opinion we summarized the influence of the internet in most significant areas (shown on Figure 2).

Various forms of distance learning exist tens of years:

- 2nd half of the 19th century – correspondence education,
- 2nd half of the 20th century – radio, television, language courses,
- 21st century – internet, e-learning.

In the past e-learning was only limited to voluntary education and distance education at universities or to obtain basic skills like using software MS Word. Nowadays the situation is completely different. E-learning in companies is usually specially designed application, whose main goal is a fast delivery of certain information usable in practice. The most modern approach to electronic learning used in companies is co-called m-learning, which is using smart phones – it allows the greatest mobility and flexibility.

Distance learning do not exclude on-site electronic learning (e-learning), however it cannot fully replace traditional way of learning. E-learning is a very efficient usage of information technologies in education. It is modern method of education, but does not mean only transformation of traditional books into electronic form. The internet makes the education cheaper and faster.

From the graph on Figure 2 flows clear proof that the internet is becoming very significant tool for our education:

- it offers information,
- it enables easy communication.

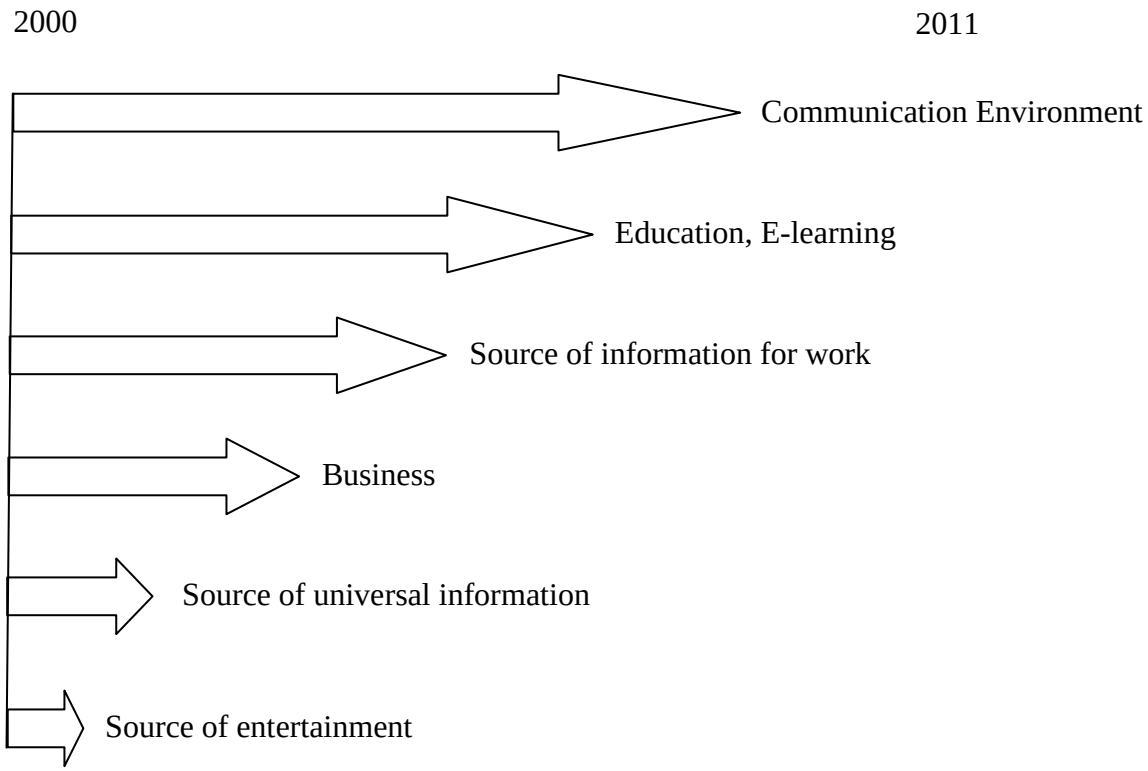

Figure 2. Development of perception of the internet.

Undeniable advantages of e-learning include:

- it is cost efficient in comparison with traditional learning (reduction of resources like space, accommodation, traveling cost, …),
- it works from anywhere and anytime (e-learning courses can be taken when they are necessary) [1],
- it enables to choose the content and level, it can also be adapted to initial knowledge of the learner, it is flexible,
- junction formal and autonomic access to training, multimedia utilization, collection enhancement,
- it can display interactive multimedia demonstrations (image, animation, sound, links…),
- learners can select the rate of studying or can skip material they already know,
- it automatically archives information,
- it offers on-line tests with real-time feedback (with printable certificate about successful accomplishment),
- it makes groups of specialists of the same sight, discussion in discussion forum.

On the other hand, disadvantages and risks of e-learning may include the following:

- it is impossible to get practical skills,
- it does not enable straight personal face to face communication (this can be solved by face to face meeting during the course),
- it is built on volitive characteristics of the learner (it requires more responsibility and self-discipline, learner must want to study, must have a motivation, …).

2. USABLE ELECTRONIC SOURCES FOR DIFFERENT LEVELS OF EDUCATION AND IN PRACTICE

From Table 1 it is obvious that distance learning and online electronic learning are suitable for the higher levels of education and also in practice and in research, but there can be a problem with the availability of high-quality materials in electronic form (as is shown on Figure 3).

Level of education	On-site learning	Distance learning	Online e-learning
Nursery school	X		
Elementary school	X		X
Middle school	X		X
High school	X	X	X
University	X	X	X
Doctorate degree	X	X	X
In practice		X	X
Research		X	X

Table 1. Utilization of different forms of learning on different levels of education.

Researchers share information platform, but it is not common to public all knowledge or all results of the research – they generally public only parts of their results, they stimulate our taste for information, but when we want to know more, we have to pay for it. Researchers usually keep their "know-how".

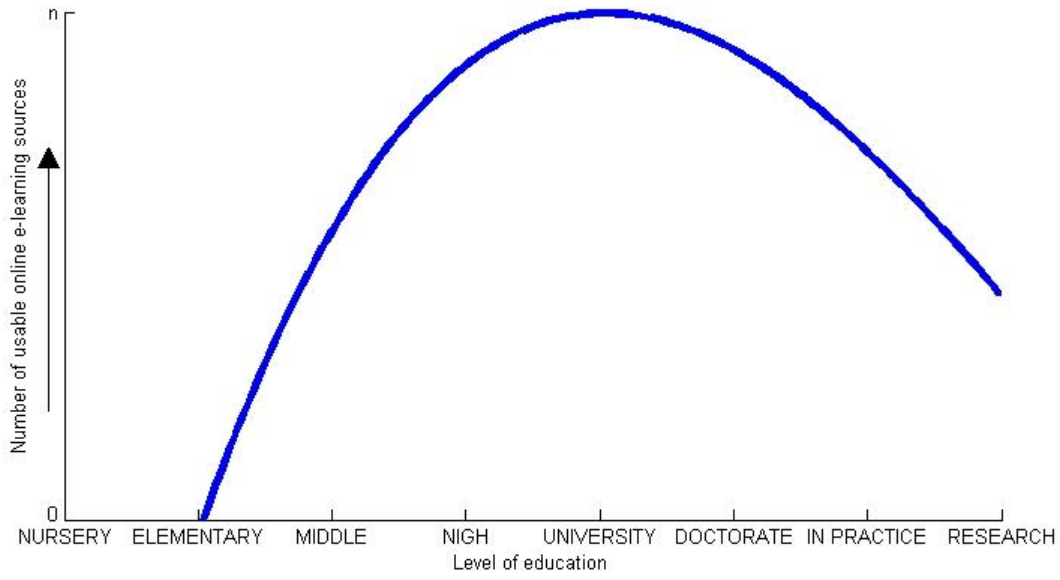

Figure 3. Number of usable electronic sources for different levels of education.

E-learning has indisputable contribution to the on-site or distance learning, but we must not overestimate it. In our opinion the optimal form of education is blended learning with utilization of materials in electronic form (traditional learning + online e-learning).

Electronic learning is focused on knowledge (often encyclopedic) and it mostly cannot develop following skills:

- improvisation,
- physical imagination gained in practice,
- teamwork => being advised is always faster than the fastest internet.

2.1 Education of different skills by blended learning in practice

Education requirements in practice are continuously increasing. The company, which wants to be competitive, has to continually educate its employees, it has to analyze what employees know and what they should know => this company should create its own schedule of education.

We differentiate following type of skills:

- hard skills (software, hardware, calculations, construction, …),
- soft skills (communication skills),
- business competence (management education),
- language preparation.

In all of these types of skills (and during their education) is very suitable to use blended learning.

An example of a successful and reliable application of blended learning in practice is Cisco Networking Academy (CNA) created by the Cisco Systems [2]. This program is engaged both in theoretical and practical education on several IT areas and it becomes very popular among employees and at universities. This program has 3 main fundamental pillars:

- traditional on-site learning in class rooms,
- individual e-learning,
- practical exercises.

The results of this worldwide blended learning program are very well trained networking specialists.

The other example of progressive using of blended learning in practice is the implementation of m-learning English courses in the company Mesit pristroje spol. s r.o. The employees have regular on-site classes, but the teacher is also available on the phone 24 hours a day, 7 days a week and every employee can call him/her when he/she wants to converse in English or consult homework (for example during the driving).

2.2 Our experience with e-learning

In all of universities we mentioned above is implemented learning management system (LMS) based on Moodle (Modular Object-Oriented Dynamic Learning Environment) [3]. Moodle is very powerful and dynamic tool for education activities, but at any of these universities it is not fully used – it is mostly only secondary application for several pedagogues to test students' knowledge, however the possibilities of this system are much wider [4].

The first experience is from pilot course Net-Trainers. The Net-trainers on-line course is European on-line e-learning course. It was developed within a Leonardo da Vinci project

guaranteed by the European Union. We have learnt a lot about e-learning (how to create on-line course and how to tutor it, how to solve problems during preparation and how to propagate our own e-learning course) [5].

At the University of Defence e-learning is mainly used for improving language skills at the Language Training Centre and also at the Department of Mathematics and Physics. Based on our personal experiences with e-learning at foreign universities (ENSIETA - France and Helsinki University of Technology - Finland) we can make a comparison between e-learning utilization at universities abroad and universities in the Czech Republic. Czech universities (Czech Technical University, Masaryk University, University of West Bohemia,…) use the modern methods of education more than in ENSIETA, there is mandatory attendance and classical type of education (class-lessons, practicing and using school library as a source of information), so they do not use a LMS but only electronic study-materials sent by teacher via e-mail. Situation is almost the same at the HUT, but class lectures and exercises are mostly voluntary and all study materials are available on the website of the each course. HUT (nowadays a part of Aalto University) is the largest technical university in Finland with potentially 30 000 users, but they have not still developed and implemented fully functional virtual e-learning systems. At CVUT, which is the largest technical university in the Czech Republic, is implemented online e-learning system based on Moodle but it is not used so often [6]. The ratio of courses using e-learning to all courses is still insignificant.

CONCLUSION

In practice is always needed to solve the complex problems, single person is usually not enough for solving all these challenges, only teams composed of the experts (or engineers) can find final solutions. Pure knowledge does not have to be enough, we have to be able to work together, collaborate with each other and share information. We must not loose contact with others.
Even the best e-learning course cannot replace conventional classwork led by experienced teacher, it also cannot fully replace face to face communication between teacher and learner and among learners. E-learning is a very good approach, but it has to be a part of blended learning.

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POTENTIAL ADVANTAGES OF ELECTRONIC LANGUAGE TESTING AT THE UNIVERSITY OF DEFENCE

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Abstract: *Electronic language testing (e-testing) has become a broadly used method of testing foreign language knowledge as it has a whole range of advantages. E-testing is, just like conventional paper-and-pen testing, a method of assessing students' ability to meet the standard required, but this modern method uses a computer rather than traditional tools. The paper is mapping the theoretical background concerning e-testing with the focus on the main concepts and approaches in this area. Advantages and limitations of each of these approaches are discussed with a view to establishing a large-scale e-testing practice at the Language Training Centre (LTC) of the University of Defence in Brno. There is a wide range of software packages used for e-testing and the paper is exploring potential advantages of e-testing for the LTC when the Moodle software is applied in practice.*

Keywords: electronic language testing, paper-and-pen testing, language assessment, large-scale testing, test administration, Moodle.

INTRODUCTION

Language testing is an integral part of foreign language teaching and learning process. To produce a high-quality test involves a long and demanding process of item development, moderation, pre-testing, statistical analysis and modification. Administration of the test to the test takers is one of the final stages of this process and the overall effect of the test might be strongly affected or even spoilt by the way this administration is practised. Logically, there have been efforts to facilitate test administration and to make it easier, faster, cheaper, safer and more efficient in general. One of the possible solutions is to apply information technology, which has already proved beneficial in many other areas of human activities. Consequently, electronic language testing (e-testing) has become a broadly used method of testing foreign language knowledge as it has a whole range of advantages. E-testing is, just like conventional paper-and-pen testing, a method of assessing test takers' ability to meet the standard required, but this modern method uses computers rather than traditional tools. The purpose of this paper is to discuss whether this approach to test administration is also feasible and suitable for establishing a large-scale e-testing practice at the LTC of the University of Defence in Brno. In this connection, basic facts concerning e-testing are presented and both positive and challenging aspects of its possible implementation are considered.

1. HISTORICAL BACKGROUND OF E-TESTING

The need for more objectivity in language testing gradually led testers to the use of computers as precise measurement tools and their application in this area resulted in establishment of computer-assisted language testing (CALT). CALT has become a widely used method of testing in the current educational system in many countries, and, even though this method of

testing seems to be a novel way, it has a longer history than we think. “Large mainframe computers have been used since the 1960s for the analysis of the test data and for storage of items in databases, or item banks, as well as for producing reports of test results for test users. More recently, with the advent of the personal computer, it is now common to use word-processing software for the creation and modification of test tasks, as well as for all of the tasks previously done on a mainframe computer.” [1, p. ix].

CALT has its proponents as well as its opponents. While the opponents express mainly their doubts about the reliability and validity of this testing approach, the proponents put stress mainly on its practicality that has gained the sympathy of both test developers and test takers. Nevertheless, as CALT has occupied a significant position in language teaching and learning in European Union, it has accepted it as one of the testing approaches. “The European Council (2006/C172/01) conclusions on the European Indicator of Language Competence ask for measures for objective testing of skills in first and second foreign languages based on the Common European Framework of Reference for Languages (CEFR). The Council invites the Commission to assist Member States (MS) to define the organisational and resource implications for them of the construction and administration of tests, including looking into the possibility of adopting e-testing as the means to administer the tests. Electronic testing could improve the effectiveness, i.e. improve identification of skills, and efficiency, by reducing costs (financial efforts, human resources etc.).” [2, p. 3].

Nowadays, one of the best-known applications of computers in language testing is the large-scale testing programme called the Test of English as a Foreign Language (TOEFL), based in the USA and delivered internationally only in the electronic mode. At European level, there are only small-scale projects using computers for language assessment, and one of them is the Diagnostic Language Assessment (DIALANG) project. “The DIALANG project is about computer based language testing. It is an assessment system intended for language learners who want to obtain diagnostic information about their language proficiency, providing also advice about how to improve language skills. DIALANG is Internet based freeware, currently managing diagnostic tests in 14 different European languages.” [2, p. 4].

2. THEORETICAL BACKGROUND OF E-TESTING

E-testing covers a wide variety of approaches to application of computers in test delivery, and the basic differences among them are based on the fact to which extent the computer plays an important role in the process of language proficiency assessment. In the following paragraphs, the most frequently used concepts and terms are explained to lay the theoretical groundwork for this paper.

The first approach, which is historically the oldest one, is called **computer-assisted language testing** (CALT). CALT “refers to any application of computers within the assessment process; the role of the computer may be extrinsic or intrinsic. It is, therefore, a synonym for an assessment which also describes a wide range of computer-related activities. Within this definition the computer often plays no part in the actual assessment of responses but merely facilitates the capture and transfer of responses between the candidate and the human assessor.” [2, p. 12]. From this definition it is clear that in CALT, the computer plays a rather passive role of a language test development and delivery tool without actively participating in the assessment process itself.

The next approach is **computer-based language testing** (CBLT), in which the computer plays a more active role and is used for assessing the responses from test takers. Administration of the language test is usually provided by means of a computer software application that is either commercial or open source. Computers as the testing medium in CBLT feature significant advantages. The most important one is the fact that for tests consisting of dichotomously-scored items, the computers can provide feedback on the test results immediately upon completion of the test. Another advantage is that the computer can provide immediate feedback on each of test taker's responses, which is a characteristic very useful for pedagogical purposes. Also the fact that a lot of paper is saved is beneficial. The negative aspects of CBLT include the potential problem of test taker's differing familiarity with computers, which can affect the test result; it is also the high cost of establishing new testing centres and the possibility of sudden computer breakdowns [3].

Chronologically, CBLT was followed by the introduction of **web-based language testing** (WBLT). Unlike in CBLT, where tests are delivered on individual computers or a closed network, in WBLT computer-based tests are delivered via the internet and written in the "language" of the internet, HTML. The test is located on a server where it can be accessed and downloaded by the test taker's computer. For this purpose, the test taker only needs a web browser to display the downloaded test. WBLT thus offers some advantages over traditional CBLT and the biggest logistical advantage is its flexibility in time and space. In case of high-stakes tests, however, the potential problems of cheating and test security must be taken into consideration, and the test administration must be carried out in supervised testing facilities [3].

The most sophisticated approach to language assessment is called **computer-adaptive testing** (CAT). The major difference between CBLT and CAT is that a computer adaptive test is interactively tailored to the test taker's level. The test "selects and presents items in a sequence based on the test taker's response to each item. If an examinee gets the first question correct, a more difficult question is selected from a pool and presented next; if this one is answered correctly, a more difficult one is selected. If the candidate misses a question, the algorithm selects an easier one for the next question" [1, p. 7]. When the test taker's ability level is estimated, the test ends and a score can be reported. Computer adaptive tests are based upon the existence of an **item bank**, a large group of items which have been thoroughly trialled and calibrated according to their difficulty index. This calibration is achieved through the measurement theory called **Item Response Theory**, when a large-scale administration of the items typically in a pen-and-paper format is necessary. Major advantages of CAT are the following: fewer items are required to estimate the test taker's ability level, which means a shorter time necessary for the test administration, only items close to test taker's ability level are presented, which creates a more positive test taker's attitude toward tests and, finally, test security is improved by selecting items from an item bank to construct individualized and unique tests [1].

3. FROM A PAPER-AND-PEN TEST TO E-TESTING

The use of computers for test delivery raises questions of their validation including test reliability, validity, authenticity, impact and practicality. Qualitative and quantitative validation of computer based tests does not differ in principle from validation of other types of tests; however, there are some specific issues introduced by this new testing medium that deserve special attention.

One of the concerns is about validity of computer based tests and the fact that test takers' varying familiarity with computers can influence their scores. There are efforts to reduce the impact of prior experience with this kind of tests by provision of special tutorials on relevant skills before the test is taken, but the question about the impact of computer delivery on test taker's performance still remains to be examined [4].

Other questions are raised about the importance of different kinds of presentation format in e-testing. "In a writing test, the written product will appear in typeface and will not be handwritten; in a reading test, the text to be read will appear on a screen, not on paper. Do raters react differently to printed versus handwritten texts? Is any inference we might draw about a person's ability to read texts presented on computer screens generalizable to that person's ability to read texts printed on paper, and vice versa?" [4, p. 81]. Also composing processes of written composition are probably different in e-testing because of word processing capacities that are available on the computer, including differences in test takers' typing speed affecting their comfort while typing a composition. Do such differences in aspects of the test method result in different conclusions about a test taker's ability? It is still necessary to carry out more complex research to answer these questions.

The language point of view must also be taken into consideration. First of all, certain types of items are not recommended for CBLT because "input and response types are limited by available technology" [1, p. 23]. Another challenging area from both language and technical points of view is considering such details as differences in British and American spelling, contracted and full forms of words when creating the tests. As for the individual language skills, even though current software applications enable testing all four language skills, the safest and smoothest to create and administer are reading and listening skills, since these can be developed without using open-ended responses. Consequently, mostly multiple choice items, true/false statements, matching tasks, ordering of text parts, cloze tests or brief-response questions are suitable for CBLT. Speaking and writing skills are the biggest challenge; their assessment is the most complicated, and, in fact, the obvious advantage of e-assessment – instantly available results, cannot be applied here. "Handling of open-ended questions is a big limitation; e-testing does not improve the current status; algorithms to process essays are still in their infancy, as well as assessment of speech." [2, p. 8].

4. CHALLENGES TO FACE AT THE UNIVERSITY OF DEFENCE

At the University of Defence, when thinking about introducing e-tests, we first had to decide which approach to e-testing we should choose to improve the overall efficiency of the entrance test administration. After considering various types of e-tests, we came to the conclusion that the most suitable approach for us will be web-based language testing (WBLT). Here it is necessary to stress the fact that this will be the case of the high-stakes, large-scale entrance e-tests. Then several dimensions have to be taken into consideration – technical, economic and organisational. In the following part, all these three aspects will be considered mainly from the perspective of test developers and administrators, which are the crucial roles for us.

From the technical point of view, the test developers (represented by language teachers at the University of Defence) will need to gain certain IT skills to develop e-tests. Not all language teachers are keen on additional IT schooling to master such skills, so here we can see a challenge to build a working team able to create e-tests. But we believe that the outcomes of

such a method of testing will overweigh the initial workload, and for this reason, we can find enough well-motivated colleagues for the team. From the test takers viewpoint, not all of the entrance test participants are used to taking e-tests, which may undermine their results. It has already been proved that a demo version of an e-test with samples of all possible items the entrance test may contain can help here. The demo e-test can be placed at the University web pages, and the applicants can try to take it from home. Technical aspects of the test administration are another area which should not be omitted; for successful administration the school needs sufficient infrastructure – computer equipment and an appropriate software application. Piloting the already-made test items is another significant aspect, because in the high-stakes tests each item requires profound pre-testing before it is used. This fact may be a burden calling for a lot of logistic support, but it cannot be neglected without serious endangering the final success of the whole project.

Cost efficiency is an indispensable part of test preparation and administration. "Costs are related to the infrastructure needed for testing (IT, bandwidth etc.), training of testing community (authors, markers etc.), piloting for ensuring valid and reliable results, development and maintenance and administrative issues." [2, p. 10]. To address this, we can only agree that "As a general rule, online assessment becomes more cost effective the higher the volumes are, while paper-methods are more cost effective for small scale assessments or piloting work." [2, p. 10].

The last but not least aspect to be mentioned is test security, which is a part of both technical and administrative area. "At the moment compromised security appears to be an insurmountable problem in high-stake testing because score users need to be assured that the identity of the test taker is the same as the person for whom the score is reported." [1, p. 57]. This problem can be solved by proper verification of test takers' identity before the test is administered. Other types of cheating - copying, using various translating devices or taking pictures of the screen will have to be solved by a sufficient number of invigilators in the administration room.

5. CHOICE OF SUITABLE SOFTWARE FOR WBLT

To launch WBLT as a means of entrance exam administration requires the necessity of adequate software enabling development of e-tests which the school can afford. There are several available software applications used by universities in the Czech Republic. Some universities use their own application designed usually as a part of an e-learning project (University Information System designed at Mendel University in Brno, LMS Barborka designed at VŠB – Technical University of Ostrava), others decided to reach for some of universally designed applications (Moodle used by Brno University of Technology or Masaryk University). Even though all mentioned applications support WBLT development, we decided to apply the last mentioned one - Moodle which, among others, has the advantage of no costs. "Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a free web application that educators use to create effective online learning sites." [6]. It has been used in English courses at the University of Defence for some time now, including low-stakes partial testing. Some of our language teachers have been schooled for work with this application, which will be helpful when the WBLT developing team is required. Moreover, Moodle not only enables development of web-based language tests, but, because it is an open-source e-

learning software platform, it also opens possibilities for broader co-operation of different universities in the future.

In our entrance test, we intend to assess only reading skills for practical reasons, because it enables easy administration and assessment by the computer. It is necessary to point out that, in this context, we consider the term "reading comprehension" in the broadest sense including testing grammar, vocabulary or language in use. For this purpose, it would be necessary to use only the following dichotomously scored types of items: multiple choice, true/false statements, matching tasks, ordering of text parts and cloze items. Moodle software makes it possible to test all the previously mentioned types of items.

CONCLUSION

In conclusion, we want to point out that we believe, after considering all conditions and limitations at the University of Defence, that the most suitable way of transformation of the present paper-and-pen form of entrance tests and their administration into an electronic alternative is web-based language testing, using Moodle as the test delivery tool. Fortunately, at the Language Training Centre, there is a well skilled team of teachers having previous experience and formal training in this type of testing, though only in a small-scale manner. The University also has a sufficient number of adequately equipped computer labs at its disposal which enable putting the idea of large-scale, high-stakes e-tests into practice. We assume this change will be also beneficial for the applicants for the study at this university, as they are supposed to be technically skilled. Hopefully, this novel idea of an electronic version of entrance tests will be acceptable and supported by the university management.

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REFLEXION METHOD IN COGNITIVE MANAGEMENT AS AN EFFECTIVE TOOL FOR AUTONOMOUS LEARNING

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Abstract: *The article outlines the reflexion method as one of the cognitive management methods with important potential of being applied in the distance form of military professionals' preparation. It demonstrates some principles and possibilities of applying this method within systematic cultivation and development of professional qualities and competences of military professionals and other experts in the area of security environment.*

Keywords: reflexion method, cognitive management, competences of military professionals.

