PAN-EUROPEAN UNIVERSITY

slovakia - ukraine project
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norway grants

ÚRAD VLÁDY SLOVENSKEJ REPUBLIKY

„Slovakia – Ukraine: Cooperation across the Border"

„Cooperation with common values"

Innovative Methods
in Education and Research

Wolters Kluwer

slovakia - ukraine project
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PANEURÓPSKA VYSOKÁ ŠKOLA

Fakulta informatiky

Innovative Methods in Education and Research

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ÚRAD VLÁDY SLOVENSKEJ REPUBLIKY

„Slovakia – Ukraine: Cooperation across the Border"

„EEA and Norway grants – Cooperation with common values"

Wolters Kluwer

Wolters Kluwer, a.s.

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Preface

The EEA Grants and Norway Grants serves as the financial contributions of Norway, Iceland and Liechtenstein with aim to achieve the reduction of social and economic disparities in the European Economic Area and to strengthen bilateral relations with 16 EEA Member States in Northern, Central and Southern Europe. Through the Agreement on the EEA the Donors are partners with the European Union.

Since 2004 there have been two separate financial mechanisms: the EEA Grants for all 16 countries and Norway Grants for 13 new members of EU. Norway is the main contributor to both mechanisms. While the term of the years 2004 – 2009 was characterized by wide spectral area of projects, for the period of 2009 – 2014 contribution was divided to 9 chapters for projects of mutual interests. Slovakia had a privilege to be the first from beneficiary countries when both documents, Memoranda of Understanding in the framework of Norwegian Financial Mechanism as well as EEA Financial Mechanism for 2009 – 2014, were signed on October 26, 2010 during the historic State visit of H.M. Harald V, the King of Norway, in the Slovak Republic. It was confirmed that our country will gain for the following period altogether 80,75 mil EUR, from which 42,4 mil EUR as Norway Grants and 38,35 mil EUR as EEA Grants.

Cross-border cooperation of Slovakia with Ukraine was included to the chapters of priorities with contribution from financial mechanisms. Norway suggested to provide its experiences from cooperation with Russia on the areas close to the border between both countries. In this connection the visit of me as Ambassador to Norway together with Associate Professor Eugen Ružický to the Norwegian Barents Secretariat in Kirkenes was very important. The Barents Cooperation is a unique form of regional cooperation, which has been highlighted as a vital factor in establishing good neighbouring relations between Norway and Russia in the north. The main purpose is to help the Russian and Norwegian partners to develop cooperation in various fields of the life. One of the remarkable successes of this cooperation is the regional people-to-people contact.

Project Innovative Methods in Education for supporting Partnerships - "InovEduc" is very useful contribution to the fulfilling of meaningful ideas and effective using of the financial supporting from Norway Grants and EEA Grants.

Dušan Rozbora

President of the International Club of Slovakia

Former Ambassador

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RESEARCH PAPERS

Innovation in Research as the support for Cross-border Education in Slovakia and Ukraine

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Abstract

In this paper, we propose research and educational activities at the Faculty of informatics in Paneuropean University in Bratislava, which lead to develop software solutions based on virtual and augmented reality for supporting the cross-border education in high schools in Slovakia and Ukraine. The mixed research teams works on creating of the 3D models of historical, cultural and natural monuments and propose the methods of interaction with it in the virtual and augmented reality. The research activities includes also the UI/UX design tested in usability lab.

Keywords: *Virtual reality, Augmented reality, Usability, UI/UX design*

1 Introduction

Traditional approach to teaching the high school students is to propose them facts and terms without showing them the connections and applications to other subjects. By using this way of learning, the students will forgot the most of the information in few weeks or months. Especially, there is minimum connections between teaching the humanity and technical subjects like history and physics or mathematics. On the other hand there are many of teachers, who want to show to the students much more, than the facts and try to show them how to use some information from one subject in another one. It works in the area of one state or region. But historically, many of the regions was divided by the artificially borders. These regions had the common history, religion, science and languages. In our work we would like to present the principles of the project InovEduc – Innovation methods in Education for supporting the partnerships, which is the partnership project of 10 partners from Slovakia and Ukraine and one partner from Norway. The aim of the project is to work on common signs of the border regions (Eastern Slovakia and Carpathian in Ukraine) with the using innovative methods of presenting the historical, cultural and natural monuments by virtual and augmented reality methods.

2 3D models as the educational objects

In the project we plan to create 24 models of the real objects (14 object from Slovakia and 10 objects from Ukraine). The selected object on the both sides of the border has the connections through its architecture, religion, history or through the historical persons. E.g. the wooden churches, castles, manor houses… We will create the 3D models and exterior and interior panoramas of these objects. The 3D model and panorama is the carrier of the visual information about the object, but for the "genius loci" of the place we need much more information. We can add this to the models as the meta-

information. For our purposes, the meta-information is the text with the object description, sounds from the objects (especially in the wooden churches), but also the historical information like the architectural development of the buildings during the centuries or information about the object constructions. Thanks to this information we can create from the 3D models the complete educational objects with the possibilities of the storytelling. In the next stages of the project development we will teach the Slovakian and Ukrainian teachers how to create 3D models and how to collect and add meta-information for creating the objects for their future teaching. The teachers will work with their students on the other 3D models and the database of the objects will grow.

Figure 1: Borders of service areas in Slovakia and Ukraine

Due to software methods and hardware capabilities of the tablets and smartphones as the devices for the imaging the 3D models we will produce low polygonal 3D models based on manual modelling. We will not use photogrammetry or laser scanning for our purposes, because they produce high polygonal meshes or point clouds and we need to show the data in real-time with various interactions.

Figure 2: Bison (on the left side) and the 3D model of bison

Figure 3: Wooden church in Topoľa – object proposed for 3D modeling

3 Workflow of the creation of the 3D models in education process

The whole process of creation of the 3D model is also the educational part of the research. We include the teachers and students into the each step of the process. From sensing the data to the creation of final presentation. During the process they are learning, how to use the modern technologies and thay apply their knowledge from various subjects (like mathematics, informatics, physics). The whole workflow is presented on the Figure 4.
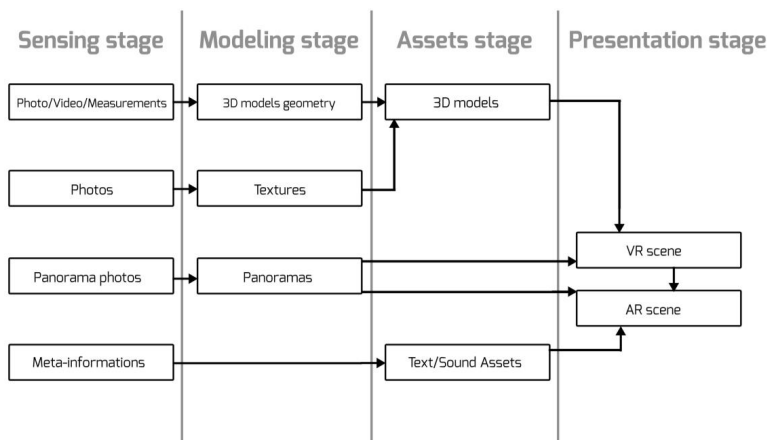

Figure 4: Workflow of creation of educational object

Before the sensing process they need to make a selection of the appropriate object for 3D model making process. It is not only about the complexity of the object and accessibility for the sensing but also it is about its history or cultural heritage value. Parallel to the process of sensing, modeling and

texturing of the object is process of creating the metadata and making the storytelling process, which lead to the interesting presentation of the modeled object. Storytelling can be different for presentation in virtual reality or in augmented reality, because each possibility have various limitations (due to technical, hardware or some other limitations).

4 Research in Virtual and Augmented reality

The proposed project InovEduc is one part of our research at the Faculty of Informatics Paneuropean University in the field of virtual and augmented reality. In our research we focus on interaction methods in virtual environments with strong focus on its potential in education. In the field of virtual reality software we will use the Oculus Rift hardware solution as the tool for strong immersive experience for users. In [1] the authors uses the augmented reality for showing the multi-context data. We will use only one context supported by other media (sound, video) and meta-information. For augmented reality applications we will use tablets and smartphones as the hardware tools. We will show the user the 3D models surrounded by its environments and also we will show the interior of the objects by using interior panoramas. For showing it, we will use the new approaches like the image mapped into the sphere with flipped normal or using the pattern image as the virtual window for showing the panorama.

In the field of research in virtual and augmented reality we use also the measuring methods, like the satisfaction of the users. Together with the Faculty of psychology we will work on creating of some new metrics for measurement of the user immersion.

These measurements will be done in Usability lab [2], which is our research laboratory covered by modern hardware and software equipment.

5 UI/UX design and Usability lab

In the process of the application development we will strongly control the UI/UX design, because if we did not bring to the user the user interface which is comfortable and simple we can lost their attention and have the problems with the immersion of the user into virtual and augmented reality. Especially, this can be true when we will use the Oculus Rift for virtual reality application, where the immersion is very strong.

For control the process of creation the user interface and for measuring the user satisfaction we will use the Usability lab. In various stages of the development process we will use the various methods for testing the usability of the applications. We will use the participatory design method for creating the design of the user interfaces and the Thinking aloud [3] method as the main testing method.

6 Partnerships and Cross-border cooperation

In the whole process of the creation of the educational materials there are many partners both from Slovakian and Ukrainian side and also the partner from Norway. The educational methods in each country differ in some parts of the process. Due to this differences, we need to identify the similar parts and make the connections in the background of the common historical, geographical, religious and other values. By the cross-border cooperation we can produce the whole system of education supported by applications and 3D models as the product of two teams working on some parts separately (data sensing and 3D modeling) [4] but mostly together with two different looking into it.

The role of the partnership is the key. Partnerships are on the various levels. Horizontal partnerships between the Universities, High schools, methodological centres, Non-profit organisations and the vertical partnerships between the students – teachers – lectors and experts. Thanks to these structures we can produce effective and complex study materials and applications for cross-border education between Slovakia and Ukraine.