Distance form of education is one of possible approaches to competence development of military professionals, or professionals working in security environment. Part of this approach is a fast developing trend including different forms of education and learning supported by modern communication and information technologies called e-learning. Supporters of this trend in education appreciate its efficiency in terms of lower operational costs, accessibility to study (internet environment), time independence (permanent access to educational materials), individual rate, etc. Nevertheless, human education and learning are a complex and multidimensional process and the advantages of using modern technologies concerning knowledge mediating and sharing cannot be overestimated. As some disadvantages it is possible to mention e. g. insufficient feedback, social isolation, high requirement for motivation, etc. [4]. These disadvantages are to certain extent reduced by e.g. blended learning, which combines e-learning approach with direct, non-mediated teaching. The importance of non-mediated interaction in terms of live contact with teacher, lecturer, coach or instructor grows especially in subjects directly connected with practical performance. In such cases, what really happens is not only acquiring some knowledge, but also re-shaping and re-processing of one's own experience. An example of this is teaching supported by simulation technologies (operation of weapon systems), working experience in the form of internships/ study stays at special working positions (shadow instructor) or models of global preparation (courses), e.g. development of specific skills and competences (specialised training, managing competences, soft skills and others). In our opinion, a significant added value of these educational activities (trainings, seminars, exercises, etc.) is also immediately shared experience of participants and lecturer (instructor). It is in fact the distance learning which, by using selected methods, can create virtual shared environment (e.g. on-line teaching, internet conference and others) in which an individual takes part with his/ her reflexion or, in other words, environment which is created by reflected knowledge of other members of the study group. Moreover, blended learning can also enable live meeting focused on certain topic or area.

The essence of the processes of professional training, should the education be conducted by direct or distance form, is learning and change which can be characterised as a change in thinking, decision-making and possible behaviour of individual. This conception highlights three facts: 1. an individual is changing in learning process; 2. the change happens in the

mind, as a result of processing the experience; 3. the change will show itself in potential behaviour. Thus, however the change in an individual has happened, it is a change in potential, in inner quality. This change will show itself depending on situation in the process of problem-solving, decision-making and behaviour [6]. The core of distance education is represented by guided self-study which is based on autonomous learning, i.e. learning depending on inner potential of an individual and his/ her abilities to "guide" this potential (acquiring, processing and creating of new information and/ or knowledge). Guided self-study is a process in which it is possible to identify three aspects. The first one is the aspect of external (educational, training) environment, concerning various methods and forms of assigning tasks, requirements, instructions, etc. The second one pertains to inner environment – an individual as a learning system – a whole (element). The third one is situational context in which learning takes place. These three aspects affect autonomous learning which is connected with processes of self-control. In the context of the development of inner mechanisms of self-control, Bedrnová [1] suggests so-called hierarchic system of these mechanisms to which she includes e.g. selective orientation, directivity, attitudes, values and value orientation, paradigm and conscience. In our opinion it is worth adding to this system aware reflexion, which we believe contributes to the development of meta-cognition (introspection to one's own cognitive processes). Moreover, in the context of the development of intra-personal intelligence [10], it contributes to the development and cultivation of mind, thinking processes and cognition in the process of human individuation and in this framework in the development of an individual in the profession. Apart from C. G. Jung, psychologists and pedagogues, the aspect of reflexion is taken into consideration by other authors involved in cognition, knowledge and development of humans and human resources. As an example we can mention G. Lakoff [14], P. M. Senge [9] or Cartwright [2], who considers it (reflexion) to be an inevitable method for awareness development and use of potential of intuitive processes in managers and leaders, especially in decision-making situations whose characteristics are ambiguity, uncertainty and changeability. The contribution of Olstedt and Lind [5] is also inspiring. They discuss the preparation (training) of military professionals at Swedish National Defence College and they describe the process of development of professional competences using a spiral model which shows different aspects of knowledge development. The process is affected by the interaction of self-reflection and practical knowledge, as well as by personal competences being developed through creation of personal opinions via the interpretation of ongoing processes and also the development of reflected knowledge. At the same time, they ponder the question of how it is possible, with the help of pedagogical knowledge, to contribute to competence development for orientation and mastering unknown and unclear situations which military professionals and commanders regularly have to face. According to Olstedt and Lind, the starting point is represented mostly by processes of self-development and self-education, in the sense of permanent reflexion, i.e. self-awareness in the process of being (existence, entity). We are of similar opinion. We believe that this emphasis on aware and reflected self-development and self-education are heading for understanding educational process in terms of creation and cultivation of knowledge which in professional framework are closely interrelated with mastery, art and tacit knowledge in profession.

Distance learning means in practice first of all mediation or transfer of knowledge towards learner and checking correctness of its application in various testing models in the form of tests or projects. Nevertheless, education and preparation (training) for security environment cannot be conducted only in this linear trend [7]. That is why in distance learning it is necessary to create for students such environment and to use such forms and methods of co-operation which will enable them to create knowledge based on their own experiences [14].

Thus, we need to work with such methods which will lead learners towards the development of their thinking and cognition for the application of new knowledge into their own practice. The above-mentioned way leads also to the development of so-called tacit knowledge and skills which we perceive as essential qualitative base for professionals. Tacit knowledge manifests on the basis of the interaction of the following three cognitive sub-processes: „selective encoding, selective combination a selective comparison". These sub-processes enable selective perception in terms of classifying information according to the importance for given context, combination of information for creation meaningful information complex for orientation in situation, including implementation of previous experiences and comparison of this information in order to update the knowledge in terms of new knowledge structure to solve given situation. The process of interaction of these sub-processes as a whole is connected with thinking, reflexion and cogitation and creating information, knowledge and experiences for or during sharing [2], [3], [11], [12].

Information and knowledge are considered to be the potential or source of wealth, power or even stock. The process of transforming information into knowledge, cognition and understanding includes also their handover/ transfer and sharing. These are the areas on which cognitive sciences, management theory and practice including management for military or security management, are focused. On that ground, at the University of Defence in Brno we develop cognitive management [8] whose main goal is the development and cultivation of aware management of own cognition and author's knowledge of people, thus the cognition based on experience processed by one's own mind. The knowledge, cognition and understanding created in this way [13] generate conditions for the development of system thinking and contributes to advance or change in thinking "metanoie" from the point of view of learning, as described e. g. by P. M. Senge when he mentions real learning [9]. We perceive cognitive management and the application of its methods and principles as an essential contribution to the process of preparation of military professionals, commanders, as well as professionals and managers working in security environment. Absence of system thinking or reduced (lowered) mobility on cognitive continuum in task solving, usually in favour of analytical thinking, can finally be the partial aspect which will not enable to process situational context and task situation in a creative way. Eventually, this will not enable to use one's own potential or any resources available. Moreover, it may even prevent them from being used.

In cognitive management, the reflexion method is viewed as a method focused on developing the ability of our mind to concentrate on itself. Reflexion from the point of view of cognition is interpreted as a process of awareness (or of getting aware) and in the context of cognitive management it is seen as "aware stabilization and concentration of attention to the process and results of own thinking to take an approach of internal distance". Thus the reflexion is not the feedback, although it can include it, as well as the analysis of own activity, present procedure from the viewpoint of problem-solving and decision-making. Although the reflexion is also re-focusing the attention to what has happened, the emphasis is put on catching and awareness of what is happening at the moment. Main step in applying the reflexion method is self-awareness, taking inner attitude and creating one's own picture (model). To practice the reflexion method means also to develop the ability to look into or aware resources which enable to shape our cognition and formulate our ideas. We mean the resources as cognitive or mental models which we have overtaken in the process of our development, including profession, and through which we "shape" the world we live in and discover, including the world of profession.

Usefulness and meaningfulness of the reflexion method in distance education is seen not only for its importance for regulation of self-study by learner, but also for learner's (learning system) stay in shared environment, whether it is virtual or live. An example of procedure in applying the reflexion method can be e. g. autonomous (unaided) work with given topic. It includes two levels. The first one concerns learner's individual work and the second one concerns the interaction between learner and lecturer or sharing in the group.

The first level is divided into three phases. In the first one, the learner gathers, familiarises with and classifies the information and knowledge related to the topic from available sources and his/ her own experience. During this phase, apart from the process of classifying and arranging knowledge, the learner simultaneously records his/ her own thoughts, ideas, considerations – in other word everything related to the problem or task being solved that "crosses his/ her mind during the process. The output of the first phase is the arrangement (organisation) of knowledge into condensed form which creates formally correctly organised informational "database" of accessible knowledge and experience related to the topic. In the second phase, the learner organises his/ her own ideas, thoughts, associations, matters to solve, etc. into brief formulations. Cogitation, consideration and testing own thoughts and their formulation into opinions represent, together with the third phase, the most important part of the process. The third phase concerns the application, thus the connectivity of the topic, the usefulness of available knowledge and own reflexions to the practice. In the first phase, learner performs two tasks. Firstly, he/ she learns to understand the environment of information and knowledge, he/ she concentrates on understanding and using the environment which mediates the knowledge from the point of view of various paradigms, scientific (expert) cognitive models. Secondly, he/ she learns to record simultaneously arising own thoughts, ideas, and opinions. In the second phase, he/ she works with his/ her own reflexions. Only self-reflexion and reflexion of meta-cognitive processes will enable him/ her to ponder over their thinking, ideas, possibilities which are currently provided by his/ her mind. In other words, learners can, with the help of reflexion and by its own way understand the studied area (thus create own, author's knowledge, as well as transform this understanding into application potential for various environments. Reflexion is an aspect of the process of cogitation of knowledge and experiences, thus also notions and formulations. The result of the process is an opinion or new knowledge. This result is formed and tested in the process of sharing, thus in live talk [12] or dialogue.

To create the environment in which it is possible to share opinions is the matter of the second level of working with reflexion. At this level, there is the co-operation either between lecturer and learner or in the framework of learning group (team). This form of co-operation - sharing – brings the "added values" which are difficult to achieve in common forms of education focused on testing the knowledge level and its organization at the output, for example by knowledge test. At this level, both intrapersonal and interpersonal intelligences are cultivated and the learners suggest their own reflexions of the processed topic in the group. They play two roles. One of the roles is to present and give opinion. The other role is to share, reflect, agree with an opinion or articulate another opinion. In such environment, the learners learn to share, accept and think over others' opinions and support it in the context of topic or task being solved. Therefore they do not work with logical or value reasons or truths, but with opinions. They learn to create live environment for creative cogitation of the results of one's own thinking.

The meeting of the group is usually organised as a colloquium and each participant has the opportunity to say his/ her opinion. The final assessment of the work of the learners is in the

responsibility of lecturers or coaches. Later on, at higher level of group's maturity it is the matter of the whole group. This approach is appropriate exactly for the area of distance education with regard to the extent of both personal and professional maturity of the participants, including their motivation and value frameworks. Here they can creatively apply, form and transform their personal and professional experience with regard to the topic. A characteristic feature of applying the method of reflexion in the process of sharing is the change in learner's thinking which will manifest itself in his/ her language by more frequent occurrence of expressions, such as: "I'd like to add...."; "I think ...."; "My opinion is that...."; at the expense of the frequency of occurrence of formulations like good x wrong, correctly x incorrectly, truth x lie, or radical statements, such as "It is like this or that". We believe that application potential of the reflexion method can be used mainly in the educational and learning processes focused on:

1. Systemic, critical and creative thinking, mobility of thinking on cognitive continuum at task-solving and in relation to cognitive and mental models.
2. Development of individual partial and complex professional competences.
3. Individual and team problem-solving and solving situations which are impossible to decide, impossible to solve or paradoxical.
4. Sharing, organising relationships within the group/ human system; organising development of communicative abilities.
5. Competence development for situational leadership, synergic, knowledge, cognitive and crisis management or management of change [8].

CONCLUSION

If distance education is expected to support educational process in terms of not only the process of handing-over and checking of knowledge, but also in terms of creating knowledge and understanding, it has to include the application of the reflexion method. This method has to be used as a supporting aspect of "guided self-study"; moreover, it also has to create environment for applying reflexion in live relationship (dialogue) between learner and instructor. The method of reflexion is one of the basic aspects which enables each learner not only to cultivate his/ her own level of education – as K.P.Liessmann says: "Since the beginning of time, the difference between education and lack of education has consisted in the ability of reflexion and distance, …" [13], but also to direct them towards what is the purpose of education and learning – hence, towards creating one's own, author's knowledge and professional mastery.

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ADVANCED DISTRIBUTED LEARNING SOLUTIONS TO SUPPORT EDUCATION & TRAINING PROCESS OF THE NATIONAL DEFENCE UNIVERSITY IN WARSAW

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***Abstract**: This article provides information on how the National Defence University, Warsaw, has developed Advanced Distributed Learning. It focuses on the development of content evaluation process adopted from NATO countries.*

Keywords: Advanced Distributed Learning (ADL), training, evaluation.

INTRODUCTION

E-learning, in military terms - Advanced Distributed Learning (ADL), increases capacity for training soldiers, improves the quality of instruction, enhances access to training, and finally, reduces time soldiers spend away from their units.

The main goal of NDU, in the case of development of ADL, is to provide for soldiers and NDU's civilian students valuable materials prepared by subject matter expert and make them available on-line.

1. DEVELOPMENT OF ADVANCED DISTRIBUTED LEARNING AT THE NATIONAL DEFENCE UNIVERSITY IN WARSAW

1.1 Reasons for ADL implementation

The National Defence University is a specific institution of higher education: despite the fact it is the highest university in the Polish Armed Forces, more and more civilians attempt to study there. Hence, in order to meet all students' expectations, NDU is looking for innovative solutions.

Advanced Distributed Learning is very well known in the civilian market, but hardly used in the Polish army. Consequently, two years ago Rector-Commandant of NDU decided to establish ADL team and develop this form of education as a support of traditional learning.

1.2 International conferences and workshops. ADL best practices

The development of ADL activities within the National Defence University in Warsaw is widely recognized and very well received by the NATO and PfP Consortium countries. The members of ADL team (NDU established the ADL unit in 2009) participate in various international and domestic events: conferences, seminars, workshops and meetings, focused mainly on the exchange of experiences and best practices. It is also about technical and methodological issues and data exchange on the latest developments and projects. The examples are: *PfP Consortium ADL Working Group, NATO Training Group Working*

Group on Individual Training and Education Development - NTG WG IT&ED, European Security and Defence College – ESDC. Currently, more than 100 ADL courses are available on the LMS ILIAS platform, which the University is authorised to run and to certificate (as of 10th March, 2011). Additionaly, NDU participates in international conferences of ILIAS, Learning Management System software used at the NDU.

2. CONTENT PRODUCTION PROCES

2.1 Team selection

Due to lack of ADL experience in the Polish army, *ACT Joint Education and training* and *ADL Working Group* was adopted as a good practice of producing courses.

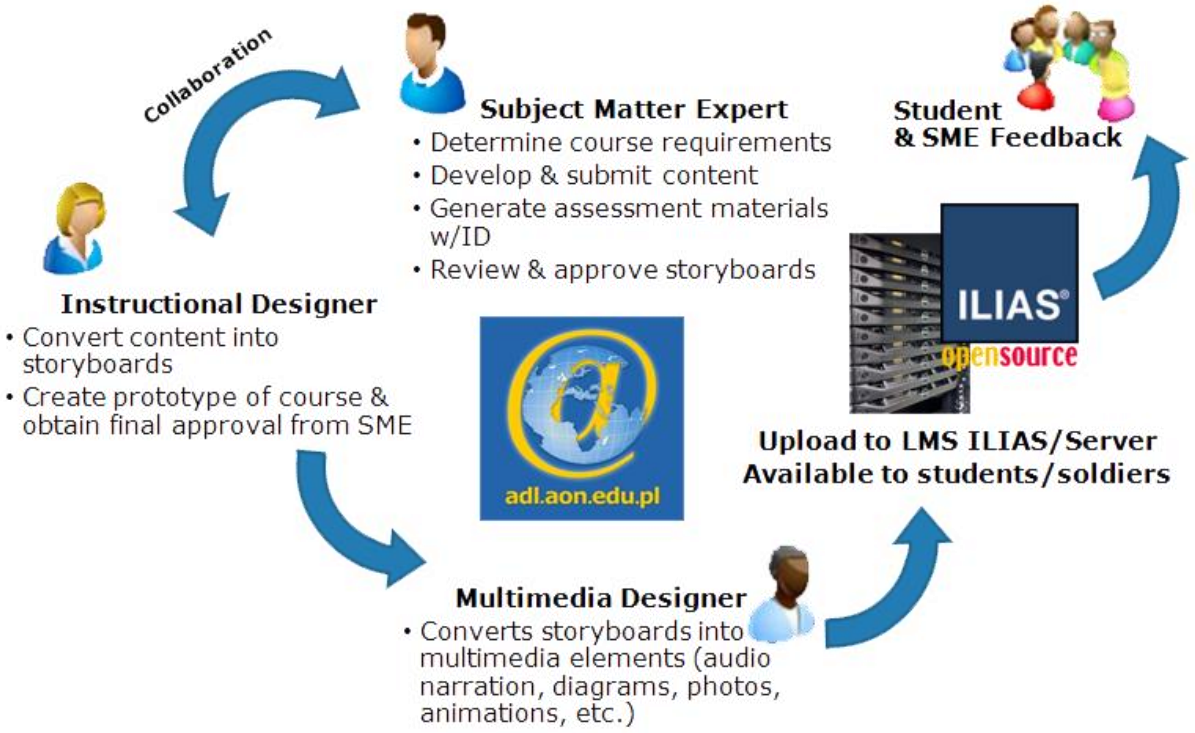

Figure 1. NDUs' Warsaw Course Development Process according to ACT Joint Education and Training.

The Course Development Process defines the production of the course from content outline, to storyboard, multimedia components and integration of content into the authoring tool. Collaboration between Subject Matter Expert (SME) and Instructional Designer (ID) could be opened and on an equal level. Their work should be focused on brief explanation of how e-learning process works, including the precise timetable and expectations for review. Such a collaboration helps to avoid problems and delay. Instructional Designer, after approval the storyboard by SME, send it to Multimedia Designer to the next phase development of the course. Multimedia Designer is the artist who knows how to create multimedia content by combining sources of multiple media. The next step is deployment of the course into the LMS and testing the content.

A very important is Evaluation Phase, which gives a feedback about the usage and volubility of the content.

The National Defence University putting on quality and reliability of ADL product has created a team that consists of all the elements presented in Figure 1.

2.2 Production of own ADL materials

The international experience and competences of the ADL team also allows for the development of in-house products (mainly courses), all in compliance with the NATO standards. It means that Sharable Content Object Reference Model (SCORM) standards are fulfilled to ensure interoperability of the ADL content for the education and training.

Of special importance is the development of the *Introductory course* for 3500+ NDU students admitted for the 2010/2011 academic year. The course consists of the following parts: four separate ADL modules SCORM standard compliant (on safety while working/studying, pre-medical aid, fire safety and library lesson), two separate tests, evaluation survey and certification (PdF format). Various means of communication for students has been actively used within the course: FAQ (based on the NDU videos available from "YouTube" portal), Twitter, forums, e-mail and messages (LMS ILIAS), and wide screens. Posts on the forum, e-mails and the survey evaluation by the students, covering all the aspects, of course have brought interesting results to be presented in details during the conference. While trying to identify the direction of the future efforts it is possible to see two areas: (1) ADL perceived as various educational services supporting the Bologna Process, (2) ADL and ADL-Mobile training, seen as Life Long Learning.

3. SUPPORT EDUCATION & TRAINING PROCESS

3.1 Evaluation

All on-line courses conducted at the National Defence University are evaluated. The main point is to find out what worked well and what did not. To evaluate we use mechanism of LMS ILIAS.

A typical survey consists of 25 questions with preconditions, so the total amount of questions is different and depends on student's profile (questions for civilian students and military students are not the same).
Questions concerned:

- characteristics of the person (experience, education),
- strong and weak points of ADL,
- organization of the course (easy to navigate and logical, understand all components and structure),
- communication tool (preferences to communication with tutor).

Presented below examples of results come form *Introductory course* for 3500+ NDU students.

In the statistic, 93% of respondents declare that they never used ADL.

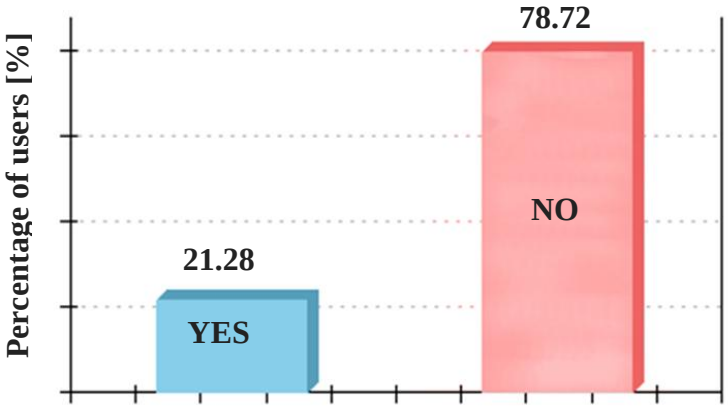

Figure 2. Lack of social contact.

One of the main features which distinguish ADL from a typical education is a lack of social contacts. However, only 21.28% of all answers agrees with that opinion (Figure 2). Probably, this feature is closely connected with self-discipline (in this point 66.26% of users reported they had no problems with that) and several options of online communication with the tutor.

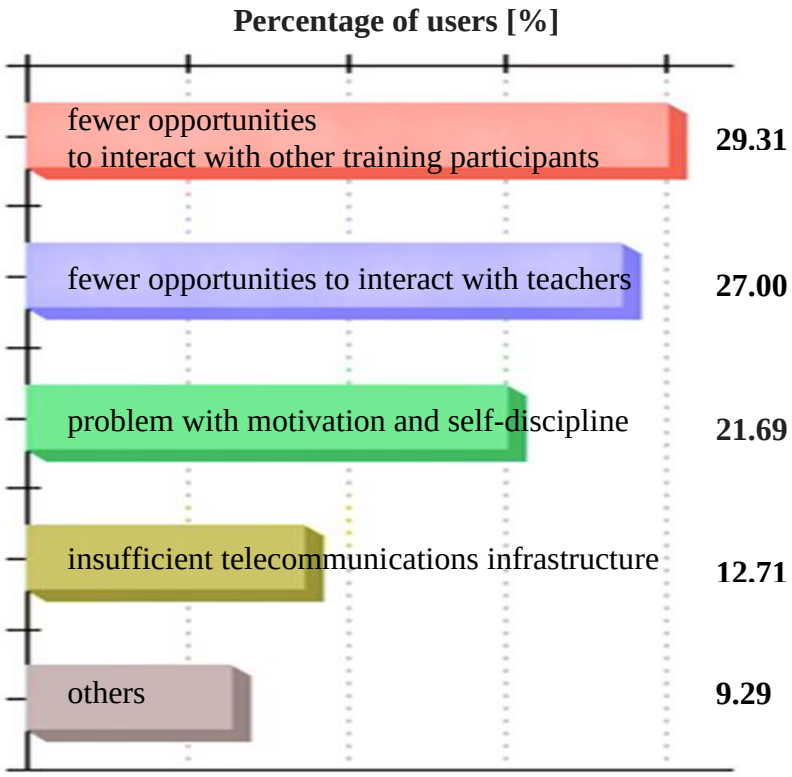

Figure 3. Week points of the ADL.

The type of questions about strong and weak points of ADL (Figure 3 and 4) was multiple choice questions with multiple answers. Questions about the disadvantages of ADL were preceded by an introductory question whether there are defects in the ADL. Due to the fact that some students skipped this question, percentage values of responses are higher.

It is important to mention that the results concerning one of the week points of ADL, insufficient telecommunications infrastructure, are connected with the fact that most respondents live in villages and towns with less than 100,000 inhabitants, where the access to the Internet may be not sufficient.

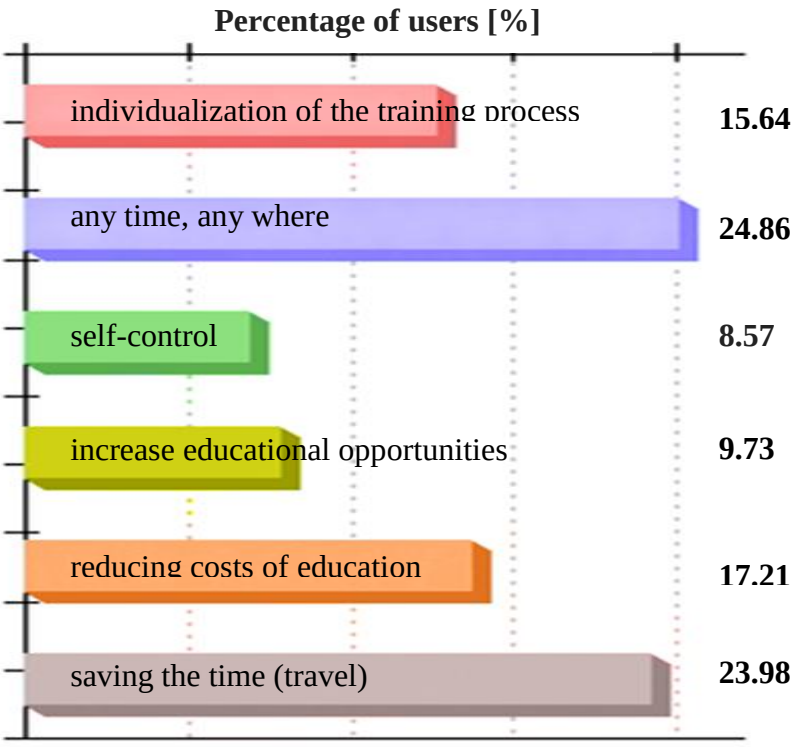

Figure 4. Strong points of the ADL.

CONCLUSION

From the perspective of a student and a teacher, ADL is a great support to a traditional learning. This method is particularly suitable for training of troops, especially those which are geographically dispersed. Additionaly, it can often be used to improve the competence before an essential training (as an initial course or pre-course). ADL also aims to develop qualities necessary for a soldier personality, especially: self-reliance, self-discipline, time management, and ability to self-assess.