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The Common History of the Regions

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Abstract

Natural environment, geographic or political (national) borders stand for just one type of lines dividing social and ethnic groups or cultures. They can be most easily recognizable, but there are borders that are "invisible". Those are defined in relation to different cultural ideas. Various regions of Europe are characterised by specific concepts. The area of Eastern Slovakia and western parts of Ukraine represents the type of region, where many concepts of boundaries have mingled. They include for example Limes Romanus, the limits of the Carolingian Empire, spread of Eastern and Western forms of Christianity, areas of German settlement in Central and Eastern Europe, the Hajnal's line, territory of Wallachian colonization, and areas subjected to transmission of various ideas (for example, Enlightenment concepts).

Keywords: West Ukraine – Eastern Slovakia, Carpathian region, borderland region, historical structural borders in Europe

1 The border as challenge

So close and at the same time so far away. The area of eastern Slovakia for centuries had been united with western parts of Ukraine: together they belonged to the same state formations. At present this unity is weakened.

The boundaries imply differences in forms and possibilities of communication; organisational structures; relations between the state and religion, economy and management, architecture, music, science and the arts. They emerge as a consequence of migration, demographic growth as well as land-use associated with it, and natural barriers such as the seas, rivers, wetlands, forests and mountains. The space of "no one's land" on both sides of border gradually decreases through successive colonization up to the idea of line.

The boundaries of modern states arose as a result of political decisions. These decisions were sometimes associated with violence. Yet borders are almost always negotiated and confirmed by international treaties. The border between Czechoslovakia and the Ukrainian SSR that included the territory of Carpathian Ukraine was established on June 29, 1945, when the Soviet-Czechoslovak agreement was formally concluded. The agreement was preceded by banishing of representatives of the Czechoslovak government as well as violent "bolshevisation" and manipulation of public opinion. [1]

Such political decisions define "our" territory (on one side of the border) and the "foreign" one (on the other side of the border) as well as people living on both sides. Consequent assigning to them characteristic features ("culture", "language", "religion", etc.) confirms the dividing lines [3]. However, in the regions that become borderlands this process is apparently artificial. "People can be

convinced that they're 'different stuff' or 'the same stuff' regardless of the opinions of statesmen." [10]

People living near the demarcation line experienced establishing the border between Ukraine and Czechoslovakia as a traumatic event. The documentary film Hranica tells the story of Slemence, a village that was divided into two parts on August 30, 1946 by the Red Army. One part, Veľké Slemence, remained in Slovakia (then Czechoslovakia), the second part got the name Malé Slemence and fell into the Ukraine (then USSR). "Barbed wire, ruthlessly stretched between the houses, divided the cemetery and properties as well as the closest relatives for decades, sometimes even forever. There are cases when parents remained on one side and children on the other." [Hranica]

2 Boundaries and collective memory of the region – the life "in between"

Natural environment, geographic or political (national) borders stand for just one type of lines dividing different groups of people, cultures or ethnic groups. Relationship between borders encompassing ethnic and cultural areas is remarkable [2]. Natural boundaries may limit population migration and thus can become cultural boundaries. They represent the most easily recognizable boundaries, but structural boundaries appear to be of similar if not bigger importance. Regardless political borders, they divide the area of (Central) Europe in terms of culture [7]. The examples of such cultural divisions include Limes Romanus, the boundaries of the Carolingian Empire, extension of Eastern and Western forms of Christianity, areas of German settlement in Central and Eastern Europe, the Hajnal's line [12], Wallachian colonization and areas subjected to transmission of various ideas (for example, Enlightenment concepts). In context of the major cultural regions of Europe Gerard Delanty links civilizational backgrounds and routes to modernity. Culture defines identity of a historical region and gives it certain unity which in turn creates the basis for a "mental map". Delanty argues that it is necessary to define the regions as transnational historical spaces in terms of their relation to Europe, as variants of a more general historical space, and in terms of their specificity in relation to each other as areas of close interaction and historical commonality. [4]

The project aims to define the historical region with a common historical experience that can be discerned in the longue durée and to reveal the significant features characteristic of the region's history that are more significant that differences between Ukrainian and Slovakian parts [8]. To do this it is necessary to investigate the contemporary ideological context behind the objects selected for digitalization (cultural monuments as well as natural specifics of Eastern Slovakia and Zakarpatian region). The interested parties would be informed about the common history of the region; the stories as part of collective memory will be presented in attractive form. Collective memory has been a frequent topic in scholarly literature. Gabriela Kiliánová, for example, defines it as a reservoir of information related to the past, persisting through the process of recollection. Information retrieved from memory is associated with new data, and all this is happening under influence of different emotions. Collective memory therefore constitutes also a reservoir of feelings and attitudes. [6]

The structural and natural boundaries of the region are recognisable. Natural conditions of the Carpathian basin have contributed to the fact that the north-eastern part of the Hungarian Kingdom since the medieval times has been represented as a borderland. It was politically influenced both by Rome and Byzantium. The line between Eastern and Western Christianity crossed the region and resulted in several ambiguities, for example, in the use of different calendars. The efforts to enforce the use of a single calendar have been futile up to 20th century. Other ambiguities include differences in fasting as well as customs and ceremonies on periphery mentioned by Peter Šoltés, such as church bells, kneeling before crucifix, making sign of cross as well as praying with rosary. Šoltés argues that several regions in Europe (Transylvania, Vojvodina, Baltic areas) manifest the same multiplicity of

traditions. They could be explored only by focusing on micro-regions, on the situation of local communities. Recently historical research faces a challenge of innovative approaches. It is complicated by the fact that historical archives are currently situated in (at least) five countries (Slovakia, Ukraine, Hungary, the Czech Republic, and Russia); and the documents are written in a variety of languages.

The region has been subjected to numerous migration waves. Consequently, in the 18th -19th centuries it homed several ethnic groups: Slovaks, Hungarians, Jews, Germans, Roma, Ruthenians and others. I do not use these terms in the sense of an essencialized identity; they rather refer to self-identification of inhabitants. According to Šoltés, the area of north-eastern Hungary could be characterized by "intensive nonviolent contacts between ethnic groups. Social communication of people with different ethnic identities has led to relativization of prejudices and stereotypical ideas. In the long run it also led to tolerance and resistance toward definite forms of confessional and national mobilization". [9]

From the 10th century until the 20th century the territories on both sides of the present-time border belonged to the Hungarian Kingdom. They were parts of Drughets' and Rákoczis' lands, on the territory of Uh County and Zemplén County. After 1919 they became part of Czechoslovakia. Before the Second World War part of it belonged to Hungary; later some territory passed to the Soviet Socialist Republic of Ukraine. Due to the peripheral position of the region in terms of East as well as West transmission of economic and cultural innovations was slow. Even at the beginning of the 20th century agriculture was technologically backward: machine devices were rarely used, peasants used the method of fallow land and in general an extensive mode of farming. The system of inheritance created tiny fields; since 19th century in combination with the so-called second demographic revolution it has led to impoverishment and overpopulation. All that caused several waves of emigration.

Specific economic conditions together with a variety of confessions and ethnic identities created regional diversity of folk culture. Folk customs and habitual behaviour of people inhabiting the region were influenced by Orthodox Christianity. Some folk beliefs, for example concerning ancestors, revenants or water worship, have been reproduced in unchanged form for generations and have persisted more than in western parts of Slovakia. Traditional patriarchal family system has also survived here for longer time.

The situation in agriculture as well as in the emerging industry has changed during the period of the Czechoslovak republic. In the structure of the Central European economy the region was important due to extraction of salt; as well as production and processing of some raw materials (in particular flax and wool) was home-based. The new state invested in development of infrastructure (land improvement, quality of local roads, modernization of communications), and in particular in development of intensive education. Overall, the interwar period was characterized by political and individual freedom. Cultural and economic development led to improvement of social conditions. At the end of the 1930s, however, this development was hindered by unfavourable international situation [1].

The region of Sub-Carpathian Ukraine declared its independence as Carpatho-Ukraine on March 15, 1939, but was occupied by Hungary on March 15–18, 1939. It remained under Hungarian control until Germans occupied Hungary in 1944. As I already mentioned, in 1945 most of the region was annexed by the Soviet Union and subsequently incorporated into the Ukrainian Soviet Socialist Republic.

Although the territory of the region is now divided, it has common experience of the communist past, shared by many European areas. According to Chris Hahn, „from Eastern Germany to Central Asia, from the Balkans to Chukotka and Kamchatka, we find that the socialist era remains the crucial temporal baseline, even for many of those too young to recall any adult experiences of living under

socialist forms of government". [5] Juraj Buzalka takes the idea back to our region: a rationalist communist project of modernization connected Central Europe to the former Soviet world. This recent convergence has lasted for more than four decades, and from this reason the former satellites of the USSR are in many ways closer to the "new East" as to the "old West". Even those fifteen years of "westernization" after the revolutions at the end of 20th century look pretty similar. The deindustrialization, the fall of the Communist social system and wild capitalism weigh heavily so on the Slovaks, as well as Ukrainians, although no doubt more on the latter. [3]

3 Conclusion

A general view on the history of Europe includes some phenomena, specific for particular regions. The area of eastern Slovakia and western parts of Ukraine represents the type of territory, where many phenomena mingle and combine. The common history of the region corresponds with the mentioned idea of Europe, which we try to find in plurality of its regions. This approach offers an alternative to the accounts of European history in terms of national narratives.

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Storytelling in Virtual and Augmented Reality

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Abstract

In this paper, we propose the possibilities of using the virtual and augmented reality for telling the stories about various kind of objects (wooden churches, castles, technical monuments and others). For purposes of education of the students there is a need to show the connections between various kind of views (historical, geographical, architectural,…). Thanks to the project "InovEduc" we can offer various interactive visualization techniques for presentation of the stories connected to the objects in Slovakia and Ukraine.

Keywords: *Virtual reality, Augmented reality, storytelling, image based rendering*

1 Introduction

Presentation of 3D objects in virtual and augmented reality [1] may differ by techniques of interaction with the content. If we present only 3D model without any environment, we can use the same techniques for both augmented and virtual reality. If we will fix the object position in the space then we can see the object from different angles by changing the position of the camera. From some angles may be we will not be able to see the object (e.g. if we lost the tracking for augmented reality). If we want to present the 3D objects in the context with its environments we will need to change the concept of the presentation (e.g. for virtual reality we can add the skybox). In the project called Innovative Methods in Education for supporting Partnerships - "InovEduc" we want to show to the users different approaches in the visualization of 3D objects. We will connect the 24 different objects (14 from Slovakian side and 10 from Ukrainian side) with the stories. For our purposes we will need to tell the stories about the objects and find the different forms of its presentation. Storytelling is the key element if we want to introduce some new knowledge about the objects to the users (secondary school students). In this paper we will describe some objects and possibilities of its presentations by using virtual and augmented reality.