Several of the evaluations mentioned in this paper examined the cost-effectiveness issue of this method, but only a large number of trained can contribute to savings. Weaknesses of the system of distance learning: mainly lack of face-to-face contact with a teacher and students, NDU minimizes by implementing of virtual classes as another communication channel. The key to success can be an appropriate choice of the team that will implement this project taking into account different metodological aspects. Adequately prepared teaching materials engage students in the learning process, increase their motivation and, consequently, broaden their knowledge.

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E-LEARNING COURSE DESIGN PROCESS – SOME DETAILS

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Abstract: *We suggest to divide the process of designing an e-course into three stages. The first stage consists of defining general template of the course in the terms of three attributes: organization, communication and methods of access to course materials. The second stage aims at determining the domain and the scope of the content to be taught at the course. At the third stage the course designer has to form blocks, i.e. to fill the template produced at the first stage with the units of the content provided at the second stage. In this paper we discuss in detail three factors of four: the general construction of the blocks, the teacher's set of actions and a variety of activities for students. The fourth necessary factor – the designing of learning objects – was referred to by many authors, and can be found in numerous papers.*

Keywords: e-learning, instructional design, e-learning course structure, e-learning design.

INTRODUCTION

Internet courses must be designed much more accurately and carefully than classroom ones. A standard lesson plan, which is enough to conduct a normal lesson at a classroom, is not enough to prepare materials necessary for an internet course. It must be taken into account that most of the teaching methods are concealed in the learning objects which must be prepared earlier (usually before the beginning of the course). Moreover, it is more difficult (and more expensive) to introduce fundamental changes into the concept and structure of an internet course than of a traditional (because, in the case, usually one may have to change or create new video or audio recordings, update layout of several files, etc.). Another feature, perhaps the most important one, results from the very structure of the internet courses. *E-learning design asks us to define our course in new terms. No longer can we think of a course as what happens in a particular room during certain hours of the week.* ([6] p. 358). The nature of a distance classes results in the separation of the teacher's actions from the learner's work. Virtually all the course elements: organization, learning objects, teacher's and learner's activities should be designed separately. Of course the project must consider certain relations, but taking into account the simple fact that the teacher is not in a position to control student's activities, it must not be assumed that they will carry out all works in the same order as assumed by the teacher. This is especially noticeable in those courses, where an asynchronous method prevails. The course designing procedure, proposed in this paper, takes into account the above named assumptions.

1. DESIGNING PROCESS OVERVIEW

The process of designing an internet course, which takes into account the specificity of this form of teaching, can be divided into three stages which must be carried out one after another.

Stage I: to determine the general educational objective and to select an appropriate type of the course. The course type is determined by its organization (the proportion of stationary to

internet classes), the communication mode (first of all it must be defined whether the course will be teacher-conducted or self-educational) and the access to the materials (i.e. the course schedule must be determined).

Stage II: to work out the course content so as to ensure the reaching of the generally assumed educational aims and objectives. Moreover it is necessary at this stage to divide the material into units corresponding to the course type determined at the stage I, and to determine the methodology and standards of learners' progress assessment.

Stage III: to design blocks, i.e. parts of the distant course corresponding to a lesson of a classroom course. The design of each block must take into account the block structure, that is the positioning and presentation mode of the material, the teacher's actions and (expected) learners' reactions.

The process of designing an internet course as described in this paper is formulated in the form of a procedure rather than in the form of general rules as in [10], and it is a modification of the procedure described in [2] supplemented with block designing guidelines.

2. DETAILS OF E-COURSE DESIGN

2.1 Designing template of e-learning course

Each internet course can be characterized by three attributes: organization, i.e. the proportion of stationary to internet classes, the communication mode defining who, when, with him and why will communicate during the course, and the structure defining the ways of students' access to the course materials [9]. All these attributes and hence the course type are set basing on the didactic aim, course purpose and the budget assigned for the course preparation and conducting.

In the first step it should be determined whether all the contents and skills required by the general educational objectives can be taught over the internet. If it is not possible for the students to learn certain skills at an internet course (as for example it is necessary to have the access to an appropriate workshop or laboratory and reagents not available in home conditions), then blended learning must be organized. This happens most of all in case of teaching of vocational and practical skills. Features making recognizable those topics, which cannot be taught in an online course, are characterized in [3].

The decision on the course communication mode depends first of all on the course purpose and budget. The best choice from the point of view of teaching effectiveness is full communication with the participation of the teacher, but this is also usually the most expensive yet the least flexible solution. Taking into account the course purpose, another, didactically equivalent solution (see 2.3.3) can be indicated.

The access to the materials determines the course general structure. Two extreme cases are: time structure: the materials are made available to the learners at precisely defined time limits, and self-studying: all materials are made available at the start of the course, and the learner decides by himself in what order and when he makes use of them. Between these cases various topical structures are contained where the student gets the access to all or some of the subjects, but within each subject he moves along the didactic path planned by the course

designer. Such courses are prepared mostly for people supplementing their knowledge of the given subject.

2.2 Designing the content

Designing the content presented in an online course must also be based on the general didactic aim. On this ground, the scope of the presented knowledge is determined together with specific notions, facts and skills which will be taught during the course. The elements to be taught at classroom meetings should now be defined (if blended learning is planned), and the remaining material should be divided according to the type of the planned course. If the course is of time nature, the division should take into account the learner's work time in subsequent intervals, while when it is subject-divided, then of course the material distribution rules must reflect the discussed topics. At this moment it is worthwhile to determine the logical sequence of the presented materials.

Another important element of designing the content is to determine the points of assessing the students' level of mastering the knowledge, and the assessment mode (both, formative and summative).

2.3 Designing of blocks

There are no lessons in the traditional meaning in an internet course. On the other hand, it is impossible to imagine a course without any division of the content. The division usually results from the construction of the course as a whole. For example, it is possible to assume that an e-course, where the students get access to new materials, new problems and new quizzes every week, a lesson is the whole of materials made available during the week. It is far more difficult to define a lesson in an internet course which does not have a time structure. It is always possible, however, to divide according to subsequent subjects. Regardless of the division principle, we will use the term 'block' for the equivalent of a lesson in a distance course, and we will consider that it has unambiguously determined limits (time limits according to dates of granting access to subsequent modules, subject limits according to topics discussed in the materials, organizational, according to subsequent html pages, and graphical, according to general course layout).

2.3.1 Block construction

The general block construction does not necessarily have to be identical throughout the course, however if certain level of uniformity is maintained, it will be easier for the learners to navigate through the course and to select materials to study. In this context however, the block graphical layout is far more important than the arrangement of its elements.

The layout should assist in presenting the logical structure of the whole block. The hierarchy of element discrimination and marking of standard elements (like e.g. problems, discussion fora) must be planned uniformly in the whole course. A well-planned block allows also flexible placement of materials. This refers to the order, in which the learning objects will be placed in the whole course, to suggest the learners in what order they should get acquainted with the material, although it is not certain that they will not change this order.

2.3.2 Learning objects description

The main part of each block are learning objects. The specification of each learning object must be determined when designing a course block. Such specification should contain information necessary to design and build this object and to position it in the course in the appropriate place and manner. Hence the description should contain the scope of the contents

discussed in each object as well as its form (text, static graphics, animation/video, audio, link, interaction, forum, simulation etc.). Moreover the method of presentation of this element in the course should be defined. The object may be shown directly (i.e. displayed at the opening of the block/course) or indirectly (requires an additional selection and may open in the browser new window). Each of these presentation ways has certain didactic advantages and disadvantages. Objects shown directly will certainly be noticed by all students, while selectable elements may be omitted or ignored. On the other hand, direct presentation may concern only small objects, or otherwise they will make navigation difficult. Hence it seems reasonable to present directly only trailers of the most important materials to encourage the learners to study them.

Another, similarly important element to appear in the description of each learning object is its influence on the didactic process. For example, the component of the Moodle platform, *the lesson*, allows such organization of the material, that the learner may pass further only when he gives correct answer to test questions. In case of a wrong answer, the platform directs the learner to the same or other elements (depending on the project of the education path). So this course element introduces certain possibility of teacher's (course designer's) control of the learners' work, actually performed by the system. It is hence possible to plan the course of the learning process, but it must be remembered that it is not possible to make student open defined material and pass the whole planned path. The student may arbitrarily select learning objects, bypass them, give up studying after a brief survey etc.

2.3.3 Teacher's actions

In internet teaching, the teacher may appear in different forms, as a person or avatar (a virtual teacher) – a special software imitating standard behavior of an ordinary teacher. In certain conditions, the teacher's role may be played by the properly prepared system or e-learning platform (see [8], Difference 4). In all of these possibilities, the repertoire of possible actions is similar, practically depending first of all on the type of communication assumed in the course, precisely whether the course is conducted by a real man or only by the computer system.

Standard teacher's actions, especially the most important ones: to present the learning objects, assigning homework and assessing the solutions of the problems and quizzes may be performed by the e-learning platform under the condition that all the problems are closed (for example tests of selection, putting elements in order, matching, determining the truthfulness of sentences etc.). Defining these activities, positioning them in the course structure, and task scheduling belongs to the course designer, so he plays the role of the teacher in this scope.

Learning content is usually presented by the means of learning objects. Their form, position in the course and display mode also conceal some teaching methods. This first of all relates to the giving methods, e.g. a text file with the right structure or a video recording realizes the method of lecture, while a hypertext (a text with internal links) corresponds to a talk. Active teaching methods may be automated, too. For example simulations performed by the learner under control of specially made software also can take place without the presence of a teacher (human).

The list of activities which cannot be performed by the system or an avatar is very short, but is usually very important for the quality of teaching. Such activities can however be planned only when the course type includes teacher's communication with the participants. Many factors must be taken into account when deciding upon the participation of a teacher in the

course. The most important are: course purpose (e.g. a training usually does not require teacher's help), the course distribution method (e.g. a course with a teacher must have subsequent editions: a group of students begins and ends the course at the same, precisely predefined time), and the course costs (it is more expensive to build a course without a teacher, but later the running costs are marginal, while a course with a teacher is less expensive in the beginning, but later the costs of teachers depend on the number of participants).

Actions specific for a human teacher's are: participation in a discussion forum (including possible assessment of learners' statements), moderating over the forum, individual tutorials and assessment of open problems. The last seems to be the most important task performed by a teacher in an internet course (apart from its creating). To increase the effectiveness of teaching, all open problems as well as blogs, participants' files, group assignments etc. should not only be assessed, but also commented, what cannot be automated. All teacher activities listed here are pre-defined by the course components: including a discussion forum effectively results in planning teacher actions (as a discussion leader or just a moderator), including an open problem requires the action of assessment and sending a return comment to the student etc.

2.3.4 Students' activities

All assignments given during the course are made by the students practically without the teacher's presence what means that they can be treated as homework: the teacher has no influence on when, where and how the learner will be doing it.

Students' activities may be divided into two groups. One of them is performed with the use of a computer. Here the most important activities are: listening, watching and writing own statements (participation in fora discussions, solving open problems and quizzes, and also non-verbal expressions like graphics are also included in this group). These activities are planned by placing suitable materials on the platform or links to selected web sites. Additional educational activities performed with a computer, that is the use of computer software (standard or specialized, like e.g. simulations, educational games) and searching may be planned as open problems, where the solution consists in sending the search results (in the form of e.g. links to web portals or software files) to the teacher.

The other group of internet course student activities contains work done without a computer. These are tasks, which have to be made in the physical world, and work documentation and/or conclusions and observations must be sent to the teacher. The plan of such activities should contain four elements: instructions for making the assignment, the method of result recording, the result format and the method of transfer to the teacher, and also the organization of the technical assistance for the students [1]. Of course, each such activity appears in certain context, so it must be preceded by an introduction exposing the position of the problem in the discussed subject and accompanied with theoretical discussion and teacher's comments (these elements can be provided before or after the instructions for assignments).

2.4 Designing of learning objects

When creating learning objects you start in much the same way as with traditional courses by defining the gap and the audience, deciding what must be trained and what can be supported rather than trained, determining the learning approach and media(s), and identifying the terminal learning objectives. This is the point at which the process begins to differ. ([7] p. 16).

In [7] the author pays attention only to technical and economical aspects, focusing on learning object reusability, that is on such design that would make learning objects applicable again in another context. However the differences in relation to materials for traditional classes are in fact much deeper, since learning objects must contain also certain teaching techniques. This is especially true for courses made available as self-learning manuals and conducted in asynchronous mode. The design of learning objects exceeds, however, the framework of this paper. The information can be found in literature (e.g. [6], [11], [4], [5]).

CONCLUSION

E-learning course design process presented in this paper: the design of a template, preparation of the learning objects and construction of blocks is not a complete algorithm to make internet courses. It is rather a check-list: a list of steps to perform to get a full blueprint of an e-course meeting the pre-assumed educational objectives. On each step decisions must be taken from which consequences for next steps result. It may happen that earlier decisions make the correct accomplishment of next steps impossible. Should this be the case, one must of course back out and take another way.

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APPLICATION OF DATA MINING TECHNOLOGIES FOR MODELING LATENT RELATIONS BASED ON TERRORIST INCIDENTS IN CONTEXT OF SYNTHETIC SOCIAL NETWORKS

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Abstract: *Spread of terrorism threat over the world is more than obvious during last years. Terrorism attacks have been practiced by a wide array of organizations or groups for achieving their objectives. We can include political parties, nationalistic and religious groups, revolutionaries, ruling governments or others. Due to this fact the need of observing and discovering relations and rules of behavior based on terrorism incidents becomes very important. The authors of the paper present the usage of data mining techniques like clustering methods or association rule mining methods for discovering and representation of latent and potentially useful relations in the data. The purpose of the paper is to model synthetic social network based on relations obtained from the data about terroristic incidents to found new, often latent or unexpected characteristics and patterns of the data.*

Keywords: terrorism incidents, modeling latent relations, data mining, association rules mining, social network analysis, community analysis, behavior.

INTRODUCTION

Data mining is the analysis of observational data sets used to find unsuspected relationships and to summarize the data in novel ways that are both understandable and useful to the data owner [8]. Data mining is commonly a multistage process of extracting previously unanticipated knowledge from large data collections, and applying the results to decision making [2]. Data mining tools are able to detect patterns from the data and infer associations and rules from them. The development and the fundamental methods of the social network visualization were published by Freeman [4]. The extracted information can be applied in the prediction process or for construction of classification models using the relations within the data records or between the data collections. Those patterns, in Social network analysis, can be represented as patterns of groups (or communities) in social network structure and can then guide the network visualization and the study of network evolution. This type of information can be valuable in the decision making process and forecast the effects of those decisions.

The main purpose or the paper is to model synthetic social network based on relations obtained from the data collection about terroristic incidents to found new, often latent or unexpected characteristics and patterns of the data. The social network is constructed under the information obtained using two data mining techniques - association rules mining and clustering. Discovered relations based on the similar behavior were analyzed and visualized using the methods of graph theory. The latent ties in the social network were represented by the level of similarity of the objects, which was computed from the attribute analysis performed on the previous data mining level.

For the analysis was used the Global Terrorism Database (GTD) produced by the National Consortium for the Study of Terrorism and Responses to Terrorism[4]. There were published several works oriented to the visualization of the information obtained from GTD [5, 10]. But they are mainly focused on projections of database giving statistics about the part of the database from the different points of view. Our intention is not to add another statistics about the different parts of GTD, but rather to "compress" all the information available from GTD by means of what we call *typical behavior* of the individual terroristic groups, and to present the obtained issues graphically using the synthetic social network.

1. BEHAVIOR ANALYSIS

The intention of this paper is to make the comparison of the terroristic groups based on their *typical behavior*, which we model on a basis of records about terrorist attacks stored in GTD. In this chapter we formally define the expression *behavior* and in the next part of this chapter we discuss the mean of the adjective *typical* using the definitions from data mining methods, especially associate rules mining.

1.1 Definition of behavior

Suppose we have data $\mathbf{D}(\boldsymbol{o},\boldsymbol{X})$, where: $\boldsymbol{o} = \{o^{(1)},\ldots,o^{(m)}\}$ is the set of objects and $\boldsymbol{X} = \{X_1,\ldots,X_n\}$ is set of variables (attributes) and $x_i^{(j)}$ are values of *i*-th attribute measured on *j*-th object, formally[5] $X_i : \mathrm{o} \to \hat{n}_i$ is mapping defined as $X_i(o^{(j)}) = x_i^{(j)}, \forall i \in \hat{n}_i, \forall j \in \hat{m}$ (we do not restrict $\hat{n}_i$ to be a set of natural numbers – it can be any finite set of categories as every set of categories can be mapped to a set of natural number – we use $\hat{n}_i$ just for simplification of notation)[6].

To form groups of objects which we want to compare, we choose one attribute X_z (let's call it *z-attribute*) from $\boldsymbol{X}$, which we use to separate objects from data $\mathbf{D}$ into classes. We assume that all attributes are mapped into finite sets of categories, so we can select X_z arbitrarily.

The rest of the attributes from $\boldsymbol{X}$, attributes $X_{i_1},\ldots,X_{i_k}$, $\boldsymbol{i} = \{i_1,\ldots,i_k\}, \mathrm{i} \subset \hat{n}, k \in \hat{n}, z \notin \mathrm{i} \wedge z \in \hat{n}$, (let's call these attributes *i-attributes*), we use to create model of a group behavior based on frequency of occurrence of individual values of i-attributes of objects belonging to corresponding z-category (let's call them *i-categories*). We can inspect these relations with question "How are objects from individual z-categories distributed over i-categories?" These numbers can be obtained by means of contingency table and with normalizing them by frequency of corresponding category from $\hat{n}_z$, so we get distribution of z-category over i-categories. This distribution can be consequently compared with corresponding distributions of other z-categories.

Generally speaking as behavior of z-category $cat_z \in \hat{n}_z$ we understand distribution of this z-category over all i-categories. Formally:

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[4] Global Terrorism Database, START, accessed on 30 January 2011

[5] We use notation $\hat{n} = \{1,\ldots,n\}, n \in \mathbf{N}, \hat{n} \subset \mathbf{N}$ (i.e. $\hat{3} = \{1,2,3\}$).

[6] It implies that attributes with continuous (infinite) domain needs to be categorized before starting the process described in next chapters.

Definition 1:
Let $i \in \hat{n}, z \in \hat{n}$, $i \neq z$, **D**(***o***,***X***) are data in form of),. *Behavior of category* $cat_z \in \hat{n}_z$ *over category* $cat_i \in \hat{n}_i$ is mapping $B_{\mathbf{D},X_z,X_i} : \hat{n}_z \times \hat{n}_i \rightarrow [0,1]$ defined as

$$B_{\mathbf{D},X_z,X_i}(cat_z, cat_i) = \frac{\left|X_z = cat_z \wedge X_i = cat_i\right|_{\mathbf{D}}}{\left|X_z = cat_z\right|_{\mathbf{D}}}, \quad (1)$$

where $\left|Cond\right|_{\mathbf{D}}$ denotes number of objects from data **D** satisfying condition *Cond*.

To investigate these relations among categories of more than two attributes (i.e. among X_z and more than one i-attribute) we formally define behavior of z-category $cat_z \in \hat{n}_z$ over set of i-categories $cat_{i_1} \in n_{i_1}, ..., cat_{i_k} \in n_{i_k}$ as:

Definition 2:
Let $\boldsymbol{i} = \{i_1, ..., i_k\}, \mathrm{i} \subset \hat{n}, k \in \hat{n}$, $z \notin \mathrm{i} \wedge z \in \hat{n}$, **D** are data in form of),. *Behavior of category* $cat_z \in \hat{n}_z$ *over categories* $cat_{i_1} \in \hat{n}_{i_1}, ..., cat_{i_k} \in \hat{n}_{i_k}$ is mapping $B_{\mathbf{D},X_z,X_{i_1},...,X_{i_k}} : \hat{n}_z \times \hat{n}_{i_1} \times ... \times \hat{n}_{i_k} \rightarrow [0,1]$, defined as:

$$B_{\mathbf{D},X_z,X_{i_1},...,X_{i_k}}(cat_z, cat_{i_1}, ..., cat_{i_k}) = \frac{\left|X_z = cat_z \wedge X_{i_1} = cat_{i_1} \wedge ... \wedge X_{i_k} = cat_{i_k}\right|_{\mathbf{D}}}{\left|X_z = cat_z\right|_{\mathbf{D}}}, \quad (2)$$

where $\left|Cond\right|_{\mathbf{D}}$ has the same meaning as in Definition 1.

The distribution for the individual z-categories over all i-attributes together differs, even if both z-categories behave equally over both i-attributes separately. This implies that to compare properly behavior of z-categories, we need to compute not only behavior over all i-attributes separately, but also we have to compute behavior of z-categories over all subsets of i-attributes. So together we need to compute behavior of $\binom{n-1}{k}$ matrices for every $k \leq n-1$, and for every z-category. One matrix has $\prod_{l=1}^{k} n_{i_l}$ elements, so we can express number of elements #B_z(**D**) of all behavior matrices as $\#B_z(\mathbf{D}) = \sum_{k=1}^{n-1} \sum_{\{i_1,...i_k\} \in \overline{\binom{n}{k}} \wedge (\forall j \in \bar{k})(i_j \neq z)} \prod_{l=1}^{k} n_{i_l}$ for one z-category,

where $\overline{\binom{n}{k}}$ = all *k*-tuples from $\hat{n}$, $k \in \hat{n}$ (i.e. $\overline{\binom{3}{2}} = \{\{1,2\},\{1,3\},\{2,3\}\}$). This number grows very rapidly with increasing *n* and n_i. Due to this fact, it is not very efficient to compute all the values of behavior to compare individual z-categories. More efficient way is to compute only *typical* elements of behavior, which is discussed in the next section.

1.2 Association rules

To extract association rules, we used framework of *observation logic*, which underlies one of the earliest methods for the extraction of general rules from data, called General Unary Hypotheses Automaton (GUHA) [1]. We used quantifier called *founded implication* (noted as $\Rightarrow_{s,\theta}, s, \theta \in (0,1]$), which is defined by means of {0,1}-valued function $\mathrm{Tf}_{\Rightarrow_{s,\theta}} : \boldsymbol{N_0^4} \rightarrow \{0,1\}$ defined on data **D** for rule in form of $Ant \Rightarrow_{s,\theta} Suc$ as

$$\mathrm{Tf}_{\Rightarrow_{s,\theta}}(a,b,c,d) = \begin{cases} 1 \text{ iff } \dfrac{a}{a+b} \geq \theta \wedge \dfrac{a}{a+b+c+d} \geq s \\ 0 \text{ else.} \end{cases} \quad (3)$$

where $a = \left|Ant \wedge Suc\right|_{\mathbf{D}}, b = \left|Ant \wedge \neg Suc\right|_{\mathbf{D}}, c = \left|\neg Ant \wedge Suc\right|_{\mathbf{D}}, \quad d = \left|\neg Ant \wedge \neg Suc\right|_{\mathbf{D}}$ (we can observe that $a+b+c+d = m$ always holds for data **D**. This quantifier is valid exactly for those data for which the conditional probability *p*(*Suc*|*Ant*) of validity of *Suc* conditioned on *Ant*, estimated with the unbiased estimate $\frac{a}{a+b}$ is at least θ, whereas *Ant* and *Suc* are simultaneously valid at least the proportion *s* of the data [6].

As behavior $B_{\mathbf{D},X_z,X_{i_1},\ldots,X_{i_k}}(cat_z, cat_{i_1},\ldots,cat_{i_k})$ is defined by (2), we can see that formula $X_z = cat_z \Rightarrow_{s,\theta} X_{i_l} = cat_{i_l} \wedge \ldots \wedge X_{i_k} = cat_{i_k}$ is valid, if and only if

$$B_{\mathbf{D},X_z,X_{i_1},\ldots,X_{i_k}}(cat_z, cat_{i_1},\ldots,cat_{i_k}) = \frac{\left|X_z = cat_z \wedge X_{i_1} = cat_{i_1} \wedge \ldots \wedge X_{i_k} = cat_{i_k}\right|_{\mathbf{D}}}{\left|X_z = cat_z\right|_{\mathbf{D}}} \geq \theta$$

and $\dfrac{\left|X_z = cat_z \wedge X_{i_1} = cat_{i_1} \wedge \ldots \wedge X_{i_k} = cat_{i_k}\right|_{\mathbf{D}}}{m} \geq s.$

We can use this important relation between value of $B_{\mathbf{D},X_z,X_{i_1},\ldots,X_{i_k}}(cat_z, cat_{i_1},\ldots,cat_{i_k})$ and validity of rule in form of (3) with quantifier $\Rightarrow_{s,\theta}$ to filter very efficiently amount of values of *B* which we will compute, by setting parameters *s* and θ, solving problem of extremely large amount of values determined by $\#B_z(\mathbf{D})$. By setting those two parameters for filtering we also define the meaning of term *typical behavior*. By setting parameter *s* closer to 1 we filter low frequented combinations of all categories (z-category and i-categories) and with setting parameter θ closer to 1 we filter low values of behavior B, focusing rather on values (combinations of i-categories) that are frequent for individual z-category than less frequented combinations of i-categories.

1.3 Experiments

In our experiments, we have set parameter *s* equal to 5 (as absolute value) to filter less frequented occurrence; the second parameter θ was set equal to 30% (as relative value) to filter low frequented occurrences related to frequency of z-category. For the demonstration, we have used GTD records that represent the terrorist accidents occurred during the year 2001. This selected data set contained 1403 records describing the terrorist accidents of 112 known terrorist groups $\hat{n}_z$. Each record was described by 122 attributes (***X***) (see chapter 1.1). We have done two experiments to compare how the social network may change if we select various attributes from the dataset. For the first experiment we have chosen 8 attributes, for which we have extracted 2005 rules. In the second experiment there was selected 12 attributes, for which were extracted 9252 rules. For the extraction of the association rules we used the last implementation of Lisp-Miner system [11], which is the project that implements the most part of GUHA method.

2. SOCIAL NETWORK MODEL

A social network (SN) is typically a set of people or groups of people with similar pattern of contacts or interactions such as friendship, co-working, or information exchange [12]. Social networks are usually represented using graph theory (with graphs), where nodes represent individuals or groups and lines represent relations among them. [3]. These graphs can be directed or undirected, depending on the type of the relation between the linked nodes. To designate different interaction strengths, there can be assigned weights to the links (edges) between the nodes. Using other additional information (often not directly related to the interactions, e.g. behavior), we can construct synthetic social networks, where the relations between the nodes can be represented by the similarity of this kind of information (e.g. similar behavior).

2.1 Discovering latent relations

From the previous data mining level related to the extraction of the association rules, we have constructed vector for every z-category from values $B_{\mathbf{D},X_z,X_{i_1},\ldots,X_{i_k}}(cat_z, cat_{i_1},\ldots,cat_{i_k})$, for those rules in form of $X_z = cat_z \Rightarrow_{s,\theta} X_{i_l} = cat_{i_l} \wedge \ldots \wedge X_{i_k} = cat_{i_k}$, which were valid for selected parameters s and θ (i.e. we ordered in vector values $B_{\mathbf{D},X_z,X_{i_1},\ldots,X_{i_k}}(cat_z, cat_{i_1},\ldots,cat_{i_k}) \cdot \mathrm{Tf}_{\Rightarrow_{s,\theta}}(a,b,c,d)$). By this we have created set of n_z behavioral vectors, from which we created Similarity matrix $S = [0,1]^{\bar{n}_z \times \bar{n}_z}$ using Cosine measure for computing the similarity $s_{i,j}$ between two objects $o_i \in \hat{n}_z$ and $o_j \in \hat{n}_z$ (terrorist groups) [7]:

$$s_{i,j} = \frac{\sum_{k=1}^{n} o_{ik} o_{jk}}{\sqrt{\sum_{k=1}^{n} o_{ik}^2} \sqrt{\sum_{k=1}^{n} o_{jk}^2}} \quad (4)$$

2.2 Visualization of social network model

Model of the synthetic social network was obtained using principles of graph theory. The model was constructed with the undirected weighted graph $G = (O, E)$ where O is set of objects (terrorist groups) from the Similarity matrix and E is set of edges, which represent relations between them. The weight of the edges is defined using the similarity measure $s_{i,j}$. The initial graph contained 33 nodes with 528 edges (which represents one large connected component). For discovering significant communities with similar behavior we processed the edge filtering and graph partitioning based on the selected level of edge weight > 0.6. For the visualization of the SN model was used the algorithm Force Atlas. The visualization was provided for both experiments with different number of selected attributes characterizing the similar behavior of the terrorist groups (see section 1.3). In the Table 1 there are presented parameters of both obtained graphs after the filtering and the graph partitioning.

	Experiment 1	Experiment 2
Attributes	8	12
Extracted rules	2005	9252
Nodes before filtering	33	33
Edges before filtering	528	528
Nodes after filtering	12 (36,36%)	17 (51,52%)
Edges after filtering	66 (12,5%)	136 (26,73%)
Number of communities	5	4
Modularity	0.6875	0.594

Table 3. Graph Parameters.

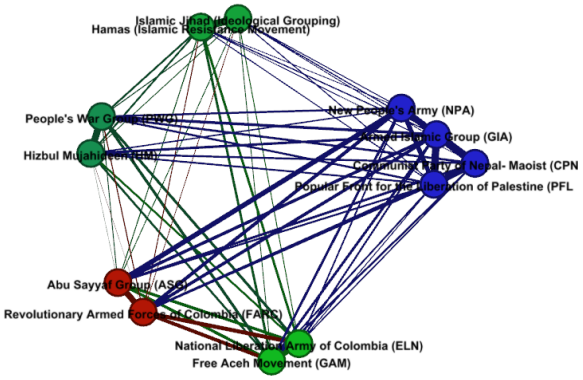

Figure 2. Synthetic SN for 8 attributes.

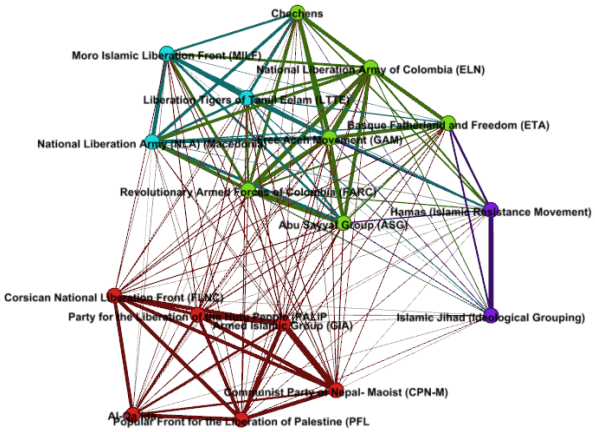

Figure 3. Synthetic SN for 12 attributes.

On the figures 1 and 2 we can see the visual representation of the models of synthetic social networks constructed from the GDT database for the year 2001 using the open-source software Gephi. The first graph was obtained for the 8 selected attributes, the second for 12 attributes. Both graphs show communities of terrorist groups with similar behavior. The width of the edges represents the strength of the relation (based on value of similarity) between terrorist groups. From both graph we can see, that the community detection can be influenced by the selection of appropriate attributes (which can depend on the user requirements).

CONCLUSION

The paper is oriented to the modeling of the synthetic social network based on the similar behavior of the terrorist groups extracted from the data collection GDT. The expression of typical behavior was formalized using the association rules mining method; the similarity between the terrorist groups based on their typical behavior was then analyzed and visualized using the methods of the graph theory. As an example there were processed two experiments with the different amount of selected attributes and two models of the synthetic social network were presented. The obtained graphs showed that the proposed data mining method is effective and can facilitate the orientation in the large amount of the extracted association rules.

The extracted information can be applied in the prediction process or for construction of classification models using the relations within the data records or between the data collections. This type of information can be valuable in the decision making process and forecast the effects of those decisions. The proposed model then can be helpful in the identification process of the attacker or known terrorist group in the situations, when incident occurs. Due to the higher time-consuming computational complexity of the association rules extraction for particular terrorist groups, it would be suitable to use parallel agent approach. This approach could facilitate the generation of more association rules during shorter time as well as more detailed description of terrorist groups, if necessary. In the future work we intent to visualize the evolution of the obtained synthetic social network model.

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PRACTICAL SUGGESTIONS FOR EFFECTIVE IMPLEMENTATION OF E-LEARNING AS A MEANS TO INCREASE STUDENT ENGAGEMENT IN THEIR OWN LEARNING

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Abstract: *This paper presents specific e-learning activities that were tailored to meet the needs of upper-intermediate to advanced EFL students at the University of Defence, but carry, by all means, potential implications for instruction across the university curriculum. Based on data collected through questionnaires, semi-formal interviews and classroom observation, teaching plans were adjusted to incorporate innovative computer-based tasks. A variety of activities were introduced to teach both general and Aviation English; including, but not limited to, participation in a social networking system or publishing online articles. The methodology and specific activities, including limiting factors and the outcome, will be discussed.*

Keywords: student motivation, generation Z, Wikipedia, video tutorials, social networking systems, Twitter, web 2.0.

INTRODUCTION

By the time students are admitted to a university, they have often studied English as a foreign language (EFL) for more than eight years. Motivating somebody who has literally "seen it all" in terms of methodology is undoubtedly one of the most challenging tasks for an educator. Various studies were published on using technology as a situation saving omnipotent tool; and indeed, many instructors still want to hope that the sole use of technology itself will provide the desired result of motivating a student to learn. While that might have been true several years ago, students now often use technology on a more regular basis than educators, and on a wider scope, too. In addition, educational institutions often poorly adapt to the ever-changing world, and "the majority of web-based learning available presently is simply an extension of traditional classroom instruction, which suffers from fundamental flaws." [1] In other words, an interactive grammar exercise is still only a grammar exercise, and it would be inane to hope that students will not be able to notice.

A certain way to attain the same staggering pace as the current technology development is to follow the latest trends. If students are to be provided with meaningful activities they also find enjoyable, their present online and computer-related interests are to be explored thoroughly. At a quick glance, generation Z (people born in 1990's) "is highly connected; many of this generation have had lifelong use of communications and media technologies such as the World Wide Web, instant messaging, text messaging, MP3 players, mobile phones and YouTube, earning them the nickname 'digital natives'. No longer limited to the home computer, the Internet is now increasingly carried in their pockets on mobile Internet devices such as cell phones. A marked difference between Generation Y and Generation Z is that older

members of the former remember life before the takeoff of mass technology, while the latter have been born completely within it." [2]

For that reason, just implementing technology in teaching will not do for increasing student motivation. Use of technology is no longer a motivating "treat", it is a must. It is content that should be put in the center of attention: do the student favorite online pastimes have a teaching potential? How can they be used in the classroom? For the purpose of this article, the following examples were selected: Wikipedia, social networking systems, YouTube videos and other sites offering online tutorials.

1. THEORETICAL BACKGROUND

1.1 Wikipedia

It is highly likely that all college students have heard of, and used, Wikipedia, an online encyclopedia which has been expanding with astonishing speed. "Wikipedia's promise is nothing less than the liberation of human knowledge - both by incorporating all of it through the collaborative process, and by freely sharing it with everybody who has access to the internet. This is a radically popular idea. Wikipedia's English-language version doubled in size last year and now has over 1m articles. By this measure, it is almost 12 times larger than the print version of the Encyclopaedia Britannica. Taking in the other 200-odd languages in which it is published, Wikipedia has more than 3m articles. Over 100,000 people all over the world have contributed, with a total of almost 4m "edits" between them. Wikipedia already has more "visitors" than the online *New York Times*, CNN and other mainstream sites. It has become a vital research tool for huge numbers of people. And Wikipedia is only five years old." [3]

According to Wikipedia, 365 million readers turn to Wikipedia for reference. Educators often call for a proof of Wikipedia's reliability on the grounds of its openness to collaborative, or even anonymous editing, but that seems to be Wikipedia's advantage. In fact, the traditional fear of Wikipedia held by many academic workers has been a basis for its frequent critical comparison to other encyclopedias, such as Encyclopaedia Britannica. The most famous case took place in 2005, when a panel of independent experts thoroughly inspected selected parts of Wikipedia and Encyclopaedia Britannica for the Nature journal, and came to a conclusion that "Wikipedia comes close to Britannica in terms of the accuracy of its science entries." [4] Several other comparative studies were conducted, which congruently agreed that Wikipedia provided similar accuracy than its commercial equivalents. [5]

1.2 Social Networking Systems

Social networking has become a worldwide sensation. The popularity of such social networking systems (SNS) as Facebook or Twitter has been on a steady rise, and can be well explained by a famous quote by Michael DiLorenzo, Senior Director of Social Media Marketing and Strategy and Business Communications for the NHL: "Social networks aren't about websites. They are about experiences."

Facebook offers its users the possibility of sharing personal information, pictures, uploading other files, and even play social network games, which have become a phenomenon on its own. At present, there are more than 200 million active users who share more than 30 billion

links, pictures, and other content items every month. [6] In recent years, numerous studies were published on positive effects of self-presentation on Facebook on user's self-esteem, usually coming to a conclusion that "in addition to evidence that online self-presentations are especially positive presentations, recent research in computer-mediated communication (CMC) suggest that online self-presentations can become integrated into how we view ourselves, especially when the presentations take place in a public, digital space. This phenomenon, known as identity shift, demonstrates that self-presentations enacted in online space can impact users' self-concepts. [7]

The success of Facebook remains unprecedented, but Twitter microblogging service keeps gaining popularity, too. It can be undeniably attributed to the fact that it only allows users post short messages, or tweets (up to 140 characters), which makes it a perfect social network tool for mobile phones. Typically, users set up their Twitter page and select friends they will follow. Their tweets will be displayed as "streams" of short messages on the user's individual Twitter home page. "These social awareness streams (SAS), as we call them, are typified by three factors distinguishing them from other communication: a) the public (or personal-public) nature of the communication and conversation; b) the brevity of posted content; and c) a highly connected social space, where most of the information consumption is enabled and driven by articulated online contact networks." [8]. The act of following someone does not necessarily need to be reciprocal, which provides an additional advantage: users can for example easily follow presidents or astronauts on the International Space Station without spamming them with tweets. Users can also directly reply to other people's tweets by using the @ symbol (and thus start an ongoing chat), or "retweet", i.e. repost a tweet they like. Furthermore, there is a possibility of sending a message to a particular person (one that will not be seen by other users).

Even though social networking might be viewed as a purely leisure activity, caution should be applied when exercising judgement. So called "Twitter Revolutions", in which Twitter was used to organize mass protests, have had enormous influence on the current political situation. Twitter played a critical role in 2011 Egyptian protests, 2010 – 2011 Tunisian uprising, or 2009 – 2010 Iranian election protests, to name a few. [9]

1.3 YouTube and Online Video Tutorials

YouTube, "a place to to discover, watch and share originally-created videos", is a phenomenon which does not need to be introduced. YouTube is a fine example of the philosophy of Web 2.0. According to statistics, more than 2 billion videos are viewed per day, and 24 hours of video recording is uploaded every minute. [10] As in the previous case, what was originally meant for sharing personalized contents, in this case homemade video clips, is now widely used for educational purposes. Numerous tutorials can be found on YouTube, often in a format of picture presentations (commented picture slideshows).
Lesser known, but no less significant, is the Khan academy with its pursuit to deliver free high quality education to anyone interested. It's founders claim that "What started out as Sal (Khan) making a few algebra videos for his cousins has grown to over 2,100 videos and 100 self-paced exercises and assessments covering everything from arithmetic to physics, finance, and history." [11] The contribution of Khan academy is enormous, as it already managed to deliver stunning 41,398,504 lessons and boasts such elite students as Bill Gates' children. [12]

2. STATUS QUO: RESULTS OF CLASS QUESTIONNAIRES

To explore the present state of student's use of technology and map their specific habits, I distributed questionnaires to a total of 25 of my students and conducted several semi-formal interviews. The results have confirmed my initial hypothesis: only 8% of students claim not to have an everyday internet access. A significant number of students (64 %) possess a "smart phone" (i.e. a phone with an operating system), and use it, among other things, to access internet. A considerable number of students also classed themselves as regular Facebook users (92%), while only 4% use Twitter. All of them report using Wikipedia to obtain information. From the results presented above, it can be summed up that most students not only have everyday access to the Internet, they also learned to resort to it for information and for social networking. Majority of them will not hesitate to do so via their mobile phones. That offers a vast potential ground for instruction.

Furthermore, the results also indicate that a sizable proportion of the respondents (72%) are used to being instructed by YouTube video presentations and online tutorials. They also consider watching a film or a documentary the best way of learning about a particular subject (52 %), closely followed by just reading about it (44%). Therefore, it is not surprising that when asked, vast majority of students (64%) also recommended "watching movies" as the most suitable way of learning a given list of new words, as opposed to making word lists (28%), paper flash cards (4%) or computer programs (4%). This, however, might indicate that they simply like watching films, and are unaware of the methodological substance of the question itself. Based on classroom observations from their first semester, even when granted online access to all classroom materials, encouragement to study on their own, and regular feedback, students rarely turn into enthusiastic and autonomous learners. The findings are in line with conclusions of Fiona A. Robertson, President of the International Civil Aviation English Association, who made the following remark on learner's autonomy: "You have to be very motivated to learn alone. The responsibility for learning is returned to, or one could say, put upon, the student. For those who have had a very conventional education which often consisted of memorising what the teacher or the textbook said, being asked to take the learning initiative oneself can be very disorienting." [13]

In semi-formal interviews, students were calling for activities that were "fun" while at the same time "forcing them to learn". As much as absurd it may sound, it is not an oxymoron. It was hypothesized they wanted the teacher to decide for a specific learning plan and activities for them and then let them provide their own meaningful content. An ideal teacher was often described as a directive facilitator, deciding for them and often pushing them to their boundaries, while still providing tremendous amount of support. That is why I chose several challenging and even venturesome activities, few of which I am going to describe here: picture and video presentations, digital flashcards, publishing online articles and Twitter.

3. IMPLEMENTING ACTIVITIES

3.1 Picture and Video Presentations

Picture presentations were incorporated into the syllabus based on Robertson's conclusion that teaching pronunciation to aviation personnel should be one of the priorities. In her article on teaching aviation English, she calls for "particular emphasis on stress and rhythm as well as the sounds that transmit badly and are difficult for the language group being taught." [13]

Students were asked to follow a given outline to create a picture presentation of one of the aircraft that has been used by the Czech military. Their task was to find pictures and specific information about the aircraft (manufacturers, variants, specifications, common incidents etc.) and combine it all in a narrated video. They were not recommended a specific type of software to do so – it has been assumed they are able to search for possible options and chose whatever software suits them most. Their picture presentation was to be submitted together with a tapescript.

When all the picture presentations were collected and checked, students were asked to exchange their picture presentation with one of their classmates. Their task was to listen for pronunciation mistakes and mark them in a provided tapescript. (To make sure they are ready to handle such a task, students were given a lecture on common pronunciation mistakes Czech learners do.) The teacher then added few more remarks on how to improve the particular student's pronunciation and handed the tapescript back to the student. For most students, that was their first opportunity to listen to their own spoken production and having somebody closely analyze the sounds they make. All students were rather hesitant when asked to listen to their own recorded voice, but realized the utmost usefulness of such a task and agreed it should be performed repeatedly during their studies.

Video presentations, when students were asked to prepare and deliver a powerpoint presentation in front of the class, were recorded via webcam. Video presentations were originally intended as a form of peer learning support – recorded presentations were to be used as learning materials. They were to be uploaded and shared in our learning management system, Moodle, where they would be accessible to all the students in the class (only), which would follow a tried and tested model of Youtube online tutorials or Khan academy. However, based on my colleague's warning that a video clearly showing a particular soldier should not be made public, even in the closed environment of a classroom, I opted for another task. Students were still recorded, but instead of uploading the video on the internet, it was saved on their flash drive.

The students then downloaded an assessment sheet with a rubric, watched their video presentation and assessed their own performance. The assessment sheet was supplemented with additional questions leading students to analyze for instance their body language, structure of their presentation, atmosphere they created in the classroom, or language mistakes they had made. Both the student and the teacher were filling in the assessment sheet for a particular video presentation, and then they compared their findings. The student was subsequently provided with advice on what to improve. Even though we were not allowed to use recorded video presentations as shared video tutorials, students still agreed that it was one of the greatest lessons they have learned.

3.2 Publishing Online Articles on Wikipedia

Even though all the students in question use Wikipedia, none of them contributes to it. The reasons range from lack of time to low academic self-esteem, but the most often mentioned one was respondent's insufficient knowledge of English. Luckily, that problem can be easily overcome by publishing on Simple English Wikipedia. As the title suggests, primary target audience of Simple English Wikipedia are learners of English as a foreign language. The language of the articles is to be simple; however, it does not apply to the content. There are nearly 70.00 articles at present, ranging from every day topics to applied and natural sciences, and the number is growing. Simple English Wikipedia is an incredibly powerful tool; as it

allows students to publish articles online, and teaches them how to write in Simple English, which has been an ever-growing trend in technical branches. AECMA (European Association of Aerospace Manufacturers) and AIA (Aerospace Industries Association) had launched development of simplified technical English as early as in the 1970's to ensure universal readability of maintenance documentation. Needles to say, it has been rewritten and updated to near perfection and is still used to ease up the work of professionals all over the world, both non-native and native speakers of English. [14]

When announced that they are to publish an article on Wikipedia, most student react with a mixture of cautious laughter and sheer horror. It is one of those tasks they never imagined they would be doing. The most common objection is, without exception, their insufficient level of English. Fortunately, as Simple English Wikipedia itself instructs writers of Simple English pages, "Your article does not have to be perfect, because other editors will fix it and make it better" [15]. Indeed, owing to Wikipedia's unique philosophy, an article is usually a result of collaborative effort, which is a rather relieving discovery for most students. A routine workflow includes a student studying the rules on how to write a Simple Wikipedia article, writing a final draft of a technical article, uploading it on the internet (alternatively, he or she may simplify an elaborate text), and then sending the teacher the link. In contrast to a regular writing assignment, the Wikipedia article then "lives its own life" and the student may (and often does) observe it. Addition of hyperlinks or pictures by strangers – editors - have been observed in student articles in time as short as one week. The mere fact that their article "is alive" - and that other people find it worthy to such an extent that they keep on working on it - is both satisfying and extremely motivating for students of English as a foreign language.

Taking everything into consideration, it can be concluded that the task was successfully implemented. Based on experience, the only thing to keep in mind is that students need to log on before submitting their article, otherwise their article might be deleted by editors (e.g. it might be proclaimed as advertisement). For that reason, it is advisable to require students to keep a backup copy of their article.

3.3 Twitter – Use of a Social Networking System

Rather controversial, yet most satisfying internet-oriented experiment which was chosen, was the use of Twitter. As mentioned earlier, most students had already experience using SNS (social networking systems) via Facebook. In this respect, they do not differ from their American peers. According to a recent study on cyberpsychology of college students, "the average amount of time spent on Facebook ranges from 30 minutes to over 2 hours daily. " [16]

Owing to the fact that most students already have Facebook accounts where they share personal information that they certainly would not wish to become a part of English instruction, I opted for a social network they are not using – Twitter. The students were asked to accept the "20-day Twitter challenge" – they were to contribute one tweet a day on Twitter. The objective was to create an informal environment where they could connect to their peers, as opposed to the formal classroom one. The students were instructed that the content of their tweets would not be limited, as long as English was used. Furthermore, they were promised that they would be encouraged to cancel their accounts after the end of the task if they find no value in their use of Twitter. In spite of the fact that the students were not taught how to sign up or use Twitter, they quickly navigated in the environment (it took them about 10 minutes to send their first tweet and to start "following" their classmates).

To circumvent common concerns of those who avoid social networking (cybersecurity, loss of privacy), students were not forced to enter their personal information. Several of them chose not only nicknames, but also fake names. Such approach has been described before in the 'rational actor theory'. "This theory maintains that people use the various features of different forms of communication technology strategically to meet their communication needs rather than technology itself determining people's behaviour. Therefore, in this case, young people are inclined to use the specific features of each type of technology to their best advantage." [17]

Furthermore, the students soon managed to make use of the attractive side of Twitter. Their tweets evolved from posting links to entertaining or educational English videos (and following their favorite personalities or institutions on Twitter), to replying to other classmates' tweets, and gradually posting their opinions or statuses. In the beginning, the 140-character limitation was hypothesised to be motivational, as it did not put excessive workload on students, but soon the students were complaining they were not provided with sufficient space to express their ideas, and often wrote in several subsequent tweets. Translated to didactics, a rare event occurred: they were calling for more space to use English in their free time, on everyday basis. On day four, they had already managed to create a working online forum, filled with attractive English content. In only five days there was no discussion about the usefulness of Twitter as a valuable complement to traditional classroom instruction. Strangely enough, the students who were most vocal about being made to Twitter at the beginning were the ones with most positive contributions in the end, posting up to 50 tweets a week, and replying to almost anybody who asked for help or simply tweeted. Once again it has been proven that students raised on Web 2.0 find it natural to provide content to webpages.

CONCLUSION

In conclusion, there is no doubt that information technology offers substantial advantages over traditional methods of instruction. Even though truly and undisputably meaningful use of informational technology still remains questionable, the author believes that students can be effectively motivated and taught by incorporating current day trends in the instruction. Based on world trends and results of studies on cyberpsychology, several complex and challenging activities have been implemented in the classroom environment to improve student performance and confidence. The following activities were all tried with success: picture presentations, video presentations, Twitter and publishing online articles on Simple English Wikipedia. However, further research needs to be conducted before final conclusions are drawn.

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USE OF E-LEARNING IN IMPROVING TEACHERS' COMPETENCIES IN THE AREA OF COMPUTER SCIENCE

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Abstract: *This article describes key considerations of the Project called "Use of e-learning in improving teachers' competences in the area of computer science". The author focuses in particular on such conceptual aspects and assumptions of the project, as the project objective, the overall aim of the project, specific objectives of the project: identification of the target group, results of the project: hard outcomes and soft outcomes, and other issues. The Programme of the project will be executed within the framework of PO KL (Program Operacyjny Kapitał Ludzki, Human Capital Operational Programme), Task 9.4. in Silesian Region. The author, throughout her scholarly career, has gained extensive experience of use e-learning in teacher training through participating and coordinating domestic and international projects, relating in particular to the use of the e-learning platform of the Faculty of Ethnology and Sciences of Education at the University of Silesia (http://el2.us.edu.pl/weinoe).*

Keywords: e-learning, computer science, teachers' competences, project, Human Capital Operational Programme, post-graduate studies, training courses.

INTRODUCTION

The global transformation from industrial to information society as well as social and economic changes taking place both in Poland and other European countries have necessitated reforms in many areas of government responsibility. In this respect, the priorities include reforming the education system involving the implementation of modern educational technologies and modes of tuition.
Distance learning, thanks to such advantages as flexibility, ease of access, modular character, quality, cost-effectiveness, state-of-the-art technology, large audiences, social balance, global reach, the new role of the teacher, positive effect on the learner, has become a leading mode of tuition and instructional technology practically at all levels of the education system.