2 Objects for storytelling

The simplest presentation of the object is to show only the object and allow to the user to navigate in the virtual environment by using camera navigation (rotation, pan and zoom). If we do that, the user has no additional information about the object and man can see only the current state of the object. For purposes of our project we need to add some more information to user, because we need to use the 3D models as the educational objects. We will describe some possibilities which can help the students to enhance the process of learning.

Big group of the objects in our project are wooden churches. They have many specifications like its construction without using any iron nails and other parts. The interesting things are not only the objects itself, but also their constructions. We plan to make the 3D models of the exteriors of the churches and for one or two of them we would like to present detailed construction of the objects. By using timeline for the interaction we can show how the church was built. In this case we need to model the detailed 3D model with each wooden parts including separated shingles. The churches have at the exterior many interesting details like crosses, windows or cupolas. We would like to present each interesting part as the highlighted object with its own description. In the description we would like to provide the meaning of the parts and its shapes from the architectural and religion point of view.

There are also the interiors of the objects. The modeling of the interior is complicated and if we want to present enough information to the user we will need detailed meshes for interior objects. Rather than this access we will use the image based rendering techniques for interiors. We will use the interior spherical panoramas, with hotspots for presentation. For transition between panorama and the 3D model of the exterior, the user will click to the hotspot or to the detail of the entrance (doors).

Figure 1: 3D model of the wooden church in Topoľa rendered in real-time virtual reality application

Figure 2: The detail of the cross at the top of the roof. 3D model is rendered in real-time

We can present the 3D models of the castles in two different ways. First is to show the current state of the castle. In Slovakia we have many ruins of the castles, which are less or more repaired. We would like to show to the users (especially to the tourists) what the state of the object is and what to expect if they will come to visit the castle. For education purposes is this not enough because the most important thing is the history. That's why we plan to use the second way and to show to the users the different architectural evolution of the castles. In the beginning there was usually built the core of the castle with the tower and through the centuries with different owners and keepers the castles grown and change the fortifications. By using this way of the presentation we can describe the stories behind the castles with the connections to various historical events.

Figure 3: Photography of the Zborov castle

In our project we plan also to make the 3D models of technical monuments. One of them is viaduct in Hanušovce nad Topľou. It was built in 1939 and is nearly 400 meters long. It has one curve. For our purposes of storytelling is interesting fact, that at the end of the World War II, it was destroyed by German army. For our work we will show the process of destroying of the viaduct, and the students can see there how it was done and how much it was damaged. There is also possible another

application of the 3D model. For physics, we can show to the students the relation between the speed of the train and the repulsive force. We can use for implementation the fact that there is a curve. Student will be able to change interactively the speed of the train and by using physical simulation they can see, if the train can pass the curve safely or if the train will derail.

Figure 4: Photography of the train viaduct in Hanušovce nad Topľou

There are more interesting objects on both Slovakian and Ukrainian side. For our purposes we need to find some connection between them. We can do that by using the historical, geographical, architectural and religional views and we will enhance the 3D models by texts, sounds (typical sound for each place) and details on the objects. For final presentation we will use three different platforms – web presentation, virtual reality presentation and augmented reality presentation.

3 Virtual reality platform

For presentation of the objects in virtual reality we will use Oculus Rift device. If we are working in virtual reality, the main goal is to surround the user by the virtual environment. For each view direction the user must be surrounded by objects. If we want to present the exterior of isolated objet in the 3D space, for many directions there is an empty space. We can use this space for textual information or we can add the 3D model into its environment, which will surround it. For our purposes we will use the second way. We will model the environment, for most of the objects it is nature or some buildings. We need to have as photorealistic environment as possible with post-processing effect for visual enhancement of images. For this goals we also need proper hardware, which is able to render the scene with effects in Full HD resolution and minimal 60Hz.

For virtual reality there could be problem with navigation in virtual environment. As we can see in [2] and [3], there are several possibilities for navigation. For our purposes we can add to the scene isolated viewpoints and camera can seamlessly change the position after the user input or we can add to the user possibility of free navigation by using walk mode. If we will allow to the user the free navigation

we want to show him also another information (text, sound, details). There are few possibilities how to enable the various inputs. We can use relative position of the user head from sensors in the headset and by using timeout, we can select the highlighted object in the scene or we will use external input device like keyboard or remote controller.

The presentation in the virtual reality is more complex than augmented reality or web presentation thank to the complex immersion into the virtual world.

4 Augmented reality platform

For augmented reality is typical fixation of the 3D model into the position of the sensed marker. For augmented reality there is no necessary to add all environment like skyboxes or terrain (whole or parts). For each type of presentation we need to create its own environment. In augmented reality we will fix the position of the primary object (church, castle,...) with the marker (image). The position of the camera is done by user by changing the position of the real camera on tablet or smartphone. There is also possible to zoom the object in two ways [4]. One of the most important things for storytelling in augmented reality is the possibility of showing additional information (texts) around the object also fixed into the position of the marker.

The interaction in augmented reality can be done in virtual space by using e.g. virtual buttons or via graphical user interface on the display of the device. If we use the device GUI we can simply collect input information by touching the button on the display. If we will use the virtual buttons we can interact with it by sensing the position of sensed hand in the scene aligned properly with marker and after some timeout the action can be provided. This kind of interaction can by problematic if there are two or more users with various devices and they use the same marker.

We can also provide additional information about objects like texts and sounds which can enhance the experience of the user.

5 Image based rendering in augmented reality

In sections above we describe the possibilities of the presentation for 3D models in augmented reality, but we also said, that we want to present also the object interiors. For this reason we made spherical interior panoramas. We can also show the panoramas in various ways.

First is to show the panorama "inside" the marker. We use the marker as the frame for panorama and the content is shown inside the marker aligned with it. The user can change the rotation of the camera which is centred in the middle of the projection sphere by touching the display of the device and make proper gesture.

Second way is after the entering into the mode of rendering the panorama mapped into the sphere change the displaying the scene sensed by the camera into the full screen rendering of image. When the user rotate the tablet into various directions the scene will render the same virtual camera movement thanks to the sensors (accelerometers, gyroscope and magnetometer). After the leaving this mode the camera start to sense the real world and try to find known marker.

Third way is to show the sphere mapped with the texture of panorama fixed in the position of the marker with proper radius and flip the normal vectors. User can see the image mapped inside the sphere. If user want to see another part of the panorama he need to change the position of the camera in sensing device or rotate the marker.

There is also one special object in the project, the wooden church in Šmigovec. The interior of this object is empty, because the iconostasis from this church was removed during the reconstruction. I looks like, that the iconostasis will be not installed back into the church. For this reason we plan to provide to the visitors possibility of using the augmented reality. We will make the image of the iconostas and when the visitors enter inside the church, they can use their mobile devices with our application and by the augmented reality they will see the church interior virtually equipped by the iconostasis.

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Scientific research and international cooperation of information technology faculty of Uzhgorod national University

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Abstract

One of the important directions of development of Informatization of education are new computer technologies. Interactivity, the intensification of the learning process, feedback is a notable advantages of these technologies that has led to the need for their use in various fields of human activities, primarily those associated with education and training. Currently markedly increased the number of studies, the subject of which was the use of information and communication technologies in the educational process. It is the development and implementation of information technologies in educational process and engaged the faculty of information technology. Main priority directions of scientific activities at the faculty are:
• Research data sets of large volume of logical and algebraic methods using the latest computer systems and technologies;
• Study of modern methods and the development of appropriate algorithmic and software complex for simulation and optimization of complex objects, which have a layered structure.
A fundamental task of the faculty of information technology is the integration of information technology with scientific, production, initiating the development of all spheres of social production, intellectualization of labour activity.

Keywords: Information technology, progressive training, model e-learning, information enterprise, innovation

1 Introduction

Information educational environment is sustained interaction between structural virtual organization the knowledge of mankind and of man in it, functioning with its information needs. In this case the huge role mental a person's formation — education and development. From the point of view of the person information educational environment should be open and provide maximum freedom of choice. At every step of personal development is education should provide the individual possible for him subjective trajectory as a sphere initiative and responsibility, which determines the vector of individually focused educational process that is consistent with the provisions of the Bologna process. So, an important milestone of the Bologna process is to coordinate policies in the field of education, providing:

- accumulated knowledge in the course of life, when General education credit updated credits consistent education,

- the individual educational trajectory. The implementation of this policy aims to meet the educational and cultural standards of the United Europe.

2 Information component

Application in teaching practice of information technology should ensure the achievement of goals. The basis of the guarantees of a result, learning is rapid feedback, covering the whole educational process. In the course of studying of educational material, the assessment of current results and correction of learning aimed at the achievement of goals. This learning objective is formulated in learning outcomes expressed in the actions of the students (listeners). And this, in turn, is necessary to analyze the meaningful information for the audience to grasp, that is, quantitative measurement and qualitative description of the content of educational material. This problem is solved in two main ways:

- building a clear system of objectives, within which allocated categories and progressive levels (hierarchy); — such systems are called pedagogical taxonomies;

- create the most clear, specific language to describe the goals of learning in which the teacher can translate the insufficiently clear wording.

- In determining the valuation of the knowledge test contains the following components:

- definition of learning objectives;

- selection of tests that verify the attainment of those objectives;

- evaluation or other method of reflection of test results.

- This can be achieved through a system of testing, surveys, control work, which involves:

- the objectivity of the test results, as the presence of a predetermined benchmark response (answers) each time will lead to the same result;

- improving the efficiency of the Supervisory activities of the teacher by increasing their frequency and regularity;

- the ability to automate the examination of pupils, including through the use of computers and use of remote setting [1,2].

3 E-learning

A distinctive feature of the modern stage of computer education at the faculty is the increased interest in its theoretical justification, and hence the increase in the number of research psycho-pedagogical problems of teaching by computer. These studies, in turn, led to a revision of many theoretical concepts of educational psychology. There are new learning theories, some of them specifically oriented on the PC. Modern state of computer education describes an enormous gap in the quality of educational programs. On the one hand, we have developed programmes in which the maximum completeness are implemented didactic possibilities of computer. To ensure problem-based learning create game and simulation program. Popular are intelligent tutoring systems that implement reflexive management of educational activities, when based on the model of the learner, the computer was discussing with him the plan, methods of control, estimates, strategies solutions, not only those challenges that are presented to the student and putting the student. On the other hand, dramatically increases the number of primitive training programs that not only enhance learning efficiency, but often give a negative result [3]. Designing learning systems with current technology of training contains three phases:

1) preparation of educational material (thematic planning, system objectives, intended learning outcomes, the planned term of study, levels of assimilation, control tasks for the achievement of the objectives of diagnosis, didactic materials for independent work of students);

2) orientation of students (reviewing the learning objectives that need to be converted to the purpose of the doctrine, the creation of motives of educational activity of students, familiarizing them with the procedural side of education and the distribution of functions between the participants of educational work, explaining the criteria and mechanisms for monitoring and evaluation of learning);

3) organization of stroke training sessions, which is characterized by the increase in the share of independent activity of students, maximum individualization, active forms and methods of learning, constant feedback [4].

4 Innovation

Organization and coordination of scientific and innovative activity of students in conditions of a higher educational institution must be sent to both instructional and research units (sectors) of the institution. This activity involved research institutions, which cooperate with the institution of higher education, enterprises of all forms of ownership and innovative infrastructures.

The active implementation of students of higher educational institution innovative activity in modern conditions implies the formation around specific research and innovation environment. The formation of such an environment, support activities of scientific, technical, research, industrial and entrepreneurial groups of workers and students, organization of their interaction with enterprises and companies for innovation centres, business centres, innovative business incubators, science and technology parks.

According to world and domestic experience, the organization of innovative forms of functionally defined as: "innovation center" is linked to organizational form, intended for the introduction of scientific developments and technologies to market in the future. Within this form students can be involved in the development of viable business plans and innovative projects, finding customers for its product as well. The "business center" corresponds to organizations - technical form that provides information, training, consulting and other services to enterprises and individual entrepreneurs. Analysis and generalization of experience of cooperation of higher educational establishments of Europe, the companies suggest that these institutions are mainly established the following structural form:

   • training business centres (business schools), consulting centers;
   • innovation (business centers), scientific and technical business centers.

Training in the business training centers and business schools is closely associated with specialization of basic higher educational institutions. It is carried out by paid training and specialised courses, which may be of interest to future entrepreneurs and managers.

5 Management methodology

Analyze the issues of methodology of management education and research of investment projects in conditions of a higher educational institution. In the scientific literature on the problems of management of scientific activity in higher education is widespread, the concept of "on - tesnogo" approach, whereby the process control can be expressed in the form of continuous inter-related activities - the so-called management functions. In this approach, the process model of management of

scientific activities of the University or faculty is defined as the interrelation of the basic functions of management: planning, organizing, program and target approach, motivation, feedback (analysis, monitoring, control) and coordination, which the joint processes of communication and establish some effective measures. One of the main tasks of the faculty is organizing and conducting fundamental and applied scientific researches aimed to solve scientific or applied problems and improvement of vocational education students. Objectives research and innovation higher education institutions can be classified according to three main groups:

- Theoretical (research): conduct research on promising (priority) directions of development of science and technology in the field of activity of meta and of the University;

- Applied: - development of scientific (scientific and technical) issues within the scope of activities of meta and educational process; improvement and development research and experimental-experimental - talino base of scientific and educational activities;

- Education: training of scientific and pedagogical staff, specialists in innovation management;

- The main form of organization of scientific and innovation activity of the faculty is an educational-scientific projects that can be classified by such characteristics as the level and structure issues that are being developed; focus, participants, type of customer, nature of funding and lead time.

- The process of implementation of research projects has a number of features, the main ones are the following:

- specific hierarchical structure of the control system in research and innovation activities of the University;

- the priority in the implementation of research projects in order to over- system;

- a significant degree of external uncertainty in the formation of goals implementation of long-term and medium-term scientific projects, as well as the requirements of the supersystem on the structure and content of specialists training.

Acknowledgments

So in universities the main result of the implementation of research projects is usually the improvement of the educational process. In addition, the faculty considerably less attention has been paid to basic research, and increasing emphasis on commercial, applied research projects, which may be regarded as innovation projects.

The main purpose of the research project management at the faculty is to ensure the desired quality of results with fixed parameters of the social order on training of specialists and key resource support of the University (logistical, financial, organizational, personnel, scientific-methodological, legal and information).

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"Carpathia" and Renaisance of Regional Historical and Cultural Heritage in Transcarpathia (Zakarpattia, Ukraine)

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Abstract

The article is dedicated to the Agency of researches of regional society "Carpathia", regional and cultural traditions and the reproduced materials (old books and newspapers) in the electronic format. Our main goal is to save interesting publications, photo illustrations and documents, and also to enrich the cultural treasure of the Transcarpathian region (Zakarpattia, Ukraine).

Keywords: Transcarpathia, Zakarpattia, Ukraine, Agency of researches of regional society "Carpathia", regional and cultural traditions, the reproduced materials in electronic format, project "InovEduc".

The idea of preserving and enriching the cultural heritage of region, adjacent geographically, but close spiritually and historically is an essential component of inter-regional cooperation. It should be noted that the issue of revival of cultural and historical values is actual for the adjacent Slovakian and Ukrainian regions and apparently requires common approaches to the principles and methods of presentation of the best samples and continuous exchange of experience in this field.

In this sphere works the Agency of researches of regional society "Carpathia", which was established in 2012 as an independent public organization in Uzhhorod (Transcarpathia / Zakarpattia, Ukraine). Although it has a regional status, but the extents of its creative initiatives are generally wider. "Carpathia" helps monitoring, study and analyze topical issues of Ukrainian, regional and interregional development, fulfill direct contacts and common research projects with research and scientific and educational institutions of Ukraine and the countries of Central Europe, and also is involved in the organization of historical, cultural, political and sociological researches [1].

The main tasks of the Agency "Carpathia" are the following:

- study of public society, social, political, cultural, educational and spiritual development of the Transcarpathian region;

- monitoring of the actual regional issues;

- research of the various spheres of social life in the region and its dynamics;

- research of the various spheres of social life in the region and its dynamics;

- conducting of surveys, questionnaires and other methods of political research with the aim to identify public opinion on issues of public life;

- realization of rating cuts of political and social organizations;

- development of statistical and expert analysis;

- realization of publishing and other kinds of activities, including the publishing of scientific series "Studia Regionalistica";

- organization of connection between the citizens and the local authorities to assess the effectiveness of state and regional policy;

- realization of direct contacts and common scientific projects with research, scientific and educational institutions of Ukraine and foreign countries [2].

The Agency conducted sociological surveys in the areas of:

- formation of civil society, political culture and mentality in a multi ethnical region;

- identification of the level of public interest in the political processes, participation in the delegation of its authority to elected representatives;

- analysis and forecasting of demand and supply for labor;

- monitoring of historical, cultural, educational and pedagogical problems [3].

Particular attention should be paid to the problem of preserving historical and cultural heritage in the region. In particular, the "Carpathia" started the campaign for preservation and reproduction of distinctive regional publications by electronic digitizing of printed materials of Transcarpathian region. It is entitled "Historical and cultural heritage of Transcarpathia". Thereby we call: "Do not be indifferent to the past! Support the Future!" [4].

Figure 1: Digitization campaign banner

The action is caused by the fact that nowadays a significant number of valuable published sources, including periodicals, popular scientific, cultural, educational and other publications that were published in our region in XIX – in the beginning of XX centuries, are unknown not only for the general reader but also for professionals.

Inaccessibility of original sources for contemporaries significantly reduces the possibility of transmission to the young generation of the best examples of historical and cultural heritage of Transcarpathia deprives to present on a high-level cultural achievements of the peoples who live here. In addition, this problem is poorly understood and virtually unknown to the general public, not only in our region but also in Ukraine and adjacent regions of neighboring countries.

Therefore "Carpathia" promotes original publication of the past, and for the first time makes them actually available in full to the public. The final result will be addressed not only to the qualified

readers, scholars, researchers of history, culture, education, journalism, writing, publishing, and also student and school youth.

The implementation of this noble mission allows readers not only to read the original text, but also to work with the source for further studies, compare the substance of the text with the historical course of events in the development of the region.

With the reproduced materials in electronic format we have an opportunity to present on education and cognitive internet portal "zaKarpatia" ("заКарпатія") (www.zakarpatia.com), where they will be stored and available for present and future generations.

Screenshots from the site

Figure 2: Carpathia web site header

For example, we have already processed a batch of brochures under the title "Books of Ruthenian" ("Knyzhky Rusyna") on educational topics that were initiated by the editorship of Uzhhorod newspaper "Ruthenian" ("Rusyn") in 1923. Publication of pocket thematic books was carried out with the assistance of the vice-governor of Pidkarpatska Rus – Peter Erenfeld. In publishing editorial were working F. Tihyi, V. Hrendzha-Donskyi, A. Shtefan, A. Voron, M. Kachaniuk.
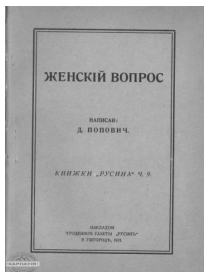

Figure 3: Cover page of book "Woman's question"

The book "Woman's question" ("Zhenskii vopros") written by Dmytro Popovych was published in Uzhhorod in 1923 under the № 9 of the series "Books of the Ruthenian" ("Knyzhky Rusyna"). In the contents: an old question in a new century, the ideal goals of a happy life, mutual respect in family life, the gift of motherhood, a woman's place in society before and after the adoption of Christianity, a woman in politics, modern feminism, etc. The edition was edited by Francisk Tihyi (Frantishek Tihyi).
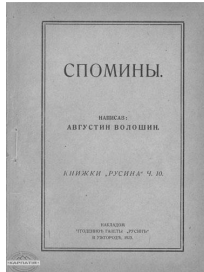
Figure 4: Cover page of book "Memories"

The book "Memories" ("Spomyny") written by Augustyn Voloshyn was published in Uzhhorod in 1923 № 10 of the series "Books of the Ruthenian" ("Knyzhky Rusyna"). In the contents: information on the establishment of "St. Basil (Vasyl) the Great Society" and the stock company "Unio", church history and the beginnings of regional periodicals, the foundation of Uzhhorod Ruthenian People's Council (Uzhhorodska Ruska Rada). The edition was edited by Francisk Tihyi (Frantishek Tihyi).
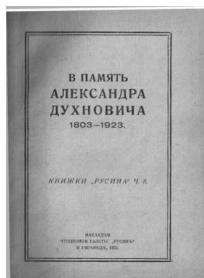

Figure 4: Cover page of book "In memory of Aleksander Dukhnovych. 1803 – 1923"

The book "In memory of Aleksander Dukhnovych. 1803 – 1923" ("V pamiat Aleksandra Dukhnovycha") was published in Uzhhorod in 1923 under the № 8 of the series "Books of the Ruthenian" ("Knyzhky Rusyna"). In the contents: articles about arouser author and his works. The publication was edited by Francisk Tihyi (Frantishek Tihyi).
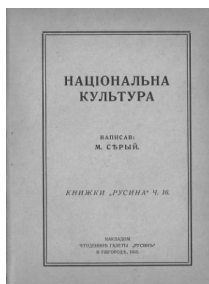

Figure 5: Cover page of book "National Culture"

The book of M. Siroho "National Culture" ("Natsionalna cultura") was published in Uzhhorod in 1923 under the № 16 of the series "Books of the Ruthenian" ("Knyzhky Rusyna") .