1. PROJECT OBJECTIVE

The timeliness and importance of the implementation of distance education, including school and teacher training in information technology and e-learning is accorded due attention in the following documents - programmes, ordinances and concepts:
1. MEN (*Ministerstwo Edukacji Narodowej, Ministry of National Education)*: A strategy for development of education in rural areas for 2007-2013 (draft);

2. MENiS (*Ministerstwo Edukacji Narodowej i Sportu, Ministry of National Education and Sport*): The concept of implementation of the distance learning system in Poland. Warsaw, June 2005;
3. MENiS: Operational Programme "Education and Competencies" for the period 2007-2013;
4. MENiS: Ordinance of the Minister of National Education and Sport of 7 September 2004 on the standards of teacher training (Journal of Laws No. 207, item 2110);
5. MENiS: Standards for the preparation of teachers in the field of information technology and computing. Document prepared by the Council for Education and Media, August 2003;
6. MENiS: Education Development Strategy for 2007-2013, August 2005;
7. MENiS: Strategy for development of continuing education by the year 2010, 8 July 2003.

Attention should also be drawn to the problem of unemployment, which in respect of a profession such as the teaching profession, which is feminized, largely affects women. Hence the need for implementation of this project, whose overall objective will be to provide appropriate skills and qualifications to 260 teachers in kindergartens, primary, middle and upper secondary schools who work and / or reside in the province of Silesia. 81% of the teachers will be women (210 persons) and 19% will be men (50 persons), which reflects the distribution of teachers by gender in Silesia, where out of the total number of 56 353 teachers, 46 141 are women (source: information and documents developed by Poland's Office for National Statistics "Education in the 2008/2009 school year"). The project is also expected to contribute to improving the situation of women in the labour market and in the teaching environment.

On the other hand one can observe the lack of education market offers which would satisfy teachers' educational needs in terms of the acquisition and development of competences in the area of information technology and distance learning.

Postgraduate studies in *"Information technology education in schools", "E-learning in the development of key competencies of students'"* as well as training in the form of improvement courses such as *"Teacher as a creator of the school's educational space in the Internet or how to launch and manage an educational portal?", „E-learning in the teaching profession", „Multimedia in improving the quality of teaching and educational process"* should be able to fill the gap in the current offering of educational services in the Silesian Province.

1.1 The overall aim of the project

The overall aim of this project is multi-fold:

- to adapt the qualifications of teachers, vocational training instructors and administrative staff of educational institutions to the requirements related to the strategic directions of development of regions, changing fields of education, to the need for new skills and changing demographic situation in the school system.
- to adapt the qualifications teachers in the Silesian Province to the requirements associated with demand for new qualifications in the field of informatization of education and the changing demographic situation in the school system.
- to improve the employment situation in the Silesia region.
- to prepare university graduates who, after completing post-graduate studies will take up employment in vocational schools in positions consistent with their qualifications etc., to teach school subjects with the use of innovative forms, methods, technology based on e-learning.

- to develop highly qualified personnel, prepared for effective, successful formation and development of students' key competencies.

1.2 Specific objectives of the project

In the case of postgraduate studies *"Information technology education in schools"* teachers acquire competence in the field of ICT and computer science and qualifications to teach those subjects at all levels of education (primary school, middle school, high school).

After completing the post-graduate studies *„E-learning in the development of key competencies of students'"* teachers acquire competence in the field of ICT and e-learning to use information technology and distance learning in the process of teaching, especially for the development of key competencies of students. University programmes will help to ensure preparation of teachers to use e-learning in the development of students' key competencies, including:

I. Planning, organizing and evaluating their own learning by students.
II. Communicating effectively in different situations.
III. Effective coordination in the team.
IV. Solving problems in creative ways.
V. Efficient use of the computer.

Training in the form of improvement courses such as *"Teacher as a creator of the school's educational space in the Internet or how to launch and manage an educational portal?"*, will prepare participants to perform the duties of a CMS study administrator (Content Management System - Mambo, Joomla, Drupal, Wordpress) and will allow for fast deployment, configuration and administration of an educational portal or other thematic portal, a school web site or an educational institution web site.

The training course *"E-learning in the teaching profession (distance learning using MOODLE* (Modular Object-Oriented Dynamic Learning Environment) *system)*" will prepare participants to act as a tutor (a distance teacher), an author of distance courses and an administrator of a support system in distance education (as shown by CLMS (Content Learning Management System).

The training course *"Multimedia in improving the quality of teaching and educational process"* will allow preparation of teachers for effective, purposeful use of media to improve the quality of the educational process and will fill the gap in the current offering of educational services in the Silesian Province.

The proposed post-graduate studies and training courses will help improve the competence of students in the use of innovative forms, methods, learning technologies, especially technologies for distance learning, as one of the most adequate and modern technologies, tailored to the needs and challenges of information society in the development of key competencies of students; development of theoretical knowledge and practical skills in information technology and e-learning.

1.3 Compliance with the objectives of the Human Capital Operational Programme. Plan of Action.

The main objective of the project is: to ensure full utilisation of the potential of human resources by preparing high qualified teaching staff having relevant professional qualifications to meet the challenges of the knowledge society, being ready to teach, mentor and develop students and their key competencies, to allow for employment growth and growth in the potential of enterprises and their employees, for increasing education level of society and reducing areas of social exclusion.

The objectives of the project are in line with the objectives of PO KL, set out in the programme, which is a response to the challenges that the renewed Lisbon strategy has put before EU Member States, including Poland. The challenges include: making Europe a more attractive place for investment and work, developing knowledge and innovation, and creating more jobs that are sustainable. In accordance with the Lisbon Strategy and the objectives of cohesion policy pursued by EU countries, the development of human and social capital contributes to a fuller utilization of labour resources and to an increase the competitiveness of the economy.

Striving for effective human resource development, the project focuses on the following areas: employment, education, social integration, development of adaptability of workers and issues related to the development of human resources in rural areas, effective and efficient public administration at all levels, implementing the principles of good governance and the promotion of employee health.

The project objectives are consistent with the objectives of PO KL, which is a response to the challenges posed by the Lisbon Strategy. These include making Europe a more attractive place to work, to develop knowledge and creating a larger number of sustainable jobs. The project contributes to the objectives of PO KL, by increasing the use of the full potentials of human resources, the preparation of highly qualified teaching staff, qualified, professional education and development of key competencies in the classroom and reducing areas of social exclusion.

The objectives established for this project are in line with European, national and regional strategy documents (and sectoral ones). The project objectives are part of the CSG (Community Strategic Guidelines) in terms of increasing investment in human capital through better education and skills (1.3.2), as well as one of the priorities of the NSRF (National Strategic Reference Framework) - "Increasing educational level of society and improving the quality of education." The project is also a response to the recommendation contained in the National Action Plan for Children 2004-2012 entitled "Ensuring the quality of education." These objectives are consistent with the objectives of PO KL, and regional education policies and targets of the Province Development Strategy. Silesian Region for 2000-2020 ", because the project will contribute to the creation of “a region with a well developed and accessible education system at all levels, ensuring high quality education and adapted to the needs of the labour market." Objectives are in line with the Action Plan for Human Capital IX priority for 2010, assuming a feasible project type:

1. Postgraduate studies, qualifying and supplemental courses for teachers, consistent with local and regional educational policies (including preparation for teaching a second subject or type of classes);

2. Postgraduate studies, training courses and other forms of improving the qualifications of personnel of lifelong learning, practical and vocational education institutions and of vocational instructors;
3. Higher education programmes and qualifying courses for teachers intending to improve or supplement their education;
4. Postgraduate studies and supplemental courses for teachers and educational administration in the organization, management, financing and monitoring of educational activities;
5. Retraining programs for school teachers in connection with the changing demographic situation (other than educational) with a view to pursuing lifelong learning (adults).

The project is directly addressed to teachers and faculty members at duly licensed schools and educational institutions, public primary, middle and upper secondary schools, vocational instructors, administrative staff and management education in schools and educational establishments and their founding bodies, residing and / or working in the Silesian Province.
In accordance with the objectives of the education reform and the concept of the transition to a knowledge society, every teacher should be a teacher of information technology and have competence in the field of distance learning. It is expected that the group to be trained will number 260.

The final beneficiaries will be primary school pupils and students of middle schools and upper secondary schools.

2. STAGES OF THE PROJECT

Recruitment will take place in April 2011. This is the most appropriate time because of the interest of listeners and the possible completion of the necessary formalities related to participation in the project. Recruitment will be conducted with all standards and rules that apply to the University of Silesia, which guarantees efficiency and reliability of operation.

April 2011 - Recruitment
Recruitment will be conducted in accordance with the rules and standards adopted by the U.S.. University staff will pursue it to ensure their efficiency and reliability of operation. In connection with the operation of the recruitment process it will be necessary to purchase relevant office supplies.

September 2011 - December 2012 - Implementation of the curriculum of postgraduate studies
A total of 185 hours of lectures, 2100 hours of practical lessons, laboratory lessons, including the use of e-learning. The duration is three semesters.

The project content includes three groups of subjects. The first group - these are general subjects, whose goal is to improve teachers' general pedagogical and humanistic competencies (learning theories, ethical, cultural and legal aspects of use of ICT in the educational process, teaching computer science and e-learning and competence in mathematical statistics). The second group - these are subjects related to the development of skills in using ICT tools and resources. The third group comprises subjects related to the methodology of teaching computer science, information technology and computer-aided instruction (higher education ICT programmes) and e-learning (running a distance learning platform, its management, development of distance courses, resource utilization, conducting lessons in remote mode),

including the formation and development of students' key competencies in the case e-learning programmes.

The teaching staff will include members of the Faculty of Ethnology and Sciences of Education, University of Silesia, Faculty of Informatics and Materials Sciences, with special focus on computer science, information technology and distance learning specialists.

High quality teaching will be ensured by laboratory classes in computer labs for groups of 10 students. The remote mode used to teach some of the classes (50%) will allow for flexible and flexible participation of the audience - active teachers attending postgraduate programs.

The classes will be held at the Faculty of Ethnology and Sciences of Education in Cieszyn, University of Silesia in Katowice and Faculty of Informatics and Materials Science in Sosnowiec, University of Silesia in Katowice.

May 2011 - May 2012 - Implementation of the program courses
A total of 30 hours of lectures and 780 hours of laboratory classes. The duration of the first edition of the course is three weeks. The training course *"Teacher as a creator of the school's educational space in the Internet or how to launch and manage an educational portal?"* - 40 hours (10 lectures, 30 lab. lessons), 60 participants (6 gr.* 10 pers.)

The training course *"E-learning in the teaching profession (distance learning with the use of the MOODLE CLMS)"* - 70 hours (10 lectures, 60 lab. lessons), 60 participants (6 gr .* 10 pers.)

The training course *"Multimedia in improving the quality of teaching and educational process"* 50 hours (10 lectures, 40 lab. lessons), 60 participants (6 gr. * 10 pers.)

The teaching staff will include members of the Faculty of Ethnology and Sciences of Education, the Faculty of Informatics and Materials Science University of Silesia with special focus on computer science, information technology and distance learning specialists.
High quality teaching will be ensured by laboratory classes in computer labs for groups of 10 students. The remote mode used to teach some of the classes (50%) will allow for flexible and flexible participation of the audience - active teachers attending postgraduate programs.

April 2011 - December 2012 - Project management and promotion
Management and promotion are a necessary frame of the project, allowing for its proper implementation. University of Silesia faculty members who are overseeing the project will be responsible for co-ordinating the project and managing individual programmes and the course as well as for technical and accounting services. There are plans to purchase materials promoting the funding source as well as office supplies that will be distributed among students. In order to ensure broad interest in the project and its products it is intended to place advertisements in regional newspapers and arrange for putting up advertising billboards. Information on the project will also be presented on the homepage of the University of Silesia and in the pages of individual faculties involved in the project.

September 2011 - December 2012 - Monitoring and evaluation of project quality
The project is scheduled to be evaluated at its inception, during implementation and upon completion, by means of surveys among students and listeners as well course participants. Their aim is to assess the level of output indicators and hard and soft outcomes. The surveys

will focus on the rationality and effectiveness of the classes and increases in competence in the teaching of information technology and informatics, e-learning and computer-aided teaching.

3. PROJECT RESULTS

3.1 Hard outcomes

"Hard outcomes" are clearly definable and quantifiable results that are achieved through participation in the project, such as obtaining a qualification, finding work, or securing a place on a course. In contrast, "soft outcomes" represent intermediary stages on the way to achieving a hard outcome. They could include, for example, improved communication skills, time management skills, personal attributes such as improved self-confidence.

The following hard outcomes will be achieved by the project:
1. The number of students undertaking education at postgraduate level: 80.
2. The number of participants taking training courses: 180.
3. The number of participant graduates of postgraduate studies: 80.
4. The number of participants successfully completing the courses: 180.

The following tools will be used to monitor the outcomes:
- list of candidates accepted for postgraduate studies, drawn up after the recruitment;
- list of candidates to be course participants;
- the beneficiary's own data, records, diplomas;
- attendance list of participants of individual activities (programmes and courses);
- a list of people attending e-learning courses.

In achieving those outcomes the following products will be instrumental:
1. Publishing an academic textbook.
2. Design of the 15 distance courses.
3. Creation of 2 postgraduate studies.
4. Creation of 3 training courses.

1.	The number of students undertaking education at postgraduate level **(**including 65 women and 15 men**)**	80
2.	The number of participants taking training courses **(**including 145 women and 35 men**)**	180
3.	The number of participant graduates of postgraduate studies **(**including 65 women and 15 men**)**	80
4.	The number of participants successfully completing the courses **(**including 145 women and 35 men**)**	180

Table 1. Hard outcomes to be achieved by the project.

3.2 Soft outcomes

The following soft outcomes will be monitored on the basis of monitoring carried out: ex-ante, mid-term and ex post amongst students and course participants. This will allow for the assessment of the teaching process, of the utility of competence acquired and development of students:
1. The number of persons competent in the field of information technology, IT and e-learning: 260.

2. The number of people with increased opportunity for career advancement: 260.
3. The number of people with increased motivation to work and raised self-esteem: 260.
4. The number of people with a reduced risk of unemployment: 260.

Achievement of these outcomes, which reflect the results of the comprehensive programme of activities outlined in the project, will contribute to achieving the overall objective, through specific objectives of the project, because:

- it will provide the ability to acquire knowledge and skills in information technology, IT and e-learning to 260 persons;
- it will directly improve the situation with the development of key competencies of students in the province as it will increase the number of properly trained teachers;
- it will allow for use, by teachers, of e-learning at work: the use of ICT in the teaching-educational process and in improving their skills;
- it will allow for training 210 women to improve their labour market situation in the Silesian region.

CONCLUSION

The University of Silesia, in order to meet the expectations of the modern economy seeks to disseminate public education at all educational levels, while increasing the quality and attractiveness of the offered educational services and their link with the needs of a modern economy. Projects implemented by the University of Silesia are aimed at the systematic and well thought-out improvement of the potential of the university, at enhancing the educational facilities and infrastructure supported by scientific research activities, improving the competence of teaching staff, enhancing the attractiveness of the programmes of key importance for the economy and strengthening the relationship between science and the economy. The Project entitled „*Use of e-learning in improving teachers' competences in the area of computer science"* is addressed to teachers all over the Silesia region, aiming to resolve some problems associated with unemployment in the region as well as raise the level of innovation in the educational system through the active implementation of e-learning at all levels of education and improving qualifications of teachers in the Silesian province.

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THE MONITORING METHODOLOGY AND INDICATORS OF BEHAVIOUR OF DISTANCE LEARNING STUDENTS GROUP

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Abstract: *Main objective of this paper is to define and introduce the basic methodology for monitoring of the performance (rather success) of distance learning students. In addition to defining the methodology, paper should answer questions such as whether and how the success of students depends on their age, type of school they have graduated, time elapsed since graduating from secondary school, whether it is possible to predict in advance the success of students admitted to the first year of study, whether the success of distance learning students corresponds to the population curve, etc. As input parameters author used statistical data describing the behaviour and the success of distance learning students at The Silesian University in Opava, School of Business Administration in Karviná and other statistics published in scientific and professional publications and on Internet.*

Keywords: distance learning, e-learning, population curve, development in number of distance learning students, indicators of quality.

INTRODUCTION

One of the main objectives of all economically and socially advanced societies is to provide education to all who want it. Appropriate way how to promote this objective is the support and development of distance learning and it´s special form e-learning. Distance learning became standard and very popular form of education. This form of study is very popular for students aged from 18 to nearly 55 years. In terms of age, this is a very broad target group in which are people who graduated different schools, have different professions, different skills and different time options for study.

General, this group is very diverse and has a specific behaviour. Behaviour of this group may be described by a number of parameters, which are based on statistical measurements, calculations and social development. On the one hand, calculated parameters describe the current state of the selected group, on the other hand, based on calculated parameters we can predict the behaviour of other groups over time. Correctly defined, measured and calculated parameters are able to help us to predict, inter alia, the development of number of students in the coming years.

At universities, all data about students are stored in the information systems and information systems are the basic and sole source of actual and relevant information. Generally, information systems should include the tools to provide up to date statistical data describing the behaviour of specific groups of students. In many cases, systems do not contain these tools and obtaining the data is time-consuming. For purposes of this article, the data were obtained from the information system STAG, which is an information system at The Silesian University in Opava.

It is clear, there is no comprehensive theory dealing with this issues. All universities calculate their own statistics that are presented at various conferences. But statistics are not sufficient and it is generally necessary to take into account many other contexts. The main objective of this paper is to present a proposal for the monitoring of target groups of distance learning students and to find possible dependences of development over time.

1. DISTANCE LEARNING AND E-LEARNING

Over the past 10 years, distance learning was being developed very quickly. It depends on the growing interest in this type of study and social and global development. Generally, world needs constantly improve the level of education and thus increase the knowledge potential for further development. One way is just to allow the study to all who wish to. There are many synonyms used for Distance Learning, such as Distance Education, Distributed Learning, or Remote Education. Distance learning is an education where [2] the teacher and students are separated by distance (this distance could mean different classrooms in the same school or different locations thousands of miles apart), the instruction is delivered via print, voice, video, or computer technologies, and the communication is interactive in that the student receives support and feedback from the teacher. The feedback may be immediate or delayed. In some cases, especially on the website, distance learning and e-learning are defined the same (for example in [5]), but it is not correct. E-learning is a subset, rather e-learning is one of the methods of distance learning. Generally, e-learning is the unifying term to describe the fields of online learning, web-based training, and technology-delivered instruction [4]. Unfortunately, we must not forget that many of the promises of distance learning are financial in nature. Universities hope to save money by delivering education to students that are unable to attend classes because of time or distance. Despite the promises and obvious advantages to distance learning, there are problems that need to be resolved. These problems include the quality of instruction, hidden costs, misuse of technology, and the attitudes of instructors, students, and administrators. Each one of these has an effect on the overall quality of distance learning as a product. [6]

1.1 Distance learning and e-learning at School of Business Administration in Karviná

At The Silesian University in Opava, School of Business Administration in Karviná (hereinafter SU OPF), distance learning has a long tradition. Distance education is provided in the traditional form but also through e-learning. Distance study runs throughout the duration of the faculty (1990), e-learning from 2004 (based on project of Ministry of Education, Youth and Sports in Czech Republic). SU OPF offers all fields of study in distance learning form, 2 in e-learning form of study. It is clear that in all types of schools, e-learning can´t be implemented only as an online education because of difficult to ensure reliable way of testing and verification of knowledge. At SU OPF distance learning and e-learning differ in the number of teaching hours during the semester. Distance learning students have lessons twice a semester and each subject has 4 lessons (4 teaching hours twice per semester). E-learning students have lessons three times per semester, and each subject has 1 lesson (so called tutorial – 3 x 1 hour per semester). Tests are offered during the examination period, and implemented in a standard way. In many cases, tests are often created with help of the special software tools (for example ToolBox Instructor) and great emphasis is placed on the quality of tests. Details on this issue (particularly in relation to the principles and options for testing) are discussed for example in [1] or [3]. The standard testing ensures the same quality output for all forms of study. In relation to the context of this paper, as a target group a group of all

distance learning students (classical form and e-learning) will be taken into account.

1.2 Number of distance learning and e-learning students

According to a survey of the Czech Statistical Office, in the Czech Republic, the total number of university students was 289 635 in 2005, 369 619 in 2008, and more then 370 000 in 2010. From the total number of students there was 68 713 distance learning students in 2005, 109 209 in 2008 and approximately 115 000 in 2010. As we can see, this is a fairly large group of students. At SU OPF from 1990 until the academic year 2005, the number of distance learning students was stable and always moving up to a maximum of 200. From academic year 2006/2007 until 2009/2010, there was a very significant increase in the number of distance learning students (Table 1). This trend has depended on the development of the whole society, the establishment of new criteria of evaluating and financing of universities and population curve.

	2005/2006		2006/2007		2007/2008		2008/2009		2009/2010		2010/2011	
	Total	**EL**	**Total**	**EL**	**Total**	**EL**	**Total**	**EL**	**Total**	**EL**	**Total**	**EL**
Number of applications	-	-	-	-	1078	605	990	439	1436	474	1404	510
Number of admitted students	-	-	-	-	552	309	783	321	1131	344	868	321
Number of enrolled students	180	165	394	160	533	298	750	299	1018	318	776	295

Table 4. Number of distance learning student at SU OPF.

As we can see from the data in Table 1 (Total – total number of distance learning students, EL – number of e-learning students), from 2005 to 2010 the number of people, who were interested in distance learning, grew steadily (beyond the small variation in the number of applications filed in 2008). Depending on this fact, a number of admitted and enrolled students has increased continuously. In this context it is necessary to ask why (in academic year 2010/2011) it was a reduction in the number of applicants and especially admitted and enrolled students and if it is a one-time deviation or start of a new trend. Due to the fact that a similar situation occurred also at other universities (number of applicants has been stagnating or slightly declining) it is appropriate to address this issue. Real reasons, why it was a decrease in number of applicants, may be dependence on the population curve and market saturation.

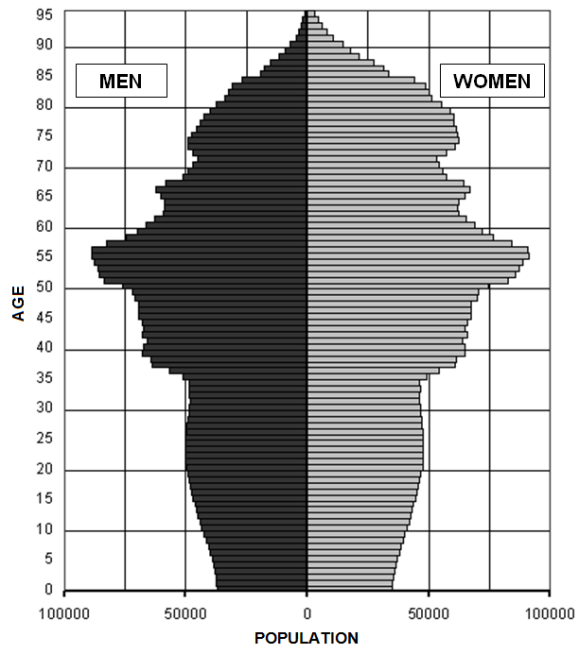

Figure 4. Population Curve in year 2030 (in Czech Republic). Source: Czech Statistical Office, 2011.

How about we all know, in 1994 in the Czech Republic, we have witnessed a small, but at that time almost revolutionary demographic events. For the first time since World War II it was higher number of deaths over births of people. Czech Republic's population curve corresponds with the European population curve. Nearly 25 percent of people in the European Union in 2030 will be above age 65, up from about 17 percent in 2005 (http://www.prb.org/). Since 2005 it has been continuous increase in the number of university students (all forms of study). After 1990, universities have accepted approximately 15% of secondary school graduates, currently it is more then 60 %. Due to the population in the Czech Republic and number of residents in different regions, the market becomes progressively saturated. Sharp increase in the number of people interested in distance learning in the years 2006 – 2010 is closely related to the population curve. Figure 1 shows the population curve in 2030 (in Czech Republic). As we can see, in the years 2005 – 2010 (move the curve back in time - about 25 - 20 years) most of the population was aged around 30 (amplitude of the population curve). Here we can see a direct link with the average age of distance learning students at SU OPF (Table 2).

	2004/ 2005	**2005/ 2006**	**2006/ 2007**	**2007/ 2008**	**2008/ 2009**	**2009/ 2010**	**2010/ 2011**
The average age of enrolled distance learning students	28	27	28	29	28	28	29
The average age of graduated distance learning students	30	29	30	31	-	-	-

Table 5. The average age of enrolled and graduated distance learning students at SU OPF.

As can be inferred from the population curve, in the following period (approximately 10 and more years), we can expect a drop in applicants for distance learning form of study, and number of applicants will be likely returned to the value from years 2006 – 2007.

1.3 Indicators of quality of distance learning students

Number of applicants for university study (generally, not only distance learning students) and the current state of market saturation is closely linked to indicators of quality. It is common knowledge that the highest percentage of students voluntarily or forced leave school in the first year of study. The same is true at SU OPF (Table 3).

	2004/ 2005	2005/ 2006	2006/ 2007	2007/ 2008	2008/ 2009	2009/ 2010	2010/2011
The first year of study	6	59	155	258	272	309	about 320 (in the winter semester)
The second year of study	10	31	98	95	50	-	
The third year of study	1	14	21	14	-	-	

Table 6. Number of distance learning students who leave SU OPF (voluntarily or compulsorily).

Success of distance learning students depends on many factors. We have to realize that most of them are people who are employed, they have their families, and generally they have much less time to study. As mentioned above, SU OPF has long experience with distance learning and e-learning. During this period, there were created quite a number of electronic courses at SU OPF. All courses have been designed to meet all conditions laid down by The Centre of Distance Education in Czech Republic. All courses are always available for students of all forms of study and are continuously updating and improving. From this perspective, it is clear that the success of distance learning students is based solely on their own abilities to learn and knowledge. If we calculate the values in Tables 1 and 2, when we are interested in decrease in the number of students in the first year of study, we get the graph in Figure 2.

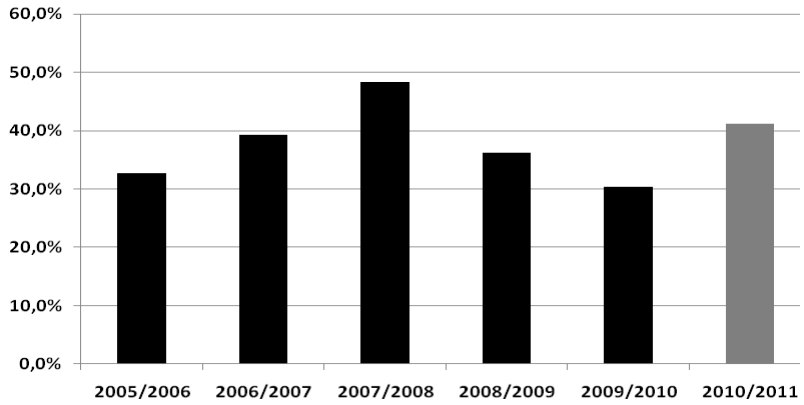

Figure 5. Percentage of unsuccessful distance learning students in the first year of study at SU OPF.

On the basis of further calculations, at SU OPF from 2005 to 2010, from the total number of enrolled distance learning students, only approximately 40% of these students successfully graduated. During the years 2005 – 2010, there was the highest increase in the number of distance learning student at SU OPF. This fully corresponds to the status of the population curve. Distance learning has opened the way for education for a greater number of people. During the years 2006 – 2007, there has been a change in the admission process (the admission process was easier mainly due to efforts to get the highest number of students). This, of course, immediately had a negative impact on the quality of distance learning

students. From 2008 admissions process has been changed again (admission process has been tightened). Despite this fact, we can see that already at the end of the winter semester of the academic year 2010/2011, 41,2 % distance learning students left the faculty (students did not make the test successfully or left faculty voluntarily during the semester). Perhaps it is entirely appropriate to ask why? Answer to this question can be found by linking several contexts. We know that a student could study in the distance learning form of study, must meet certain prerequisites. This is essentially a student's ability to study independently. Not everyone student has this ability. So although there is a base of potential students with the ability to pass entrance exams, seems to have diminished the percentage of distance learning students who are able to cope with studies. One of the other parameters that can be observed and which may affect the success of students is type of school they have graduated before. At SU OPF from 2004 to 2010, on average 24,6 % of students came from grammar schools, 41,7 % from secondary industrial schools, 13,5 % from secondary vocational school with diploma and 20,2 % from business academies and other. Of course, here again we must consider the fact that the market is increasingly saturated and there is a decrease in the number of potential students (this applies to all forms of study) with the ability to cope with university studies.

1.4 Anticipated development in the field of distance learning

To monitor the development in number of distance learning students, we need to identify indicators that have impact on this number. In this context as the key indicators may be indicated population curve, the average age of distance learning students, secondary school or another school where they graduated in the past, ability of distance learning students (existing and potential students) to study in distance learning form of study, monitor students' interest in various form of study, monitor students' interest in various fields of study, monitor the success of students in different fields of study, track the number of students within the region and the entire country. Monitoring these indicators can help all schools, and generally the whole education system to develop new approaches to assessment and planning of distance learning at universities. The data in this article presented in each table were obtained from the information system STAG. Data gathering was a very difficult and time-consuming. In this context it is appropriate to appeal to developers of information systems for universities, that information systems should be able to allow quick access to those and a number of other statistical data. It would also be appropriate that these data treats the Czech Statistical Office for the whole Czech Republic. It is clear that higher education should be improved continuously and intensity of higher education should not fall, but rather increase. Reduce in number of students in all forms of study will contribute significantly to the improvement of education. Assumption, of course, is a change in the financing of universities, the key parameter of the distribution of funds should not be the number of students. On the other hand, universities must seek a new approach to retain the possibility of distance learning for all high-quality applicants. If the university has prepared courses (rather field (-s) of study) for the e-learning, under consideration is to establish cooperation with domestic and foreign institutions and allow to study foreign students. Examples may include European Association of Distance Learning Universities (EADTU) and the European Distance Universities Contact (EduContact) that provides resources and assistance to students who are researching e-learning options in Europe. Condition is, of course, accreditation courses mainly in English and generally dealing with the issue of return on investment (ROI). In relation to all facts above, I believe that we should:

- monitor continuously a number of distance learning students as well as number of students in full-time form of study;
- know how students are successful in different forms of study;

- ask what is better for us and society as a whole, whether the high number of university graduates or „standard“ number of well educated people;
- look for new approaches to find optimal relationship between the number of students and the quality of the educational process.

CONCLUSION

In the Czech Republic, Europe and around the world, distance learning is an important form of higher education. In the coming years, demographic trends and market saturation will significantly affect the number of distance learning student (and the total number of students). Due to the creation of strategies and plans for the next period is necessary to monitor the statistical data related to number of students and look for all related parameters. Recent developments clearly show the necessary changes that will be required in the strategies and plans. For this reason there is need to monitor the behaviour of groups of distance learning students not only in schools themselves, but by statistical offices at national and transnational levels. The whole issue deserves more detailed analysis based on facts mentioned in this paper.

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GANN SYSTEM CONCEPT: A COMPARISON CONCERNING THE PERFORMANCE LEVEL IN A PATTERN RECOGNITION TASK

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Abstract: *According to literature, a major problem appearing in standard design process of artificial neural networks is to identify the optimal neural architectures which are able to learn a given task. To eliminate this disadvantage, an efficient approach can be represented by the use of GANN (Genetic Algorithm Neural Network) system concept. Accordingly, this paper is aimed to present some proper design solutions for GANN systems assuring a full-genetic optimization of some well-known neural networks namely, MLP and RBF. Finally, to obtain a comparative view as performance level of the proposed GANN systems, the optimized neural architectures have been used to solve a real pattern recognition task.*

Keywords: GANN system, artificial neural network, pattern recognition.

INTRODUCTION

According to literature, a major problem appearing in standard design process of artificial neural networks is to identify the optimal neural architectures (i.e., neural connectivity, fitting algorithm of neural weights etc.) which are able to learn a given (e.g., pattern recognition) task, [1]. Usually, the standard searching techniques are unable to solve this complex problem because of high number of constrains related to the neural network connectivity, network training procedure, concrete way to define a quantitative estimation of the neural architecture quality etc. Anyway, an interesting and efficient approach in this scientific research domain can be represented by the use of GANN system concept, [2].
The main idea related to the mixing mode between genetic algorithms (GA) and neural network (NN) theory has as starting point the encoding of the information about neural network architecture in the genome of genetic algorithm. Consequently, it can be observed that this general design (or optimization) procedure of the neural networks is one as soon as directly, and the most important problem of GANN systems consists in fact, in the finding of the specific encoding way of the network, [1]. In another train of thoughts, the study of the basic properties and the structure of GANN systems, involves the approach of some specific aspects (e.g., overfitting of the neural networks, structural-functional mapping problem, global versus local search, long genome problem, Baldwin effect etc.).
Finally, it is also very useful to mention that a lot of examples and results related to the potential applications of GANN system concept into optimization of the artificial neural network architectures are indicated in the literature, [1], [2], [3], [4]. Generally speaking, the most part of these applications are centered to genetic optimization either of network connectivity or training rule, and less on simultaneous optimization of these, [2].
This paper is aimed to present some proper design solutions for GANN systems assuring a full-genetic optimization of some well-known neural networks namely, MLP and RBF. To obtain a comparative view as performance level of the proposed GANN systems, the optimized neural architectures have been used to solve a real pattern recognition task. Therefore, in the first part of the paper a theoretical description of the methods used to obtain the architectures of the proposed GANN systems is presented. Then the design procedure for

the real training database is shortly described. In the last part of the paper, the experimental results that confirm the broached theoretical aspects from beginning are indicated. Finally, the most important conclusions are also included.
More theoretical details related to GANN systems theory can be found in [1] and [2].

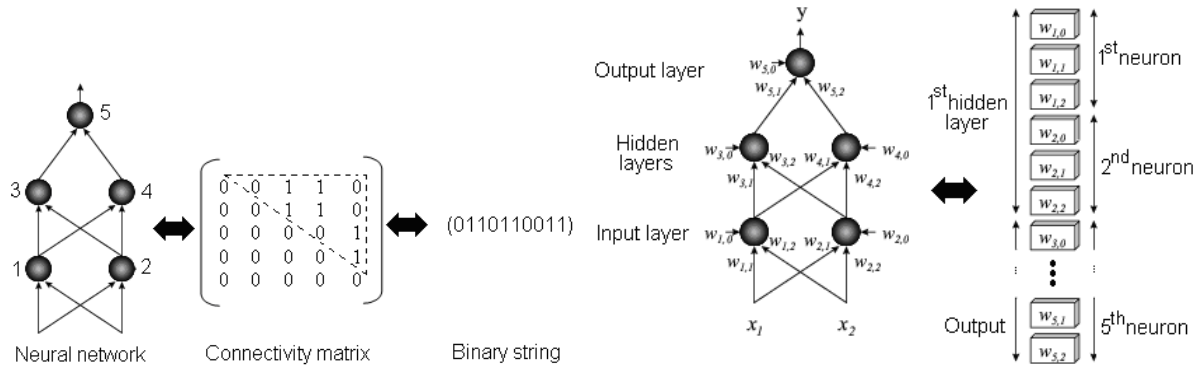
1. ARCHITECTURES OF THE PROPOSED GANN SYSTEMS

1.1 GAMLP system

To optimize both neural network connectivity and training rule of a MLP neural network, the proposed GAMLP system will contain the following two basic genetic modules:
*m*11*)* the task of the first genetic module was to optimize the connectivity (i.e., the number of the neurons, layers and neural weights) of a MLP neural network. Having as starting point in chromosomal encoding process an empirical neural topology (e.g., the neural topology resulting at the ending of the standard BP training algorithm), a binary direct encoding technique was used (Figure 1a). Finally, conserving a constant length for each chromosome, the initial population was made using a random initialization process.
The fitness function used for each chromosome evaluation was calculated according to the following equation:

$$E^{(1)} = \frac{k_1}{1+\mathrm{MSE}} + \frac{k_2}{t_c},\ k_1 + k_2 = 1, \tag{1}$$

where MSE was estimated for all training cycles, and t_c represented the medium convergence time (calculated in the same conditions). As can be seen from equation (1), the values of constants k_1 and k_2 determine the influence of each chosen performance parameter on the final value of the chromosomal fitness etc.



a) connectivity b) neural weights fitting

Figure 1. The encoding techniques used in optimization of MLP neural network.

The stopping criterion was represented by the exceeding of the maxim generation number (this number had a constant value) or when the goal error was reached. The selection of the parents for the next chromosomal generation was also made using the well-known roulette principle. The crossover supposed the use of two splitting points (randomly chosen), and each chromosome had attached a certain crossover probability with values into $[0.6, 0.95]$ range. To introduce new chromosomes inside of the current population and to protect GA against irreversible and accidental information failures generated by improper crossover operations, the mutation was also used. The mutation probability was chosen with values into

$[0.001, 0.01]$range. Generally speaking, it is known that the solution given by a genetic algorithm is encoded under the form of the most performant chromosome belonging to the last generation but in fact, nothing guarantees us that a more performant chromosome has not been already obtained Thus, using the analogy with the Gallant algorithm from neural network theory at each chromosomal generation, the best chromosome from this population will be kept into virtual pocket, [5]. Thus, after a suitable decreased order procedure, the best final chromosomal solution (i.e., neural connectivity) certainly comes up.

*m*12*)* having as starting point MLP neural connectivity which was before determined (i.e., the best chromosomal solution), the task of the second module is to optimize the distribution of the neural weights which are assigned to this. Consequently, for a suitable chromosomal representation of the neural weights, these were random initialized, and were real encoded into linear structure, so that each chromosome represents a single weights set (Figure 1b).

The fitness function used for each chromosome evaluation was calculated according to the following specific equation:

$$E^{(2)} = \frac{k_3}{1+\text{MSE}} \cdot \left(\frac{\text{maxim number of iteration}}{\text{current iteration}} \right), \; k_3 = \text{ct}, \tag{2}$$

where MSE error was estimated for all training patterns and k_3 is a calibration constant.

The stopping criterion was similar with the one used in the case of first genetic module. The selection of the parents for the next chromosomal population was also made using the well-known roulette algorithm. The continuous crossover supposed the use of two splitting points (randomly chosen), and each chromosome had attached a certain crossover probability with values into $[0.5, 0.85]$range. To introduce new chromosomes inside of the current population and to protect GA against irreversible and accidental information failures generated by improper crossover operations, the uniform mutation operator was also used. To certainly obtain the best solution offered by the proposed genetic module, a procedure quite similar with the pocket algorithm above described was implemented.

1.2 GARBF system

To optimize both center positioning and training rule of a RBF neural network, the proposed procedure contained the following two processing modules:

*m*21) the task of the first processing module was to achieve the setting parameters of RBF network $\{t_i, \sigma_i\}_{i=\overline{1,m}}$, where *m* represents the number of centers (or hidden neurons). Accordingly, the first processing module will contain the following basic steps:

*s*1) if the input training dataset is by the form $\{x_i, d_i\}_{i=\overline{1,P}}$, $x_i \in \mathrm{R}^n$ and *c* is the number (in this case, known) of the classes from the input data space, then using standard ISODATA clustering algorithm, the most natural tendencies inside of each main data cluster were determined (i.e., each main data cluster was bounded into m_i new subclusters where, $m = \sum_{i=1}^{c} m_i$). On the other hand, it can be observed that using this first preliminary grouping procedure, a deep preclustering of the input data space very useful for the next genetic optimization method, was thus obtained (Figure 2a);

*s*2) the starting chromosome population was made using a random selection of m_i vectors x_i from each class (i.e., one vector for each bounded subcluster) and finally, a suitable linear

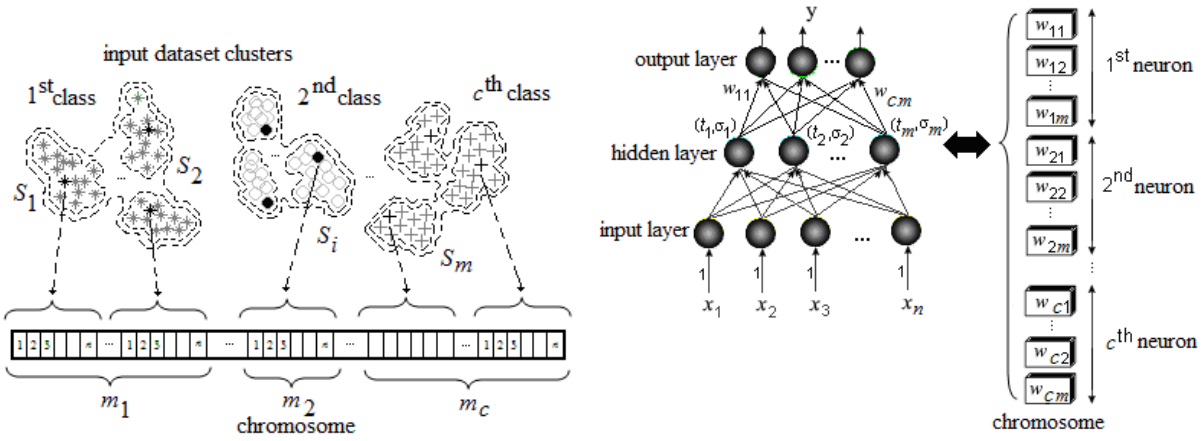
concatenation. Therefore, each chromosome had assigned m vectors $\{t_i\}_{i=\overline{1,m}}$ which are extracted from the input dataset. To achieve a proper chromosomal representation, a real encoding technique was also used. The fitness function used for each chromosome evaluation was calculated according to standard equation:

$$E^{(3)} = \left(1 + \left[\frac{1}{P} \sum_{i=1}^{P} (y_i - d_i)^2 \right]^{0.5} \right)^{-1}, \quad (3)$$

where y_i denotes the RBF neural network real output.

The stopping criterion was represented by the exceeding of the maxim generation number (this number has a constant value) or when the goal error was reached. The selection of the parents for the next chromosomal generation was also made using the well-known roulette principle. The continuous crossover supposed the use of two splitting points (randomly chosen), and each chromosome had attached a certain crossover probability with values into $[0.5, 0.85]$ range. To introduce new individuals inside of the current population and to protect GA against irreversible and accidental information failures generated by improper crossover operations, the uniform mutation operator was also used. To certainly obtain the best chromosomal solution, a method similar with Gallant algorithm was used.

After the applying of RBF centers selection procedure, $\{\sigma_i\}_{i=\overline{1,m}}$ width for each hidden neuron was calculated according to standard equation described in [1]. Because in this moment RBF setting parameters $\{t_i, \sigma_i\}_{i=\overline{1,m}}$ are known, the weigths to the output layer $\{w_{ij}\}_{i=\overline{1,c}, j=\overline{1,m}}$ will be calculated using the second module which will be below described.



a) center positioning b) neural weights fitting

Figure 2. The encoding techniques used in optimization of RBF neural network.

*m*22) having as starting point RBF network parameters which was before determined, the task of the second module was to optimize the distribution of the neural weights to the neural output layer. Consequently, for a proper chromosomal representation of the neural weights, these were random initialized, and were real encoded into linear structure so that, each chromosome represents a single output weights set (Figure 2b). The fitness function used for each chromosome evaluation was also calculated according to a similar equation with (2).

The stopping criterion was similar with the one used in case of the first genetic module. The selection of the parents for the next chromosomal population was also made using the well-known roulette algorithm. The continuous crossover supposed the use of two random splitting points, and each chromosome had attached a certain crossover probability with values into $[0.6, 0.95]$ range. By the same reasons as in case of the first module, the uniform mutation operator was also used. To certainly obtain the best chromosomal solution, a procedure quite similar with the pocket algorithm was also implemented etc.
More details related to the previous GANN systems can be found in [3] and [4].

2. DATABASE DESIGN

To add more consistency to the theoretical aspects described in the first part of the paper, the developed GANN systems were used to solve a real and complex pattern recognition task related to classification of some modern military aircrafts using their video imagery. Consequently, the networks training database was made using the real information given by a sensor in visible spectrum (i.e., a CCD camera). The structure of the acquisition and preprocessing stages used in case of video imagery is depicted in Figure 3.

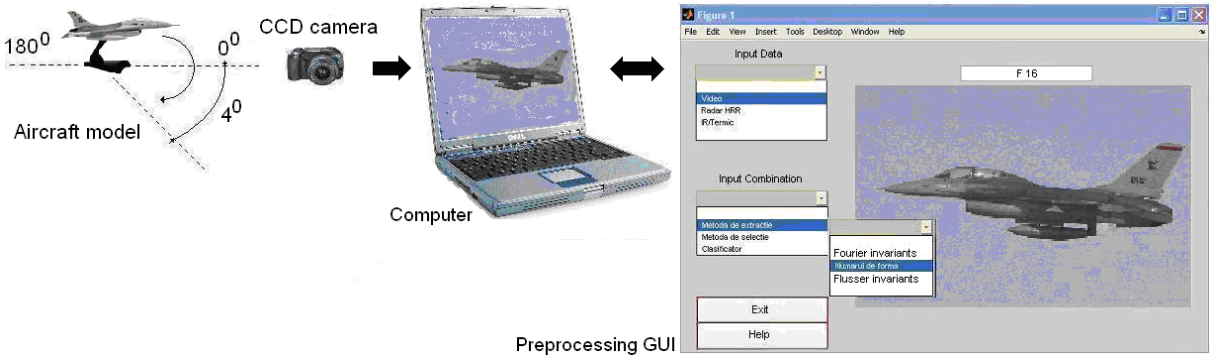


Figure 3. Basic diagram used in case of video database design.

As can be seen in Figure 3, video database was obtained using a digital photographical survey of seven aircraft models scaled at 1:48. The survey was taken using a 4^0 increment in the azimuthal plane and into an angular range of $\left[0^0, 180^0\right]$, option justified by the shape symmetry of the aircraft models. After the acquisition and preprocessing stages, a number of 46 video images/class was obtained. As feature extraction method, the modified Flusser invariants (described in [5]) were used. Accordingly, the feature vector matrix had the dimension of (11×46) for each input class. Finally, using a proper interlacing algorithm, each feature matrix was split in two parts: one used for training and respectively, one used for testing of the standard supervised neural classifiers (i.e., MLP, RBF) and GANN systems.
More details related to the design algorithm of the video image database can be found in [5].

3. EXPERIMENTAL RESULTS

The main objectives of this final experimental part of the paper were:
*o*1) to demonstrate that the use of the proposed GAMLP/GARBF systems leads to improved classification rates (CR) comparing to the case of standard supervised neural classifiers;
*o*2) to obtain a comparative (i.e., quantitative) view as performance level between above described GANN systems (using naturally, the same pattern recognition task).
Using the proposed pattern recognition task, the experimental results obtained after two comparative studies are synthetically presented in Table 1.

Classifier	Performance level and other NN training parameters	
	CR (%)	Parameters of GANN systems running
MLP with standard BP rule	91 (11:7:5:1 (117 weights), nepochs=10^3, ε_0=10^{-3}, 2.5 s)	1st GA module: maxpop=100, maxstring=117, maxgen=200, p_c=0.8, p_m=0.001, k_1=0.75, k_2=0.25 ε_0=10^{-2}, 145 s 2nd GA module: maxpop=100, maxstring=107, maxgen=200, p_c=0.75, k_3=0.8, ε_0=10^{-2}, 125 s
GAMLP system (optimized MLP)	95.2 (11:5:3:1 (87 weights), nepochs=10^3, ε_0=10^{-3}, 1.5 s)	
RBF with OLS algorithm	92 (n=11, m=10, c=7, 0.15 s, nepochs=10^4, ε_0=10^{-4}, σ=1)	1st GA module: maxpop=50, maxgen=100, p_c=0.8, ε_0=10^{-2}, 155 s 2nd GA module: maxpop=50, maxgen=75, p_c=0.85, k_3=0.75, ε_0=10^{-3}, 121 s
GARBF system (optimized RBF)	96.5 (n=11, m=14, c=7, 0.67 s, nepochs=10^4, ε_0=10^{-4}, σ=0.8)	

Table 1. Experimental results.

All applications presented in this paragraph were developed using MATLAB toolboxes *nnet* and *image processing*. To implement the proposed genetic modules, *gaot* toolbox was also used on a Pentium processor at 2.4 GHz.
More details related to the experimental part of this paper can be found in [3], [4] and [5].

CONCLUSION

The theoretical and experimental results presented in this paper lead to the following remarks concerning the efficiency and proprieties of the proposed GANN systems, namely:
*c*1) using GAMLP system, the connectivity of MLP network was pruned generally 34% at the level of hidden neurons and respectively, 26% at the level of neural weights. The CR was also increased 4.2% more than the case of standard MLP classifier;
*c*2) using GAMLP system, RBF centers mapping over input data space was improved (i.e., each significant data subcluster had allocated in this case, at least a RBF center) and thus, the number of hidden neurons increased generally 40%. Finally, the CR was also increased 4.5% more than the case of standard RBF classifier;
*c*3) generally speaking, the computing resources required to implement the proposed GANN systems are not very high because of the medium complexity of the neural networks connectivity/training algorithm used to solve the given pattern recognition task;
*c*4) in case of proposed real pattern recognition task, the best CR (96.5%) was assured by use of GARBF system and as final conclusion, both GANN systems could be used with a high level of performance (CR more than 95%) inside of modern ATR/ATTR military systems.

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EXECUTION OF COMPLEX TRAINING SOLUTION IN ACR – MULTIMEDIA 3D-ORIENTED COMPUTER BASED TRAINING AND SIMULATORS

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Abstract: *Our Company has been specialized for its whole existence on development and production of simulators and training systems. This presentation demonstrates the practice realization of complex training for vehicle Pandur. The project was realized for Czech army last year and includes computer based training (CBT) classrooms and set of simulators for collective and individual training - crew, weapon and driver simulators.*
The multimedia classroom includes learning management system, SW for classroom management and especially multimedia web based oriented courses and tests. These courses were created using highly professional tools allowing for 3D models, animations, videos, sounds and the complete design. Delivered learning management system provides planning, evaluation and records of training. Used software and courses meets open e-learning standards AICC and SCORM.
The excellent teaching aid is the easy interactive vehicle 3D model presentation.
The response from user is very positive. The complex training solution and this way of education is intelligible to students.

Keywords: simulator, training system, complex training, multimedia courses, 3D model, computer based training.

INTRODUCTION

Our Company has been specialized on development and production of simulators and training systems. Electronic learning represents an effective use of Information technologies in Training process. In modern military training centres we cannot imagine the training without multimedia and simulation parts. The complex training includes three phases. The first phase is Computer Based Training for theoretical preparation of trainees which can greatly reduce training time and costs. The second phase is the practical training on simulators. The last phase is practical training using real devices.

The training lessons are multimedia and web based oriented. This type of education is very attractive for students and lectors too, although it is hard for lesson preparation and creation.
Learning management system (LMS) iTutor controls learning and provides administration, evaluation and planning. The simulators are the second phase of complex training. They include simulators for individual and collective training.

Multimedia classroom for CBT are connected to Simulator rooms. All these things enable to lecturers provide quality training.

The aim of this paper is to give information about complex training and present example of modern multimedia training from our last project – Pandur CBT for Czech Army.

1. 1ST PHASE OF COMPLEX TRAINING - CBT

1.1 Training lessons

Currently delivered electronic courses are prepared using Learning Content Management System (LCMS) iTutor Publisher through highly professional tools - using multimedia sources such as Flash animation, 3D modelling, videos, sounds and the complete design. Courses offered by our company are oriented to attractive and educationally right presentation. The students can see all parts in 3d space. They can imagine things, his functions and operation procedures. The Czech Army got 30 electronic courses. It was twenty technical courses and ten weapon courses for Pandur vehicle training.