We also made available pedagogical periodicals – professional newspapers and journals for teachers of Pidkarpatska Rus, which were published by professional associations. Among them are periodical publications under the titles: "Teacher" ("Uchytel"), "Teacher's voice" (Uchytelskyi holos"), "Our School" ("Nasha shkola"), "People's School" ("Narodna shkola") [5].

Figure 5: Front page of newspaper "Teacher"

Therefore, our collaboration draws attention of contemporaries to the little-known pages of multifaceted life of Transcarpathia, returns from oblivion dozens of famous and unjustly forgotten names of great personalities of social, political, religious, spiritual, cultural, educational, journalistic and publishing life of Transcarpathian region.

We have a goal – to save interesting publications, photo illustrations, documents, and to enrich the cultural treasure of the region!

However, we are extremely interested in interregional cooperation with our Slovak partners towards the preservation and restoration of cultural and historical heritage, which has a large number of common characteristics. In particular, we have great hopes for the realization of the project "InovEduc", which largely serves as a prop for our common aspirations for the enrichment of regional and cultural traditions and also the methods of its reproduction in the educational sphere.

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Professionally-oriented teaching at university focusing on information-based enterprises

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Abstract

The article deals with the professionally-oriented teaching focusing on information-based businesses. Higher educational institutions do not often have the emphasis on promoting the professional concept of education as a continuous activity throughout life, the promotion of active labour market policies and on professional consultancy. Effective higher education professional preparation is not only a question of mastering a specific theory, but also high-quality professionally-oriented teaching systems in relation to the development of direct contacts with employers, create a high-quality supply of educational and training modules leading to the development of key competences. These key competences and their mastery allows high adaptability to changing requirements in the labour market, increasing the competitiveness of the labour force and is a prerequisite for the extension of the culture of lifelong learning. Significantly, these facts are also valid for the teaching of information-oriented businesses.

Keywords: Professionally-oriented teaching, experiential learning, learning methods, information enterprise, practical learning models

1 Introduction

Professionally-oriented teaching is in close relation to the application of the graduates, follow-up practice, practical teaching and completed internships for the enterprises. At the same time it is a very frequent topic of academics and employers to consider. We could not overlook statistics which clearly demonstrate the increase in unemployment in this age category, and the fact that the first "employers" become often the labour offices.

Universities often publish data about the employability of their graduates. However, the data is missing completely, which would have shown the economic benefits for the society. Therefore, the number of jobs that graduates create, the annual production of these companies, and the number of patents generated by innovation or the number of newly created companies.

It is usually a professionally discussing whether a larger share of this fact have universities or businesses. Often it is forgotten on one basic economic approach. There is a labour market, on which it is defined the demand and the offer of labour. An employer demands a particular profession, therefore, to take her or his knowledge for the manufacture of a product or service creation. Therefore, there are competences and ability to handle the job performance. The employer does not ask for an academic title as the formal output of higher education. Employers aware very well that knowledge is not information. The information in the information society is losing its value. Even Professor Zelený [1] emphasises the fact that knowledge is an action. The required knowledge must be used in the corporate action, and business activities. Therefore, the workforce must demonstrate the ability to

specific offences, procedures, and practical skills. Only information, theory and academic titles are not enough yet.

What does this mean for universities? The answer is clear. Do not teach them only information, let's teach the knowledge. And the specific knowledge needs of graduates in the profession can be assessed by the particular representatives of the employers. They define the demand curve and create its shift. This is a fact which cannot be changed. The process of formal accreditation scopes must be based on the differentiation of universities, understanding the need to educate our students for specific application on the labour market.

2 Professional orientation of teaching

Learning by doing is a classic approach, which was already described by philosopher Jean-Jacques Rousseau. He stressed that the work of the teacher always was "to present problems and to stimulate curiosity". His views were the opposite compared to the educational structure, which was focused on memorization.

John Dewey, born in 1859, is perhaps the biggest proponent of learning by doing. Dewey [2] argued that "education is not a preparation for life, it is life itself". Both Dewey and Rousseau lived in times of great changes, the industrial age and therefore they could see the need of learning which was pragmatic, focused on individual connection with the surroundings. Dewey said that "life, including professions, should form the basic framework for learning".

Unfortunately, there are very few teaching methods used today at universities, which lead students to be able to actually do what they learn. It allows both the teacher assess whether the objectives of the training courses are fulfilled but also it allows the students to be able to do, what they are led to. Thus, to learn so that they could use the skills they have learned.

Schank [3] already in 1995 said: "One of the most interesting questions for me today is education. I want to know how to restore the school system. One thing is to look at how people learn and how schools operate. At schools, students are taught to read a lot of things, not to do the things. Then it generates endless problems ".

3 Models of practical teaching

Dewey´s experiential teaching model [4] consists of logical sequence, which includes the perception of the problem, followed by his verbal description, the creation of hypothesis for finding a solution. Then there are experiments with the possibility to test the hypothesis and, finally, giving a feedback.

Dewey believed that the importance of the experience is the result of the interaction between what the student brings to the situation and what happens. Dewey thought, continuity and interaction are the two basic criteria for determining the quality of the experience. The student should be able to link aspects of new experience with what he or she already knows.

Reflection of the practice is an important part of the process of experiential teaching. Learning through everyday experience is not enough; it is a continuing process, which allows individual learning. Experiential learning, as stated by Kolb [5] stresses that the account of the direct, specific experience are the most important. The practice should be an opportunity for reflection, which allows the creation of connections between their own experience and knowledge. According to Georgiou, Zahn and Meria

[6] is valid: "the heart of experiential learning lies in the specific experience and the possibility to actively experiment with abstract conceptualization"(p. 81).

Grosby [7] emphasis the same place in practical teaching by "educational process is based on the human experience of the difficulty of moving resolution.". "Experiential teaching" is a way to represent the sequence in the experience learning.

4 Teaching and learning in the new millennium

The position and function of university teachers from the viewpoint of loyalty and trustworthiness of transmitted knowledge and information will be much more fully reflect the amount of resources that will be available to students. Computer networks and information services of the type of global information network will allow much broader information base which you can draw from, than it has been at any time in the past. A computer links on a network becomes immediately a source of vast amounts of information of unprecedented scale. It is necessary to take advantage of this fact in the concept of learning by doing.

The ability to critically evaluate the information received and occupy the position to their content takes more importance than the memory performances focused on memorizing content of serially produced textbooks. In the digital world the product lines come into existence with an appropriate combination of partial solutions that are available in network environment. Such a model is very well applied when drawing up new educational programs and teaching materials. The new context, which can be used in this way, may apply as a significant motivating and inspirational element.

How the world has ceased to be geographically limited, any information source becomes the principle reachable over the network environment. Good schools will begin their training programs to offer as network applications and navigate to the business community. Managers of the enterprises have already known the fact that the practical education of workers is a fundamental prerequisite for achieving strategic goals. The current innovation of corporate know-how is not based only on knowledge of facts, but on the overall knowledge and key competences. The ideal state is our own knowledge of the need for lifelong learning among the workers, and their motivation for undertaking further self-education. The most effective methods of learning are combined (distance) learning linked with our own practice.

New vision begins to discuss of the non-contact teaching. In my opinion this vision of teaching without personal contact is certainly extreme. There will always be teachers who are not expendable in their physical presence and communication. However, there will be the teachers, who can handle the actions via the electronic media. It is only a matter of the world with the modern technology which makes them self explanatory tool for common activities.

The deployment of information technologies will not only mean the ability to use computers in the environment of the classic schools, but it may indicate trends in changes the form of the school becoming a very radical nature. Information and knowledge revolution turns into the form of education with new technological possibilities that information technology brings. It will allow a substantial diversification and individualization of educational opportunities and offers a selection of them, but it will also bring changes in the way of learning, the importance of education for the future application of individual and economic performance.

5 Professional teaching focusing on information-based enterprises

In the considerations concerning the form of the practically-oriented university and education at the beginning of the millennium is impossible to avoid another context associated with the development of information and communication technologies and their significance for modern economic entity. Their implementation has brought significant change for the entire society, the organization of a series of activities and a way of life virtually every individual. The relationship between corporate objectives, methods of control and information systems and information technologies is very balanced. In computer science, you cannot see the primary factor in business management, but at the same time you cannot set business objectives and methods of business management. There are changes in the organization of work in enterprises and companies, changes to the structure of the management of the centralized bureaucracy into the flexibly configurable network cooperating with smaller units or teams. The problems of large industrial giants are not just a symptom of our current economic situation, but a sign of the period presenting the situation in every developed country. The richest man is neither the oil tycoon nor the owner of steelworks, but the founder of the software company, that has lasted for over two decades.

Information technology in a growing range supports the business activities primarily through new instruments – for example, bar code, electronic labels, customer loyalty cards, monitor the flow of customers in the shop. The traditional distributors and retailers have been disappearing and their place is replaced by a direct contact with the manufacturer, through the electronic media and communication. The traditional shopping of manufactured goods from the store has been disappearing as well and the warehouse production itself too. The possibility of immediate knowledge of the condition of sale, the quantity of the items on the sales are all examples of the use of the information in the sales and production chain, which allow to replace information with the built-up area of the warehouse, decrease the volume of the "ready-made" production produced for the storage and replace it with a virtually immediate production of a product that is adapted to the specific demand and the requirement of the customer. It's potentially almost everything – travel agencies, stores offer cars, financial services.

There is a growing business process of re-engineering (BPR). The aim of the BPR is an optimal response of undertaking to an external event. The optimal reaction means the fastest and best response upon minimum consumption of resources. In the approach, emphasis is placed on the main processes (e.g. order processing) and the worker's responsibility for the whole process (functional approach). This optimization is achieved very often using new features of the information-based business. New virtual work teams have been established. For these teams are not the characteristic of work in the one site team, but the information base and the means of communication. Rapidly there is developing mobile services based on information technologies. It is a comprehensive information support for a worker on business trips - portable computers, the connection to the computer network of the company and cooperating companies, the connection to the public databases.

Key issues of the information society becomes the disappearance of borders in the geographical sense, the ability to create "virtual" communities that are not spatially limited, increasing the importance of individuality, which can be encouraged with the ability to pursue connections otherwise difficult to practically feasible.

The above mentioned activities in enterprises must be reflected in teaching at universities. It is not possible to teach professionally if the curriculum does not include the knowledge of the processes described above. This is not only about the memory information. Processes need to be practically overmastered. Students should pass the corporate life. Information technology will become a practical tool for business management.

Acknowledgments

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Practical Evaluation of Selected Mechanisms for Interoperability between IPv4 and IPv6

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Abstract

In this paper we evaluate selected mechanisms for interoperability between IPv4 and IPv6 protocols. We provide not only theoretical description, but also practical information on how to configure selected mechanisms on widely available networking equipment. Furthermore, we provide information on real-life user experience and evaluation of complete topology design and configuration by means of simulation using the widely known GNS3 simulator.

Keywords: IPv6, IPv4 & IPv6 Interoperability, network simulation, IP tunneling, 6to4

1 Introduction

Recent rise of global utilization of IPv6 protocol brings the necessity of shifting focus of network administrators worldwide from studying RFCs and documentation to performing actual practical experiments and evaluating the various aspects of IPv6 using a hands-on approach. Before actually implementing the new protocol on production network, it is a necessary practice to perform a test configuration and evaluation. This can be easily done using the free GNS3 simulator, able to emulate Cisco hardware providing almost 100% fidelity to real topology configuration, at a fraction of cost.

In our work [1] we focused on two tunneling mechanisms of interest – one being the configuration of static tunnel for transmitting IPv6 packets inside IPv4, also known as 6in4, and a somewhat similar mechanism for automatic tunnel creation – 6to4. Our goal is to provide connectivity to two remote branch offices, with focus on demonstrating the complete configuration by creating custom test topologies. Configuration of these topologies brings important practical experience, necessary for later problem-free deployment in actual real network.

The paper is organized as follows: The second section brings a brief summarization of necessary IETF documents regarding the theoretical background for tunneling of IPv6 in IPv4. The next section then presents our own test topology for configuration and evaluation of a static tunneling. It provides a complete address plan along with a complete Cisco IOS configuration. The fourth section provides another original topology for testing a 6to4 implementation again along with complete address plan and configuration walkthrough. Section 5 then concludes the paper.

2. Basic IPv6 tunneling

Static or manually configured tunnels are described in several RFCs [2][6][7]. The IPv6 payload is identified by the value 41 in the *Protocol* field of IPv4 packet header. Source address of encapsulator and destination address of decapsulator must be configured and matched on both tunnel endpoints. Packets without matching addresses are discarded for security reasons, which results in breaking of broadcast and multicast mechanisms. A similar mechanism Generic Routing Encapsulation (GRE) tunnel IPv6 over IPv4 is another static type of tunnel, providing additional benefits, such as keep alive messages. GRE includes extra header into the carrier IPv4 thus lowering the MTU for the passenger IPv6 protocol. For this reason we will further focus on the direct IPv6 in IPv4.

Dynamic automated 6to4 tunneling defined in RFC 3056 [3] specifies a special IPv6 address format with dedicated 6to4 prefix *2002::/16*. The tunnel is created automatically, based on the public IPv4 address embedded in the destination 6to4 address. As shown in Figure 1, there are 16 bits reserved for subnetting, making this mechanism suitable for potentially very large networks.

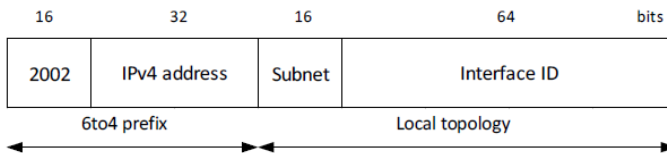| 16	32	16	64	bits
2002	IPv4 address	Subnet	Interface ID	
6to4 prefix		Local topology		

Figure 1: 6to4 address format

The connection of IPv6 networks using 6to4 is completely ISP agnostic, thus giving the control to the administrator of the network, that wishes to be connected. However, the problem of potential filtering of tunnel packets at ISP border router still applies. Connecting 6to4 networks to native IPv6 Internet is implemented usually using a relay router with standard defined [3] IPv4 anycast address *192.88.99.1* and its corresponding 6to4 equivalent prefix *2002:c058:6301::/48*. Given the asymmetric nature of anycast 6to4 versus native IPv6 communication, the likelihood of filtering at ISP gateways is relatively high, thus limiting the practical usability of this mechanism.

3 6in4 – practical configuration of static tunneling

3.1 Configuring the GNS3 simulator

The GNS3 simulator must be configured first, IOS images must be set up and an IdlePC value must be calculated in order to practically use the simulator. Without calculation of these values the simulation would be prohibitively slow, even when run on a very powerful computer. Only older Cisco IOS images (such as v 12(4)xx) are usually supported, so only selected mechanisms can be evaluated. The details of simulator setup are available at GNS3 website [4] .

3.2 6in4 – static tunnel plan and configuration

As described in [2], the static tunnel configuration best fits the scenario, in which two remote branch networks belonging to the same company are already implementing the new IPv6 protocol and need to be connected together. The ISP infrastructure connecting the branch offices is assumed to be IPv4-only.
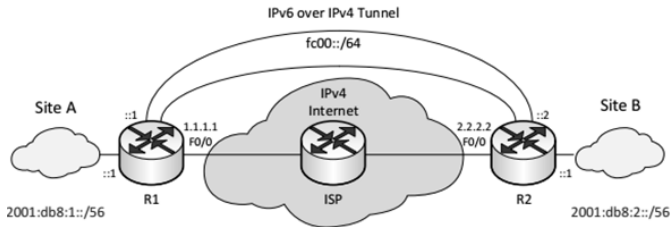
Figure 2: Topology Nr. 1 - A manually configured tunnel connecting two IPv6 networks using IPv4-only infrastructure

Site A has been assigned a global unicast IPv6 prefix *2001:db8:1::/56* while site B has been assigned a prefix *2001:db8:2::/56*, creating two subnets of the same large network. Unique local addresses (ULA) were used in this example for addressing of the tunnel endpoints. The ISP network is implemented as simply as possible by one intermediate router. Further reduction would be in theory possible, but would omit the important observation, that one hop for IPv6 can represent several hops for the carrier IPv4 protocol. The exact address plan,with address formats according to [5] is given in the following table:

Table 1: Addressing scheme for topology Nr. 1

Device	Interface	IPv4 address	IPv6 address	Comment
R1	F0/0	1.1.1.1/29	-	Tunnel endpoint
	F0/1	-	2001:db8:1::1/64	Local IPv6 network
	Tun0	F0/0	fc00::1/64	
R2	F0/0	2.2.2.2/29	-	Tunnel endpoint
	F0/1	-	2001:db8:2::1/64	Local IPv6 network
	Tun0	F0/0	fc00::2/64	
ISP	F0/0	1.1.1.2/29	-	
	F0/1	2.2.2.1/29	-	

Regarding the configuration commands, the configuration of a static tunnel is implemented easily by creating a virtual tunnel interface with correct endpoints and mode settings (Table 2, Comm. 7-13). The IPv6 routing through tunnel is then configured in a standard way (Table 2, Command 14). First two steps represent the configuration of native IPv6 and are mentioned here for completeness.

Table 2: Cisco IOS configuration commands for configuration of static 6in4 tunneling on R1

Step	Command	Comment
1	**ipv6 unicast-routing**	Enable IPv6 on the router
2	**ipv6 cef**	
3	**interface** *FastEthernet0/1*	Setup native IPv6 network
4	**ipv6 address** *2001:db8:1::1/64*	
5	**ipv6 address** *fe80::1* **link-local**	
6	**no shutdown**	
7	**interface** *Tunnel0*	Setup pseudo-interface serving as tunnel endpoint
8	**ipv6 address** fc*00::1/64*	
9	**ipv6 address** *fe80::1* **link-local**	
10	**ipv6 mtu** *1280*	
11	**tunnel source** *FastEthernet0/0*	
12	**tunnel destination** *2.2.2.2*	
13	**tunnel mode ipv6ip**	
14	**ipv6 route** *2001:db8:2::/56 fc00::2*	Setup routing towards the other site

3.3. 6in4 evaluation

The connectivity was easily tested using the ping utility. Given the simulational nature of experiment, more advanced evaluation of throughput and latency were not feasible and thus not performed. The stacking of network protocols was evaluated using the Wireshark tool. In its protocol analysis output in Figure 3 at interface *f0/0* of router R1 it is clearly visible how IPv6 packet carrying the ICMP echo is encapsulated by an IPv4 packet with addresses corresponding to the tunnel endpoint interfaces.

```
Internet Protocol Version 4, Src: 1.1.1.1 (1.1.1.1), Dst: 2.2.2.2 (2.2.2.2)
    Version: 4
    Header Length: 20 bytes
    --- OMITTED ---
    Protocol: IPv6 (41)
    Header checksum: 0xb64a [validation disabled]
    Source: 1.1.1.1 (1.1.1.1)
    Destination: 2.2.2.2 (2.2.2.2)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
Internet Protocol Version 6, Src: 2001:db8:1::1 (2001:db8:1::1), Dst:
2001:db8:2::1 (2001:db8:2::1)
    --- OMITTED ---
    Next header: ICMPv6 (58)
    Hop limit: 64
    Source: 2001:db8:1::1 (2001:db8:1::1)
    Destination: 2001:db8:2::1 (2001:db8:2::1)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
Internet Control Message Protocol v6
```