Figure 1. The lesson example – driver training.

The courses are running under Internet Explorer and enable:

- online training in LMS iTutor
- off-line training (CD-ROM, HDD)

Used software meets most widespread open e-learning standards AICC and SCORM. Every lesson is divided into two parts:

- Instruction
- Training

Every Instruction part contains blocks of pages with description, main parts, principles, preparation, operation, safety precautions and maintenance. Last part is the training block.

When the student's answer in training block is not correct, the system automatically jump to the page in instruction part which is relating to the question.

Figure 2. The lesson example – question in training part.

1.2 Learning Management System

Learning management system (LMS) iTutor has a unique architecture with a central database. It allows lector to manage and control learning, provide administration, evaluation and planning. The LMS system iTutor is implemented to many of languages and has modules for Administrator, Lecturers, Students, modules for electronic course creating and test creating. The system is running under Internet Explorer. iTutor is an open system supporting e-learning standards SCORM or AICC on the highest levels.

1.3 Interactive 3D model

Animations and pictures were created using detail 3D model of vehicle Pandur. The 3D model enable to developers to create pictures, animations, to simulate procedures and show everything outside or inside the vehicle. The user gave one bonus - easy interactive 3D model of Pandur. The application was designed as teaching aid for lectors.

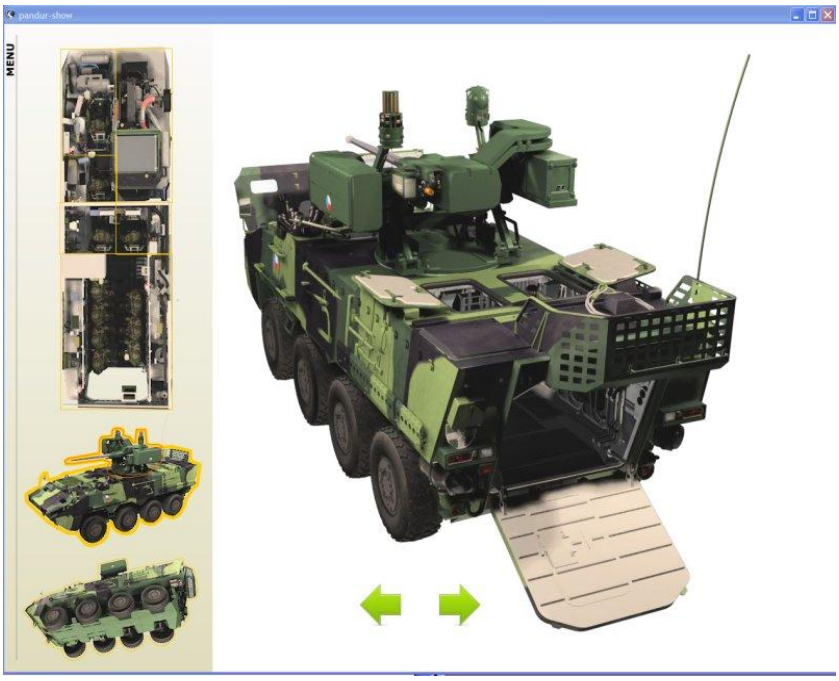

Figure 3. Pandur interactive 3D model.

1.4 Multimedia classroom

Multimedia classrooms can be configured for individual and/or group training. These classrooms make use of the latest, most up-to-date multimedia technologies, and can be connected to other training systems. The classrooms consist primarily of commercially available equipment, which reduces overhead, maintenance, and life cycle cost.
Multimedia classroom solution includes:

- Complex HW and SW solution
- SW for classroom management
- Commercially available equipment
- High-quality projection and sound systems

Multimedia classroom for CBT are connected to other training system.

Figure 4. Multimedia classroom.

2. 2ST PHASE OF COMPLEX TRAINING - SIMULATORS

2.1 Simulator training

The simulators are the light replicas of real vehicles on the electrical motion base. The computing system includes special computers for visualisation. The visualisation system use virtual terrain databases, 3D models and special effects. Instructor operation station controls and evaluates all training. The system of Pandur simulator includes:

- Driving simulator
- Crew simulator
- Gunnery simulator
- Combat and weapon simulator

Figure 5. Pandur simulators.

CONCLUSION

This paper presented a real example of functional training system in military use.
The complex training has important place in a military general education. The Pandur CBT project with using 3D models and flash animations is an example of well designed system.
CBT and the simulator training will prepare soldiers for Pandur using very well. We have a lot of positive responses from the users in Czech Army.

LITERATURE

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AGENT-BASED SIMULATION IN DECISION SUPPORT SYSTEMS

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Abstract: *Global competition enforces appropriate flexibility and speed of decisions in companies in order to survive. Simulations can improve existing decision support systems. Typical process or value chain models meet some difficulties when modelling of complex environments including social behaviour factors is needed. In that case, in order to model a network of rather individual acting entities with social behaviour, some local intelligence has to be included. This is the field of agent–based simulation models - a new approach to modelling systems, especially for decision-making support. The paper presents an agent-based simulation and modelling framework based on generic business-oriented company model using control loop paradigm. The generic business-oriented company model is complemented by software agents forming a closed-up simulation framework.*

Keywords: modelling and simulation of business processes, multiagent systems, generic company model, distance learning

INTRODUCTION

Companies are coping with global competition. Their management systems meet with necessity to ensure appropriate flexibility and speed of decisions to achieve customer satisfaction, optimal market share, profits, generally, to survive in present market environment. In complex market and social conditions, the managerial decisions have to take many key factors into consideration. This is why simulations can improve existing decision support systems. Simulations of business processes are typically based on business process modelling. Process oriented modelling methods are treated by many authors. (Davenport [5], Koubarakis and Plexousakis [14], Řepa, [19]; van der Alst [22], Zdun and Dustdar [25], etc). Profound analysis of process models has been done by Řepa [20]. Formal notation of business process modelling can be found in Business Process Modelling Notation [3].

Other approach to enterprise modelling methods - value chain oriented models has been studied parallel. Value chain perspectives concentrate on value flows inside the enterprise and on value exchange with its environment. They are primarily based on underlying economic activities. Currently, the most popular value chain enterprise methodologies are e3-value (Gordijn and Akkermans [11] and the REA (Resources, Events, Agents) ontology (McCarthy [18], Hruby [12], Geerts and McCarthy [9], [10]; Chang and Ingraham [4], Dunn, Cherrington and Hollander [6], etc.). We presented a dynamization method of the REA models bridging the gap between process oriented models and value chain modelling perspective (Vymetal et al. [23]).

Typical process or value chain models meet some difficulties when modelling of complex, fluctuating environments including social behaviour factors is needed. In that case, in order to model a network of rather individual acting entities with social behaviour some local intelligence has to be included. This is the field of agent–based simulation models. Agent-

based modelling and simulation can be seen as a new approach to modelling systems, especially for decision-making support. Rather rapid development of this new modelling paradigm is caused by substantial increase of computational resources available to researchers.

The aim of this paper is to briefly present a general agent-oriented simulation framework outline to be used in education and distance learning with the target to use it in real decision support systems eventually. The course of the paper is as follows. In the first section a general software agent definition is presented including a short description of agent communication means. The discussion on agent-based model appropriateness and the limitations of such models follows. Next, a generic business-oriented company model is sketched and then complemented by a set of software agents modelling company's environment, management, and other internal units in order to form a modelling framework. Finally, the proposed framework possibilities and potentials for distance learning and further research motivations are discussed.

1. THE SOFTWARE AGENTS

Agent-based modelling and simulation is a relatively new approach to modelling using autonomous software agents. Agents (more specifically the software agents) can be defined as software modules that are based on the agents' paradigm. However, no real exact definition of software agents can be found in the research papers. Macal and North ([16], [17]) briefly define following basic features of agents:

- An agent is identifiable, discrete individual governed by its behaviour and decision-making capability;
- An agent is situated in an environment with which it interacts with other agents;
- An agent is goal-directed, autonomous and self-directed;
- An agent is flexible, and has the ability to learn and adapt its behaviours over time based on experiments.

Another definition of agents says (Bellifemine et al. [1]):

- Agents are autonomous - they can control their own actions and under circumstances can take decisions;
- Agents are proactive - they do not react in response only, but they can have own goal-oriented behaviour and /or take initiative;
- Agents are social - they are able to interact with other agents in order to accomplish their task and achieve the overall goal of the system.

These features of agents could be seen as justification of their use in complex economic environments like business. However, the question arises: when are the agents the appropriate solution for business simulations? A profound analyses done by Bond and Gasser [2], or Jennings and Wooldridge [13] show number of factors speaking for the appropriateness of an agent based approach. Such factors include following:

- The system environment is highly dynamic, uncertain and complex, it includes social factors. In such environments, systems capable of flexible autonomous acting are often the only solution. This is exactly the case of modelling processes in global markets.
- Agents mirror natural processes. Most processes in highly competitive environments can be naturally modelled as societies of agents. These agents can either cooperate

with each other or compete with one another or even solve common problems and tasks.

- Legacy systems. Problems increasingly faced by ERP (Enterprise Resource Planning) add-ons delivering some extended functionality coping with new dynamic business challenges are legacy ERP. ERP software cannot be discarded because of such add-ons only. And yet ERP is required to interact with them. One solution to this problem is to extend the legacy ERP components, providing them with some interface realized by agent functionality.

The structure of the agents depends on the tasks to be executed. (see e.g. Wooldridge [24], Jennings and Wooldridge (eds.) [13] or Kubik [15]).

The main advantage of agent oriented models is the reaction of the system to changes in the environment, their flexibility, easy reconfiguration, scalability and openness to the integration of new parts. Agents may be added to the system or removed from the system. There is no problem to replace one agent with completely different implementation of the same external behaviour. Existing software or hardware may be agentificated. We can provide it with interface, which functions on the one hand as a controller of the original system and on the other hand, acts as an agent (Šperka [21]). However, if the dynamics of the environment is predictable and not really complex, then models using classic methodologies are to be preferred.

Like in other complex systems, modellers using MAS (Multi-agent Systems) are confronted by some disadvantages. The most frequently mentioned disadvantage is the considerable complexity of the design. This may be partially compensated with the standardization and re-use of developed solutions. One of the pitfalls of agent development is the overestimation of their potential. Other of the limits encountered by agent-based solution design is the difference between object oriented design and agent oriented approach. The main limitation here is that object oriented design does not capture some important aspects of agents like autonomy, proactiveness and social behaviour based on agents' own targets. A serious limitation, in spite of computing resources expansion, is the overhead present in MAS environments, especially due to inter-agent communication. Thus, in order to achieve needed MAS potentials in modelling, known standards and solutions have to be taken advantage of.

The development of agent-based simulation methods has lead to numerous standardization attempts. In our opinion, the most important standard in this field is the Foundation for Intelligent Agents (FIPA [7]) - FIPA Abstract Architecture Specification. As the agent-based business process simulations use more agents to simulate the processes and events, it is obvious that multi-agent systems have to be used. In multi-agent systems, the most important issue is the communication. There are two basic multi-agent communication standards: the Knowledge Query and Manipulation Language (KQML) and Agent Communication Language (ACL) defined by FIPA. In our research we use the ACL standard for the communication (FIPA [8]) - FIPA ACL Message Structure Specification and most FIPA features for agent structure and behaviour.

2. GENERIC BUSINESS COMPANY MODEL

In order to achieve functioning MAS based modelling framework, some general company model has to be used. In our research, we use generic business-oriented company model. The

model uses well known control loop paradigm (Figure 1). There are four basic company subsystems in the control loop. The controlled subsystem comprises company business areas of production, sales, procurement, human resources etc. The inputs to the subsystem are represented by decisions in form of data flows coming from the regulator – the management of the company. The controlled outputs (e.g. revenues, units sold, customer base and other key performance indicators – KPIs) are measured in the measuring element and compared with the targets. The differences are computed, evaluated in the measuring element and presented to the regulator – the management. The management decides on corrective adjustments of the controlled subsystem parameters using several management strategies executing negative feedback in order to stabilize the system in the neighbourhood of the target values. The whole system meets various disturbances originating in its environment. These disturbances, e.g. the varying market conditions and actions of competitors, legislation, social conditions etc. affect the behaviour of the system which has to outbalance the influence of such disturbances yet achieving the targets and goals set. It is obvious that we are dealing with a complex dynamic environment, where rigid, hierarchical management rules do not allow for needed flexibility. Moreover, the enterprise has to be seen as a social system, too, where local goals and desires of the staff have to be taken into consideration. Hence, to simulate such system, the agent-based simulation (ABMS) can be justified.

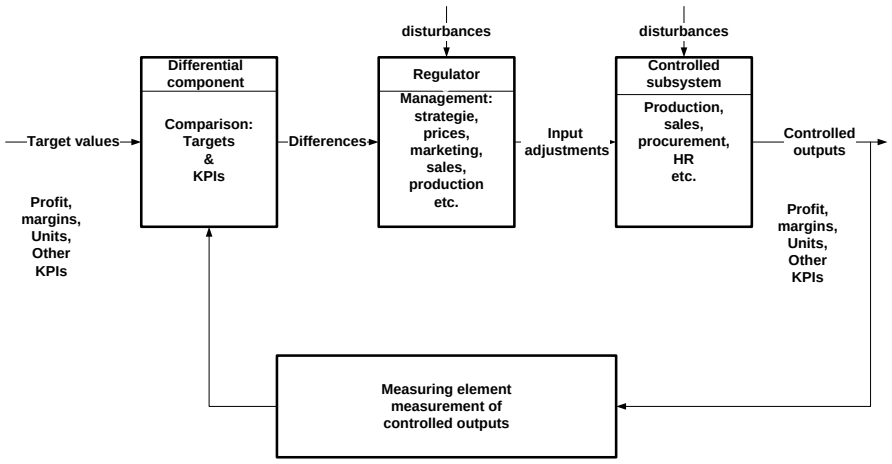

Figure 6. Generic business-oriented company model (source: own).

3. AGENT-ORIENTED FRAMEWORK

In order to simulate the behaviour of a company, the generic model is complemented by a set of agents. The agents are internally structured. Proposed general outline of our software agent structure is presented in Figure 2. The actions of an agent are started by some message from the agents' environment. The message is captured and analyzed by the social behaviour layer of the agent and passed to the cooperation level which has the task of cooperation with other agents in the system. Cooperation level interacts with the planning level, the task of which is to send plans, assignments and conditions to the reactive level. The reacting level itself prepares the output action and performs it. All levels use the data regarding the agents' knowledge of the environments, target, goals and aims of the system and the agents themselves, terms and conditions of the possible actions etc. stored in a special agents' database. This database can be shared by other agents.

The simulation framework uses a combination of MAS system and ERP representing simplified business-oriented company. The general structure is based on the generic model

presented in section 2 and in Figure 1. The outputs of controlled subsystems Sales, Marketing and Purchase are measured by the ERP functions and compared with the values stored in Targets & budgets database. The differences are then communicated to the controlling subsystem - the management. The management decides on the next steps using various strategies and optimization methods executing thus negative feedback to achieve stability. The decisions – management outputs are communicated to the controlled subsystems as settings for the next simulation step by means of messages following FIPA ACL rules. This general scheme is presented in Figure 3.

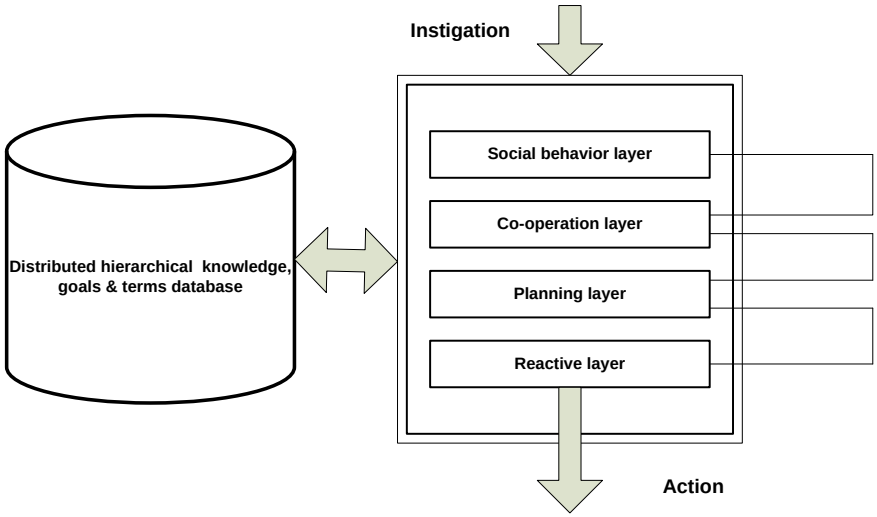

Figure 2. Layered software agent structure (source: own).

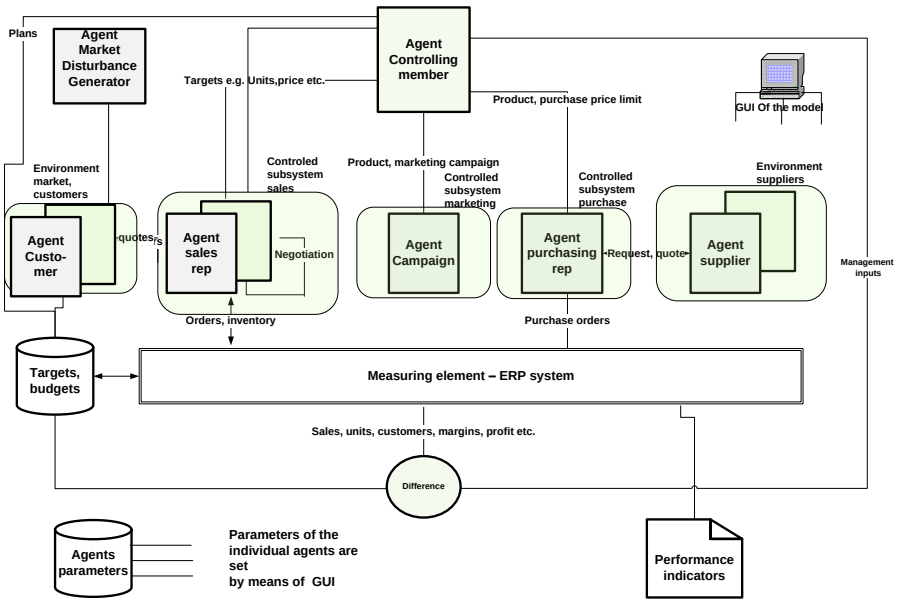

Figure 3. General scheme of MAS simulation framework (source: own).

Each controlled subsystem is represented by one or more agents, namely the sales rep agents, the marketing campaign agent and the purchasing agent. The sales rep agents communicate with the customer agents by means of quotes using contract net negotiation. The orders are then sent to the ERP system which finishes the operations and enters necessary records in the

ERP database. In case of lack of inventory (products) on stock, necessary messages are sent to the purchasing agent, which sends the request to the supplier agents and makes necessary price negotiations based on the contract net again. The controlling member (management) agent reacts on the KPI differences and conducts decisions based on the pre-defined strategies and optimization calculations. The disturbances on the market are modelled by an agent-disturbance generator. The parameters of the agents are stored in the parameters database. The performace indicators, targets, budgets and agents parameters are set up by graphical user interface agent of the model. The simulation results are also presented on the graphical user interface.

By means of parameter settings, various conditions can be modelled and the behaviour of the modelled enterprise can be studied. If we need more controlled subsystems, we can add other agents representing them. In case real business data are at disposal, the presented framework can be used for decision support. In other cases it can be used as a tool for education purposes.

For the students studying economy and management fields of study it would be a beneficial way of teaching to have the possibility to design aforementioned solution, and then interact with it in the form of simulation. They would be able to watch visually certain virtual world of the company in which the virtual staff (agents) should carry out their tasks. A web implementation of the framework could be made useable to simulate agent's behaviour. This could be available for the students who participate in e-learning form of study. Distributed nature of multi-agent systems literally calls for this type of implementation.

CONCLUSIONS AND CLOSING DISCUSSION

In this paper we presented agent-based simulation framework as a basis for modelling of a virtual company with the aim to use it in education and distance learning. Specification of the simulation described above offers advantages in the form of understanding the organization of work and gives scope for improvement. The use of simulations designed in this way is not limited to teaching of students. It may also serve as a basis for other uses. The general outline of the model can be seen as a basis for further research in order to develop such framework for real existing companies as a decision support tool. The opportunity to try a few different options to solve the specified task and analyze their impact on the model situation is also useful for real companies.

However, several questions have to be solved before this target could be approached. First, necessary real business data have to be collected and the model is to be tested by means of their use. Second, other controlled subsystems (agents) have to be added in order not to keep the model too simplified. Third, any outcome of simulation has to be analyzed having other not simulated circumstances in mind. This can be seen as a motivation for further research.

ACKNOWLEDGEMENT

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MODELLING OF STUDENT'S WAY THROUGH THE E-LEARNING COURSE BY MEANS OF GENERALIZED PETRI NET

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Abstract: *For e-learning system modelling there is possible to use Petri nets. The limitation of Petri nets using for this purpose is the fact, that Petri nets cannot make a difference between the request propagation from the customer into the proper part of the system, where the required information is stored and the process of the request disposal from the source of information to the customer. The same situation is typical in e-learning when the student is navigated to the source of information, which is required for solving the individual problem. For this purpose some generalization of Petri net seems to be useful. The formal description of such a generalization of Petri net concept and using it for modelling student's way through the e-learning system is the intended benefit of this paper.*

Keywords: E-learning system, Petri net, generalized Petri net, knowledge testing.

INTRODUCTION

In the intelligent system that works in some subject area, a difference between the objects and object relations has to be made. Therefore it is possible to use a diagram with two types of nodes and the relations between them. One type of nodes represents objects; the other type of nodes represents relations between them.

The changes are happening in the time or in the information area. They are represented by moving the marks through the diagram nodes. This principle is possible to describe via standard Petri nets [1], [2], [3]. The same situation is typical in e-learning when the student is navigated to the source of information, which is required for solving the individual problem. For this purpose some generalization of Petri net seems to be useful. The formal description of such a generalization of Petri net concept and using it for modelling student's way through the e-learning system is the intended benefit of this paper.

Generalized Petri net design and object connection modelling rules were described in [4]. The aim of this article is description and using of the generalized Petri net for modelling of the student's way through e-learning course.

1. GENERALIZED PETRI NET

1.1 Definition of generalized Petri net

In [4] the generalized Petri net is defined as bipartite and directed multi graph $G = (Q, S, H)$, where:

- $Q = \{q_1, \dots, q_m\}$ is a nonempty set of nodes called places (positions),
- $S = \{s_1, \dots, s_n\}$ is a nonempty finite set of transitions,
- $Q \cap S = \emptyset$,

- H is a set of oriented edges. Every edge is assigned the ordered pair of nodes, exactly one edge is Q and exactly one is S. It can be represented by two incidence matrix (m, n) and (n, m).

1.2 Generalized Petri net using for e-learning system modelling

Rules for an e-learning system modelling using the generalized Petri net are following [4]:

- For each information (data) source is defined a position in the generalized Petri net.
- For each system which transforms data of objects from one set to data of objects from another set is defined a transition. The information flows in the direction of oriented edges.
- There is possible to use two types of the marks – the mark * and the mark • in the generalized Petri net.
- The marks * are used for representation of requirements. The marks • are used for representation of answers (accomplishment of requirements).
- The requirements (*) are assigned to positions (data sources) and to transitions (transform systems). Marks • are assigned only to positions, not to transitions.

The e-learning system analyzes requirements and tries to complete them. This process can be described by the change of the generalized Petri net states:

- Questions or requirements are represented by *. Answers are represented by •.
- The mark *, which represents some requirement or question, is inserted into the generalized Petri net from some data store or from some executive element or from outside. The answer is created in the position marked by *.
- If sufficient information (information which accomplishes the requirement) is in this position the mark * will be changed to mark •.
- If information is not sufficient in the position the mark * will stay and will be filled in all input transitions of this positions in opposite of the direction of edges.
- The requirements can be transformed parallel or gradually. If information is sufficient in the positions, the mark * will be changed to mark • and the mark * will be removed from the transitions. The process will continue recursively until the mark is change to • at least one position.

These rules can be used to manage a student to (repeatedly) study and practice a part of study document to be able to acquire further knowledge and required habits of it.

1.3 Example of using generalized Petri net for student's way through the e-learning course modelling

Using generalized Petri net for student's way through the e-learning course modelling is possible to see in the following example. We can see example of the net, which is composed from seven educational linked topics (represented by seven positions in the net) in the figure 1. The following example describes one possible testing method of student knowledge of the topic P7, which is represented by the position P7. For completing the main topic P7 student knowledge from previous partial topics P1 – P6 are needed. Each mark * assigned to position means a verification (test) of student knowledge of the topic included in this position.

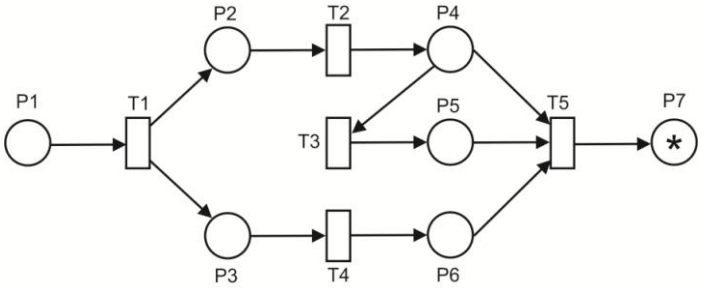

Figure 1. Example of the net containing seven linked topics.

Now we suppose, that student is unsuccessful in the topic P7. If the student is in the topic P7 successful, is it possible to replace the mark * by mark •. Educational process can go on according to rules of the classical Petri net in this case – the student is allowed to study another topic, which follows the topic P7.