Figure 3: Tunneling analysis by Wireshark protocol analyzer

4 6to4- automatic tunneling

4.1 6to4 plan and configuration

The automated 6to4 tunneling mechanism is implemented by using special 6to4 IPv6 address prefix *2002::/16*. To be able to successfully configure 6to4, it is first necessary to configure IPv4 connectivity between 6to4 sites. Public IPv4 addresses need to be used on the tunnel endpoint interfaces. As show in Figure 4 and Table 3, simple values were used for easy conversion to hexadecimal representation.
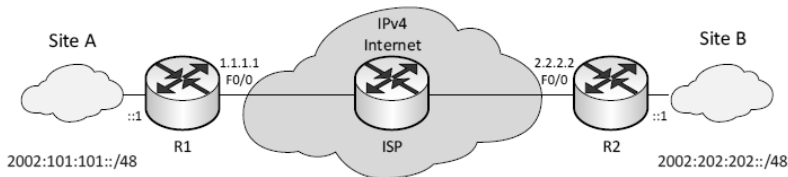
Figure 4: Simple topology for automated tunneling test of 6to4 mechanism

Subnet value zero was used for the tunnel itself, while subnet number 1 was assigned for site A and the same subnet number 1 for site B. Given the different 6to4 prefixes, constructed from unique public IPv4 addresses, the same subnet numbers don't create any collision.

Table 3: Address plan for the test 6to4 topology

Device	Interface	IPv4 address	IPv6 address	Comment
R1	F0/0	1.1.1.1/29	-	Tunnel endpoint
	F0/1	-	2002:101:101:1::1/64	
	Tun0	F0/0	2002:101:101::1/64	
R2	F0/0	2.2.2.2/29	-	Tunnel endpoint
	F0/1	-	2002:202:202:1::1/64	
	Tun0	F0/0	2002:202:202::1/64	
ISP	F0/0	1.1.1.2/29	-	
	F0/1	2.2.2.1/29	-	

The configuration of 6to4 is very straightforward. It is advised to use the optional command (Table 4, Command 3) setting a human-friendly alias for the 6to4 prefix. This alias is then comfortably used in further configuration commands. As shown in Table 4, the configuration is similar to static tunneling – a virtual tunnel interface must be configured. Routing to the tunnel is configured in a completely standard way (Table 4, Command 11).

Table 4: Complete configuration commands for setting up a 6to4 tunnel in Cisco IOS

Step	Command	Comment
1	**ipv6 unicast-routing**	Enable IPv6 on the router
2	**ipv6 cef**	
3	**ipv6 general-prefix** *PREFIX* **6to4** *Fa0/0*	Construct 6to4 prefix from IPv4 address of the interface
4	**interface** *FastEthernet0/1*	Setup native IPv6 network
5	**ipv6 address** *PREFIX ::1:0:0:0:1/64*	
6	**no shutdown**	
7	**interface** *Tunnel0*	Setup pseudo-interface serving as tunnel endpoint
8	**ipv6 address** *PREFIX ::1/64*	
9	**tunnel source** *FastEthernet0/0*	
10	**tunnel mode ipv6ip 6to4**	
11	**ipv6 route** *2001:db8:2::/56 fc00::2*	Setup routing towards other 6to4 sites

4.2 6to4 evaluation

After configuring both routers, the communication was tested using the simple ping command. To eliminate the need of adding more unnecessary nodes to the topology, the ping was used with an optional *src* parameter to specify the source as the router interface facing the local IPv6 network (the Ipv6 address *2002:202:202:1::1*):

```
Internet Protocol Version 4, Src: 2.2.2.2 (2.2.2.2), Dst: 1.1.1.1 (1.1.1.1)
    Version: 4
    Header Length: 20 bytes
    --- OMITTED ---
    Protocol: IPv6 (41)
    Header checksum: 0xb551 [validation disabled]
    Source: 2.2.2.2 (2.2.2.2)
    Destination: 1.1.1.1 (1.1.1.1)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
Internet Protocol Version 6, Src: 2002:202:202:1::1 (2002:202:202:1::1), Dst:
2002:101:101:1::1 (2002:101:101:1::1)
    --- OMITTED ---
    Next header: ICMPv6 (58)
    Hop limit: 64
    Source: 2002:202:202:1::1 (2002:202:202:1::1)
    [Source 6to4 Gateway IPv4: 2.2.2.2 (2.2.2.2)]
    [Source 6to4 SLA ID: 1]
    Destination: 2002:101:101:1::1 (2002:101:101:1::1)
    [Destination 6to4 Gateway IPv4: 1.1.1.1 (1.1.1.1)]
    [Destination 6to4 SLA ID: 1]
```

Figure 5: 6to4 automatic tunneling analysis by Wireshark protocol analyzer

As shown in the packet analysis in Figure 5, the actual tunneling works as expected. For the sake of brevity, the configuration of a native Ipv4 destination topology is omitted from this paper and will be the subject of further analysis.

5 Conclusion

In this paper, we demonstrated a successful configuration of two similar mechanisms for interconnecting of IPv6 sites using an IPv4-only infrastructure. We developed custom simple topologies to demonstrate various important aspects of interoperability mechanisms configuration. We provided detailed examples of practical address plans and complete router configuration walkthrough. We also compared actual packet analysis of network traffic with theoretical description of selected mechanisms.

Acknowledgements

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Shop Floor Management – Communication and Visualization standard in Smart Factories, New Roles of Managers

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Abstract

Efficient communication and easy understanding visualization are very important and inseparable parts of Shop Floor Management (hereinafter SFM). Speaking about communication efficiency we mean a reduction of reaction time and a transparent and consistent information flow. This information flow should be based on a structured daily routine with standard content and reporting. This type of communication leads to quick decisions based on facts. Speaking about visualization we mean all visualization of standards, current situation and targets. Also transparent documentation of problems and measures can be very helpful. The paper presents some our experience we have gained with SFM projects. Efficient communication and transparent visualization were one of the most important parts of this.

Efficient communication and visualization is extremely important in Smart Factories being in compliance with Industry 4.0 concept [3]. All these facts have an important impact on the education of production teams and their managers, who must be able to analyse big data and understand production processes in detail, as well.

Keywords: *Shop Floor Management, Information Flow, Communication, Visualization, Industry 4.0, Education.*

1 Introduction

Shop Floor Management (hereinafter abbreviated to SFM) is already known for some time as one of the most effective strategies for managing work teams in production – e.g. [4], [5]. An integral and essential part of this is a very effective communication and transparent visualization. Effective communication enables to reduce time that managers need to take a decision. Regular, proper and structured information in a standard way minimizes the risk of misunderstandings and risks, perhaps that may occur due to the lack of awareness of the people in production. Transparent visualization then helps to visualize the situation in production and performance goals. This paper presents the concept, which was designed for communication and visualization in the context of SFM for the XY Company. The concept is currently being implemented. Soon it will be possible to meet the system directly in production [1], [2].

2 Fractal organization

The Company XY has the fractal organization. The fractal organization can be characterized as an open system, which consists of independently and proactively acting elements, so-called fractals. Fractals can be described as a set of several elements that are still repeated, and which create very

diverse, complex structures customized with meeting tasks. A dynamic organizational structure of the fractal company in the optimal case evokes a living organism (figure 1).
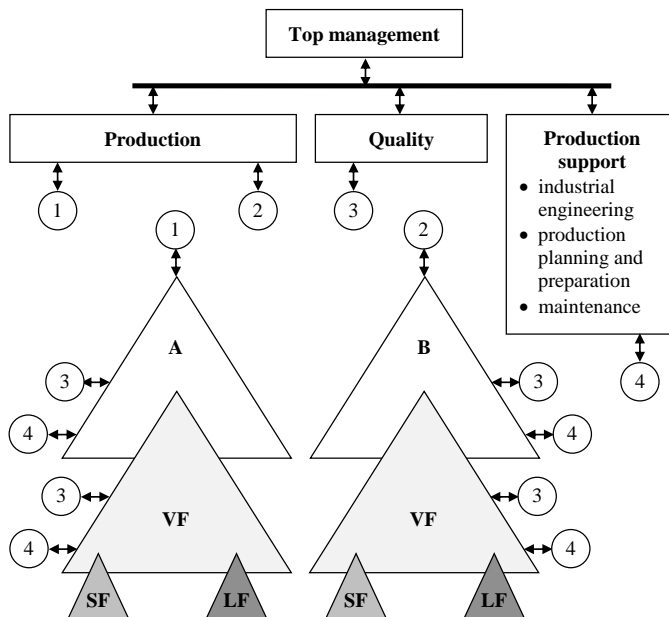

Figure 1: Production fractal organization (A, B – higher fractal level; LF – logistic fractal; SF – service fractal; VF – production fractal

3 SFM Communication and Visualization Standard

In order to fulfil the role of SFM in visualization and communication standard, there was designed visualization for the XY Company, that will be the appropriate way to display the key information related to SFM. As information resources there have been selected the information boards, which will be placed directly on a production area (shop floor) of the company.

Information boards have been divided into two basic types. They are as follows:

- SFM board of production fractal and
- SFM board of working team

This distribution of information boards has been chosen due to the relevance of the information for which the individual information boards are intended as well as the boards reflect the information depending on the proposed organizational structure.
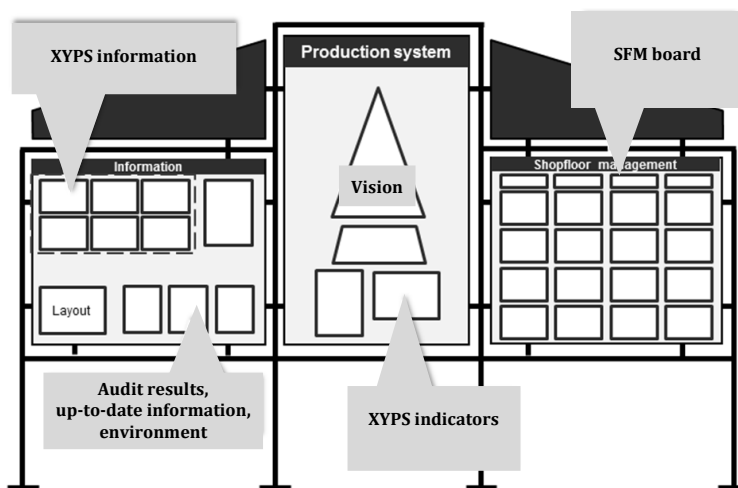
Figure 2: Information board of a production fractal

3.1 SFM information board of production fractal

SFM information boards of the production fractal for the XY Company were designed so those consist of three separate parts (figure 2). Simply it can be indicated as the left part, middle part and the right part.