But in case of student bad success in the topic P7, there is necessary to navigate him to previous topics of the topic P7. Therefore the mark * will be moved to the positions P4, P5 and P6 (which represent topics P4, P5 and P6) in the generalized Petri net. This situation is shown in the figure 2.

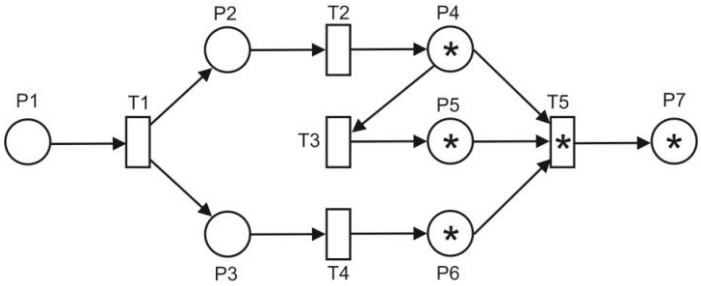

Figure 2. Generalized Petri net marking in case of student bad success in a knowledge test in the position P7.

Now we suppose, that student is successful in the topics P5 and P6. Therefore it is possible to replace marks * by marks • in the positions P5 and P6. But student is unsuccessful in the topic P4. It means, that it is necessary to move the mark * through the transition T2 to the position P2 (topic P2). Study of the topics P2 is prerequisite for succeed result in the topics P4. This situation is shown in the figure 3.

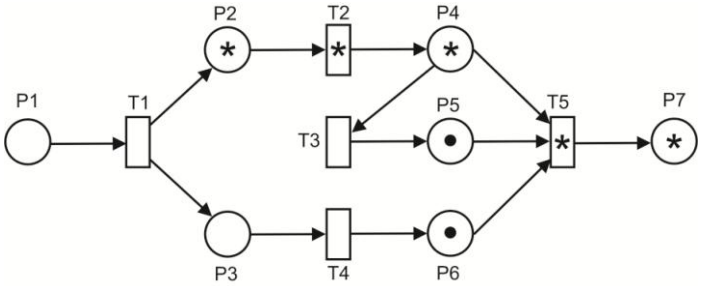

Figure 3. Generalized Petri net marking in case of student bad success in a knowledge test in the position P4.

Now we suppose, that student is unsuccessful in the topic P2 again. Therefore it is necessary to return the student to read up the starting topic P1. This situation is shown in the figure 4.

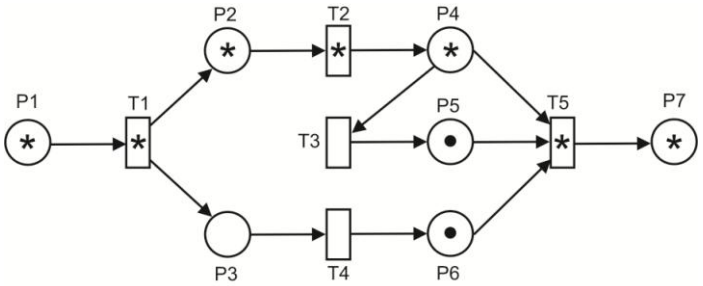

Figure 4. Generalized Petri net marking in case of student bad success in a knowledge test in the position P2.

Now we supposed, that student was successful in starting topic and in all consequential topics. It means, that the student will go trough all tests (included in all positions) without necessity of revision. In the generalized Petri net progress the marks * will be changed to the marks • in the positions and the marks * will be removed from the transitions. The process will continue recursively until the mark is change to • at least one position. This progress of the net is shown on the following figures 5 – 8.

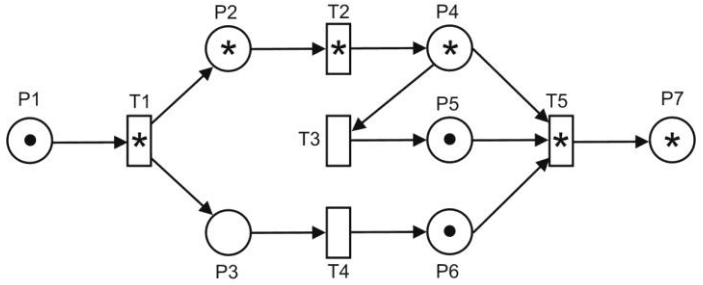

Figure 5. Generalized Petri net marking in case of student success in a knowledge test in the position P1.

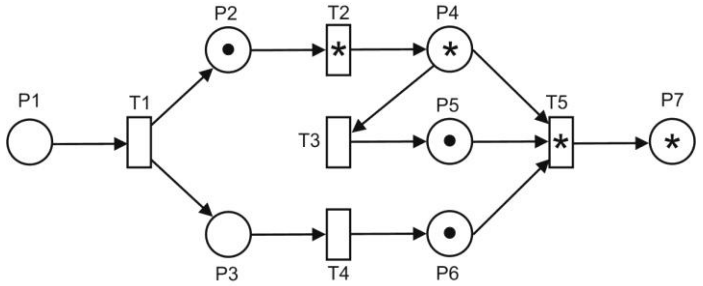

Figure 6. Generalized Petri net marking in case of student success in a knowledge test in the position P2.

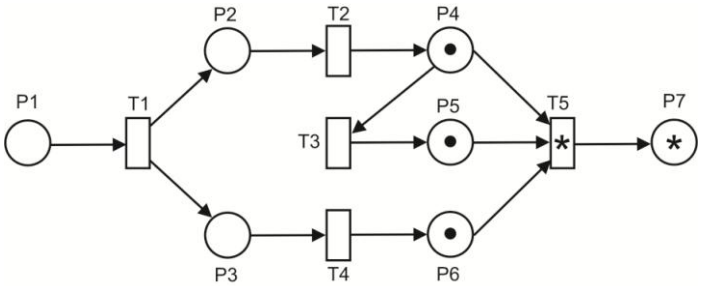

Figure 7. Generalized Petri net marking in case of student success in a knowledge test in the position P4.

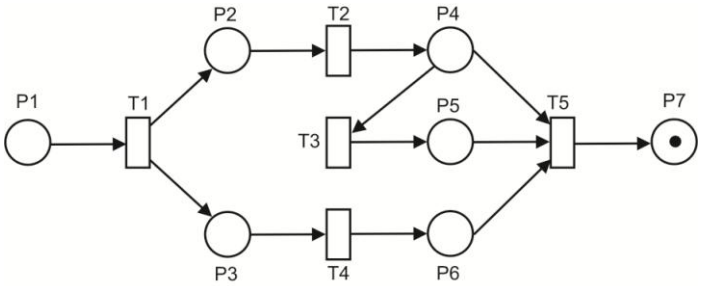

Figure 8. Generalized Petri net marking in case of student successful way through all seven positions (topics P1 – P7).

1.4 Possibilities of implementation model in the real e-learning system

There is possible to implement this designed model of generalized Petri net to the real existing e-learning system. For example, the suitable learning management system could be LMS Moodle CULS. This system was chosen because both authors of this article are the administrators and the developers of this LMS. It is possible to implement designed model as an independent module in LMS Moodle CULS. By the help of this module it is possible to monitor, control and eventually modify student's way through the existing course (educational topic). This module is possible to transfer and reuse in the other Moodle based systems. The system Moodle CULS is the biggest one in the Czech Republic (it contains more than 36 000 users and 3600 courses), therefore this system is well useful for testing this module.

CONCLUSION

It is able to use Petri net for student's way through the e-learning course modelling. But it is possible to generalize Petri net, because the generalized Petri net tries to model educational process more suitable. The main profit of generalized Petri net is the fact, that there is possible to model questioning (testing of the student knowledge) and answering (test results) process in this net together. The question (test) is represented by mark * and the student correct answer is represented by mark □. Using of this generalized Petri net is described on the example of student way through seven educational topics.

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MODERN TECHNOLOGIES IN EDUCATION PROCESS OF MILITARY STUDENTS (NATIONAL DEFENCE UNIVERSITY EXPERIENCE)

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Abstract: *The paper considers Advanced Distributed Learning (ADL). Preparing commissioned officers for carrying out activities in area of mission and operation by means of e-learning technique is an effective method of vocational improvement. The technique may also be applied within the framework of consultation and decision development in special conditions. However, it needs to be pointed out that operational knowledge and professional experience are the basis for preparation of commissioned officers for education within the framework of e-learning. Conditions changing in system of military security make armed forces of numerous nations create knowledge databases using modern IT assets. Collected knowledge is an element of educational process designed not only for commissioned officers but also for civilians deployed in various parts of the world. The contemporary military of information society requires novel means of education and knowledge transfer. In order to meet the requirements, for the purposes of armed forces, a new form of education – e-learning – is developed.*

Key words: e-learning, knowledge, information society, military education.

INTRODUCTION

Introduction of novel technical and organizational solutions into educational process on the basis of modern technologies makes the process take on a different substantive and methodological aspect. Implementation of modern technologies results in sweeping changes in numerous areas. Advanced distributed learning (e-learning), medical consultations or videoconferences make a teacher, a knowledge expert available without any distance or time limitations. Taking such sweeping changes into account raises the following question: what factors make the military more and more widely use innovative technologies, not only during military operations but in the process of training/educating military personnel as well?

1. NEW TECHNOLOGY IN EDUCATIONAL PROCESS

Official duties of a commissioned officer include a wide range of responsibilities, which results from necessity of directing subordinates, organizing and conducting training activities, fulfilling competence tasks related to a post occupied by him/her and continuous professional improvement. Meeting such complex duty requirements is, of course, neither easy nor simple because management skills need to be combined with the necessity of personal development. Proper fulfillment of tasks is connected with adequate education, both general and professional, including highly specialized expertise resulting from professional military specialty such as intelligence, electronic warfare or air-mobile forces. The necessity of a new view on educational requirements of the military arises in the process of numerous changes considering the concept of use of armed forces and plans of the military capabilities

utilization. There is no doubt about the wisdom of the thesis that increasing requirements considering commanders (managers) result in increasing effectiveness of the whole educational system preparing participants of a future military operation for actions carried out in a network-centric environment characterized by information warfare conditions [1].

Giving up the draft and introduction of contract service instead, accompanied by increasing professionalization of operational force units, application of new detection, reconnaissance and delivery assets based on innovative technologies remarkably widen needs for educating commissioned officers both in terms of practical aspects and military theory. Moreover participation of the Polish Armed Forces units in many military operations (peacekeeping/making and stabilization) conducted abroad creates new tasks for military educational system. Including our military in the NATO structure determines the necessity of adequate preparation of military personnel for specific tasks fulfilled at home and abroad. Striving for lower educational costs results in implementation of novel technologies in teaching process becoming necessity of today and creating a challenge of the future. The considerations mentioned above are the essential arguments indicating validity of using innovative technologies in educational process run by the military.

Additionally an important argument supporting new technologies applied during preparation of commissioned officers for conducting tasks in contemporary conditions is the fact of changing value judgments related to concepts of numerous definitions including, for example, redefining "potential enemy/threat".

Past understanding of military threat as confrontation of two opposing pacts has been replaced by asymmetric threats, actions conducted by irregular armed formations that do not have a central management. In many situations military operations carried out by detachments and armed groups functioning independently are inspired and financed by local chiefs and political leaders. The presented situation enforces necessity of new view on the process of preparing personnel for conducting operational tasks in peace, crisis and war.

Education for the future, even assisted by modern technology, is still a complex issue because future vision of military activities contains a number of unknown elements [2]. It is nowadays difficult to predict problems faced by the officers after they complete programmed educational process organized and conducted by an academic institution, what tasks they will carry out and what conditions they will use acquired knowledge and skills in.

However, it seems that in spite of dynamic development of combat technology and new ways of using specific combat means, certain framework - requirements considering training commissioned officers in terms of operational thinking - remains invariable. The framework deals with shaping features providing officers with conditions for conscious and independent solving problematic situations and obtaining comprehensive, multilayer general knowledge, which results from unanimous belief of numerous teachers that general education makes the basis for logical reasoning.

2. OPERATIONAL THINKING

The term "operational thinking" may be considered in two aspects: as a definite state of knowledge and as a process of intuitive prediction of the future or consequences of decisions made in action (combat and operation) [3]. The former meaning includes understanding basic

set of terms, claims and regularities considering combat system and processes taking place in various political and military conditions, and within different, as experts emphasize, structural and organizational solutions. Operational thinking analyzed in its latter meaning is perceived as the whole of processes enabling anticipation of situation regarding activities of subordinate units in military and peace time conditions. It is assumed that operational thinking is naturally realized through the educational process by the combination of theory (operational and tactical principles of planning and conducting activities) and practice (utilization of experiences acquired during exercises and analysis of conclusions drawn from previous armed conflicts).

Currently realized education of commissioned officers is a comprehensive process that may be divided into three levels:

- basic level - realized at military colleges and training centres, which will lead to attaining professional qualifications in a definite specialty (platoon leader, company commander);
- advanced level - courses and specialized studies within improvement of officers resulting in obtaining higher level of specialized qualifications (battalion commander, chief of tactical level staff cell);
- higher level - postgraduate studies (unit commander, chief of section/department, senior staff officer).

If characteristics of officers' education is considered, one can distinguish: theoretical education (e. g. lectures, seminars) and practical education (e. g. participation in exercises and training activities). It should be emphasized that in particular situations we deal not so much with kinds of education mentioned above - literally perceived - but with a combination of them characterized by predominance of one of them. It results from the fact that each education, especially education within a wide profile of military knowledge, contains a general professional (military) aspect and a specialized one both in theoretical and practical dimensions. Therefore elements of command-staff exercise may often be observed during group training and within paper-discussion seminars other teaching forms may occur.

Development of operational-tactical imagination is not a one time action. It consists of a complex of teaching undertakings that allow officers to develop capability of abstract thought, to form a habit of searching for links and relations within analyzed military operations. It needs to be underlined that the understanding of battlefield phenomena meaning recognition of correlations enables drawing proper conclusions concerning future type of potential enemy's activities. Learning characteristics of individual kinds of combat activities makes an element allowing for recognition of series of operational-tactical conditions that should be created in order to achieve a definite combat objective. It should be indicated that the process of threat evaluation is one of the ways to shape operational thinking. Drawing conclusion considering future actions of potential enemy must be consistent and supported by logical arguments. Computer simulation applications are tools enabling realization of teaching tasks within this area. Modern technology is irreplaceable in solving multaspect problems of contemporary military operations. It allows for carrying out a simulation of staff and operational unit performance in the near-realistic-activity way. Simulation system enables not only scenario wargaming but also replay of its course indicating mistakes made by players.

The laboratory of command, control, communications, intelligence system (C3IS) JAŚMIN is used in the National Defence University for the purpose of teaching process. The laboratory capabilities allow for conducting command post (CP) exercises – from the battalion level

through the division level. Apart from imagery of military activities, it is also possible to plan operations, develop branch courses of action (COAs) and command and control (C2) documents. Data transmission system provides secure transfer of information resources to units exercising in other garrisons. Students have an opportunity to play the roles of combat order/formation elements being part of operational brigades and divisions. COAs developed by the staff are reviewed by the means of tactical activity simulation system. Analyzing simulation results, students playing the roles of staff officers may amend their solutions and enter more effective decisions into the system. Education of NDU students also includes elements of advanced distributed learning (ADL). ILIAS platform contains selection of courses for commissioned officers. Additionally, for the purposes of students, special materials for complementary education have been prepared. The materials are supposed to help equalize the level of tactical-operational knowledge among all students. CP computer assisted exercises (CAX) are remarkably significant in the education process of commissioned officers. War Games and Simulation Centre (WGSC) organizes virtual wars supported by Joint Theater Level Simulation system. The system enables imagery of military activities carried out by land, air and maritime component. Technical system capabilities consider terrain conditions, fire delivery assets, manoeuvre, operational capabilities of services/arms and branches. Significant advantage of the system results from the fact that effects of conducted exercises may be used during analysis and evaluation of solutions applied in planning and carrying out operational activities. JTLS is designated for analysis, design and assessment of operation plans, assessment of alternative solutions (development of combat COAs) and analysis of combat unit structures in terms of combat systems. WGSC applies JTLS for CAX by making use of combat activity models in order to create operational environment in computer environment. The operational environment of decision making elements is similar to the one they may encounter in the battle field."

Observations made during command post exercises and group training activities show that information about political and military situation are received by staff officers conducting analysis of troops' position in diverse ways (different interpretations). The phenomenon is connected both with the aspect of correlating received information sets and understanding its content in terms of overall operational-tactical situation. Assuming that threat estimate and forecast of subordinate forces' activities is a decision making process conducted with information shortage, one can draw a conclusion that analysts largely go by obtained experience and intuition (operational-tactical imagination). If owned information set is incomplete then its completion is intuitively done by officers through correlating certain characteristics of other potential elements (distinctive features) belonging to analyzed set (e. g. enemy forces mobilization time or overall situation in area of operation).

Intuitive perception of officers is based on association processes (cause – effect), which affects perception of not only objects in operational space themselves (e. g. elements of battle formation) but also their capabilities concerning current and further activities. It is of a special importance during the threat evaluation process in aspect of performance possibility (courses of action) identification. These are elements allowing commanders to make right decisions. Of course apart from operational-tactical imagination, sensual perception is crucial for the process of threat evaluation and activity forecast. It is another area where novel technology supports officers' activities. Computer systems supporting staff work are capable of determining possible capabilities of own troops and potential enemy. Due to application of modern technologies database resources containing aggregated information about characteristics of combat equipment, manoeuvre, firepower or physical-geographical

conditions considering area of operation enable situation imagery and determination of effective proceeding ways.
Information perception, both sensual and intuitive, is conditioned by personality features of commissioned officers - analysts dealing with operations on information. It is true that many characteristics may be shaped during the process of education. However the way and range of knowledge obtained during education period largely depends on individual features of each man (officer in this case).

In reference to analytic and operational activity, especially issues of information sets' utilization in the process of threat evaluation and activity forecast, validity of heuristic method application should be indicated and emphasized since the method leads to discovering new facts, their relations and thus generating new truths. Heuristic forecast means anticipating events taking place in the future that may unnecessarily be described by the use of analysis of the past. The heuristic method, commonly known as the intuitive one, is based mainly on intuition, imagination, thorough knowledge and experience of commissioned officers. Therefore it may be applied only by personnel having relevant expertise, habits and skills. One cannot posses command of operational thinking without long-standing education, practical involvement in activities of staff teams during numerous specialized training activities and various exercises including complex operational-tactical situations that enforce nonstandard, "out of the doctrinal box" solutions.

Teaching practice proves that using intuition and heuristic principles should be noticed in the situation when remarkable information shortages occur and the enemy conducts intensive disinformation operations. Experts in military teaching emphasize that the greatest drawback of the method may be routine because long-standing experience may cause a template type situation estimate which may be characterized by a serious error. In the complex process of shaping tactical-operational imagination of officers, computer applications of command and control process support enable recognition of situation but do not release from rational decision making. Situation progress scenario and way of likely action are developed on the basis of heuristic methods and reviewed by simulation systems. COA (Course of Action) errors and drawbacks, identified during the simulation process, are now eliminated and corrected in the way limiting level of operational risk to minimum.

3. MILITARY EDUCATION – NEW CONDITIONS

According to opinions of many academic teachers and some operational commanders, utilization of innovative technologies in support of previously tested teaching solutions, especially in context of shaping operational-tactical imagination, is a very desired phenomenon. The process is realized through comparison of enemy COAs (Course of Actions) in individual exercise stages or limiting amount of information about enemy troops in order to create adequate level of operational risk. It needs to be underlined that officers are able to improve their knowledge of "art-of-war" principles through proper estimate of threat.

Analyzing potential enemy activity scenarios generated by computer system they also notice mutual correlations among factors of time, forces engaged in combat and operational space. Because each military situation is built on the basis of operational activities of opposing forces, officers participating in simulation game have a chance to consolidate command of principles conditioning use of arms components and conditions for utilization of service branches.

In the personnel education process it is assumed that each officer graduates from an appropriate preparatory (qualification) course before he or she takes over his/her new position. Officers of different military specialties that are expected to take up new posts are sent on a career development course. Such courses have the following goals:

- develop operational thinking skill, general knowledge of officers and shaping their personalities and abilities that will enable them to occupy staff and command positions;
- deepen and supplement expertise and general knowledge ensuring efficient professional performance on duty posts;
- familiarize with novel organizational and technological solutions in terms of proper management and efficient organization of military activities.

Deepening knowledge and skills of commissioned officers takes place on courses mainly through realization of undertakings included in course programme and also independent studies of latest theoretical materials during so-called self-education. Classes, lectures, seminars, etc. are carried out with the use of multimedia presentations developed with support of modern technologies. Interactive computer applications enable evaluation of officers' preparation/readiness for their future duty post tasks. During self-education students explore electronic libraries and virtual information resources of specialized publishing houses.

During seminars course participants can freely express their thoughts and opinions, which encourages logical reasoning, imagination development and shaping operational thinking. Students have to prepare presentations illustrating described issues for each seminar. Deepening officers' skills in independent estimate of situation and drawing final conclusions takes place during group training activities and improving exercises. Improvement achieved during education process deals also with ability of working on computer map of terrain and development of appropriate tactical solutions on the basis of specialized calculation applications/spreadsheets (comparison of combat potentials of conflict sides, determination of strength ratio).

It should be said that in spite of introduction of new technologies into teaching process still the most serious shortages may be observed in planning process considering operational-tactical activities. Planning activities requires creative combination of obtained theoretical knowledge and practice, intuitive understanding of the terrain, operational thinking - not only in terms of a given unit commander but staff officer noticing and understanding advantages of exploiting different service branches as well. Moreover shortcomings may be observed in terms of expertise, especially considering application of assets that should be deployed in operational space in order to fulfill assigned tasks.

Conducted analysis of drawn conclusions allows for proposing the thesis that noticeable shortcomings occurred during teaching-learning process as a result of not following the principle of student's individual preparation of basic operational-tactical calculations and reasonable arguments justifying decisions they make. Results of computer simulations are excessively utilized instead. In this way students lose their abilities to improve principles of conducting activities by tactical and operational formations/units. Conducted experiments show that conversatorium classes or seminars are effective forms of education because students develop recommendations for undertaken solutions on the basis of acquired knowledge and skills concerning staff work, hence the conclusion that excessive trust in new

technologies, especially systems supporting decision making process, may lead to decrease in the level of operational-tactical imagination.
In many cases officers improving their professional qualifications go on NDU courses. In such a situation it seems to be advisable to conduct education process in accordance with a different programme that allows for the necessity of providing officers with a specialist knowledge. A way to achieve this goal consists in including e-learning in programmes of chosen specialist courses. Thus novel technologies are used in teaching process as a tool of transfer and review of basic military knowledge. The courses run within an ADL programme framework are recommended by NATO training centres.

In the process of officers' knowledge quality enhancement the attention is focused on graduate and postgraduate studies. Currently studies include managing, directing, commanding and leading issues in terms of national and multinational structures. Study programme assumes that a graduate will present thorough knowledge and definite abilities concerning fulfillment of command and control or staff functions in contemporary and future military activities. During studies the officers participate in exercises assisted by automated C2 (C4I) systems and computer simulation applications.

The following claim seems to be a regularity: development of armed forces is unthinkable without continuous professional improvement of commanders. The officers, through obtained knowledge and experience, are able to creatively shape AoO (Area of Operation) structure and in case of emergency to properly estimate status of opposing forces and forecast scenario of operation.

The essential reasons for application of modern technology in the education process of the military includes the thesis indicating necessity of preparing commissioned officers for the creative solving of new, previously unknown operational-tactical problems. This conditioning results in a need for building complex scenarios of command/staff exercises. Introduction of novel technologies enables reduction of time required for exercise development, its modification later on and, what is most important, flexible management of exercise course through adjusting the flow of data available for exercise players.

CONCLUSIONS

Recent turbulent years have brought a lot of changes, gradually implemented, fundamentally affecting conditions of education in military academic institutions. System of officers' education has undergone transformation which resulted in structural and programme changes. The military education system has been reorganized, number of military colleges has been reduced and training centres have been established. Education system of NDU - command-staff academic institution of the utmost importance in the officers' education system - has also been modified. Therefore in the situation of dynamically changing conditions there is a need for application of novel technologies. However teaching practice shows that it is necessary to go back to the specialist training. Plans and concepts developed by students need to be reviewed in practice, which means in the field. Only reconnoitring probable area of operation enables comparison of planning effects with real conditionings of environment. Then, during practical training, operational-tactical imagination may be shaped in near-realistic conditions.

Commanders and representatives of tactical formations/units strongly support the option of practical education of personnel because they need experts in staff work. Numerous

arguments include the thesis that specialist education makes the foundation of each profession. This principle applies to a physician, an engineer and a driver whose most important concern deals with driving technique (operational tactics) and command of road traffic principles and regulations. Such theoretical knowledge and practical skills make him or her successfully drive his or her car even through the most crowded city streets.

Changes implemented in education system resulted in the fact that civilian academy/university graduates became another group of officer candidates. The arguments presented in this paper support necessity of introduction and utilization of modern technologies in the long term process of gradual shaping operational thinking. They allow for advancing the thesis that, in terms of teaching principles of warfare and understanding phenomena occurring in armed warfare system, the educational effects considering the above mentioned group of commissioned officers will be satisfactory. The process of shaping operational-tactical imagination among the group of the officers must be spread over time and supported by professional experience, participation in exercises, training and deployments within peacekeeping contingents. Only then knowledge understood as theory and practice of operation may make "operational thinking" not only an academic term.

Analyzing the conclusions presented in this paper, one can say that modern technologies introduced into the process of shaping operational-tactical imagination are very helpful tools. However, their excessive use in teaching practice may, in case of education creating operational-tactical imagination of officers, result in a reduced efficiency in realization of basic staff activities. One cannot forget that man is a supreme value for each organization. Nothing can replace human thought, imagination, ingenuity and creativity in operation.

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