The left part of the SFM information boards of the production fractal was designed to display the information relating primarily to the deployment of machines, workplaces and the necessary documents (e.g., descriptions of processes, documentation of the corrective actions, the results of customer audits, audits of the environment protection, work safety and health audits, etc.)

The middle part of the SFM information boards of the production fractal is envisaged to include information about the production system of the company, the strategic system of the plant, an overview of the implementation of the in-company and the fractal objectives etc.

The right part of the SFM information boards of the production fractal was designed to present the SFM fractal indicators. These indicators are presented in more details in figure 3, figure 4, respectively.

In order to ensure communication and visualization of SFM standard, it was necessary to propose a structure of indicators, which will be linked on the company goals and at the same time they will be influenced and analysed at the level of SFM. These indicators (KPI) are important parameters for the transmission of information and evaluation of the results of individual teams, shifts, production lines and fractals, whose results subsequently affect the overall implementation of the objectives of the company, as it was previously defined in the various levels of SFM.

SFM standard of visualization was designed such that it includes the following indicators:

- S – Safety,
- Q – Quality,
- C – Cost,
- D – Delivery.

Although the area of work safety and health in the workplace is not one of the key indicators of the XY Company, they have been included to the design standard of the SFM. Other indicators have been designed to follow the company objectives.

The figure 3, figure 4, respectively defines SFM standard of fractal information boards. It is divided into five rows and four columns. Each of the rows has defined rules for update and how to fill in. In order to be evidently seen at first sight, how to work with information on the boards, there are defined rules for treatment.
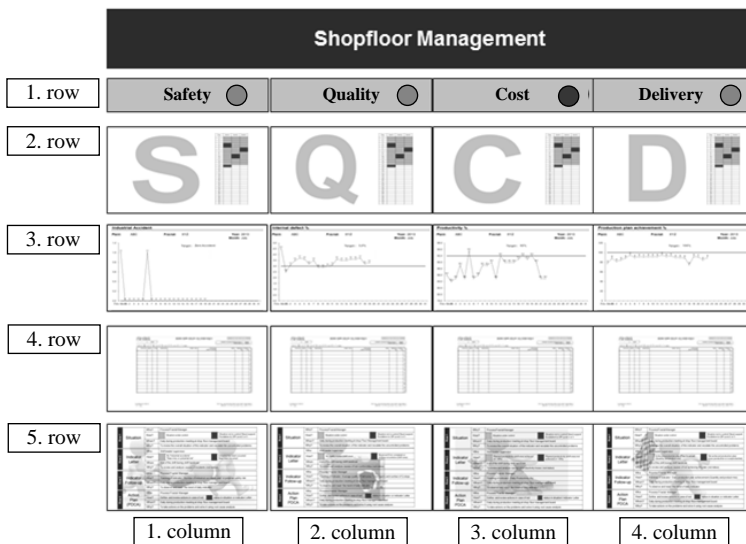

Figure 3: Shop Floor Management information board of a production fractal

For each of the indicators was subsequently designed a plan of action, which is used as an auxiliary tool to detect the root cause of the problem by using a structured solutions, which is one of the principles of SFM. The aim of this action plan is:

- support the structured procedures with solving problems,
- precise written record of processed findings,
- learning support, precision and cooperation,
- creating a transparent solution to the problems.

The principle of structured troubleshooting procedures supports the structured operations for their solutions. It includes: title, description of the problem and its background, required status, analysis of the causes and the measures as well as monitoring and extension within the organization.

3.2 SFM information board of production team

With the same logic with which it was designed the SFM boards for production fractal, it was designed also the information boards for each of the working teams (figure 5), which are defined in the design of the organizational structure. The difference in the way of visualization of the information is in the evaluation, when information on the team board is relevant only for the particular team and reflect only its results.
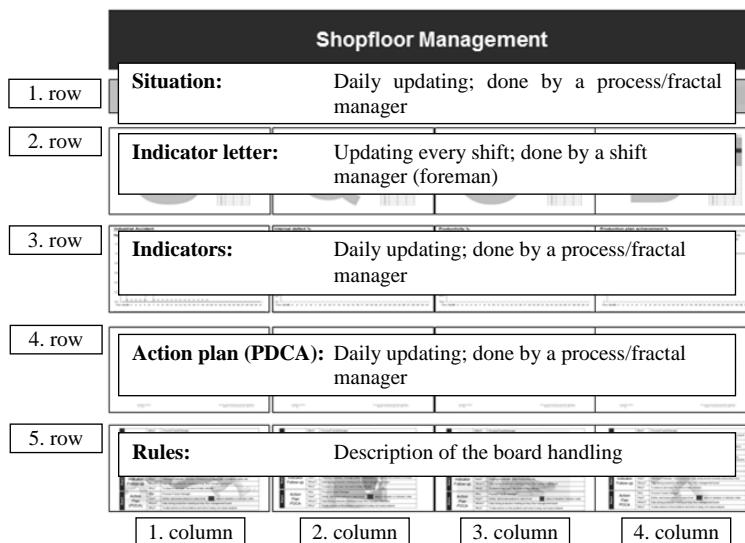

Figure 4: Shop Floor Management information board of a production fractal

Figure 5: Shop Floor Management information board of a production team

Acknowledgments

On the basis of the experience gained from the SFM implementation we can submit that current production workers (including managers) should control not only the procedural management, but also they should take very well in information technologies and data analysis – especially the explorative statistics and basic of Data Mining [3]. In compliance with this trend there should be modified and form the teaching at secondary schools and universities, as well.

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CRISP-DM Data Evaluation phase of simple bibliographic data evaluation platform design

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Abstract

The presence of high variability in bibliographic data and importance of proper value establishment in academic research has attracted the focus of data mining specialists. This paper focuses on bibliographic citations in scientific literature and provides guidelines for a bibliographic data evaluation platform design. Bibliographic data acquisition and storage are addressed in compliance with CRISP-DM data mining project management methodology. Furthermore, an operational model of a simple sequential Web crawler and selected crawler implementation challenges are presented. The data storage section provides a general proposal of simple MySQL database schema able to store bibliographic data required for prestige and quality rank determination procedures.

Keywords: *Bibliographic citations, Data Mining, CRISP-DM methodology, Web crawling, Relational database, Hadoop*

1 Introduction

At first glance, bibliographic data evaluation seems to be a straightforward process. However, multiple judicial, psychological, security and informatics challenges must be considered. Relevance, authority, prestige or quality represent a key element in any area of the human society as they reveal objects (e.g. publications) with a strong impact on all members of the social network. This paper focuses on bibliographic citations in scientific literature and provides guidelines for a bibliographic data evaluation platform design.

Unified analytical approach to the large amount of data related to bibliographic citation is necessary to properly understand the real impact of individual or collective scientific contributions. As such, the citation counts have been generally accepted as proxies for the scientific influence of papers, journals, scholars and institutions [1]. The importance of proper value establishment in academic research has therefore attracted the focus of not only specialists in bibliometrics, but also wider academic audience with varied specializations. Some of the more advanced approaches include, but are not limited to, data mining, facilitated by the presence of high variability in bibliographic data also observed in other humanities Big Data, as suggested in [2].

This paper is organized as follows. Chapter 2 introduces basic definitions of state of the art areas of Big Data and Data Mining (BDDM) present in bibliographic data processing applications and provides

a general description of CRISP-DM (Cross Industry Standard Process for Data Mining) methodology of effective data mining project management. Chapter 3 utilizes the CRISP-DM methodology to describe the requirements, selected challenges and authors' approaches present at simple bibliographic data evaluation platform design, with focus on phases of data acquisition and data storage. Remarks regarding alternative approaches and possible directions of future research are formulated in the Conclusion section.

2 State of the art - Big Data and Data Mining in bibliographic data

Significant improvements in computer processing power and storage capacity, availability of cheap and fast memory cards, advances in database technology, steady progress towards machine-to-machine communication in the Internet of Things (IoT), popularity of cloud based solutions and significant advances in computational statistics, machine learning and artificial intelligence, when combined together, represent the key features enabling storage and analysis of large and complex datasets containing both structured and unstructured data – the phenomenon commonly referred to as Big Data and Data Mining.

2.1 Big Data

The term Big Data refers to any types of datasets with size and complexity prohibiting efficient processing using standard data management tools and traditional data processing methods. According to the IBM's Big Data & Analytics Hub, Big Data can be defined in four dimensions: *Volume* (scale of data), *Velocity* (data change rate), *Variety* (wide spectrum of different forms of data) and *Veracity* (uncertainty of data) – the so called 4V's group [3]. Some data miners even consider a fifth V representing *Value* of the data.

The Internet minute infographic created by Intel shows that in a minute a gargantuan amount of 1,572,877 GB of global IP (Internet Protocol) data is transferred [4]. In 2013, digital devices generated a total amount of 4 Zettabytes of Big Data. This amount will significantly rise with the approach of another phenomenon – IoT. It is expected that the number of devices connected to the Internet will reach three times the total human population till the end of 2017. Machine-to-machine communication between these devices, including a vast variety of different sensors will provide additional data for storage and processing. However, it is questionable if all data can and should be stored. According to [5], some kind of data scheduling must to be implemented. The presented heuristic approach suggests the division of data into multiple groups based on data importance. The least important data, mostly obtained via machine-to-machine communication and from Wireless Sensor Networks (WSNs), could be deleted shortly after processing. This approach could though be in conflict with the essence of Big Data and Data mining, because new data processing methods could be developed in the future, enabling the utilization of presently seemingly unimportant data.

2.2 Data Mining

Regardless of Big Data application, data masses can contain hidden, yet relevant information which can be extracted by data mining and consequently used to gain an advantage over competition and become beneficial for the whole human society. The process of data mining can be defined as technology combining traditional data analysis methods with sophisticated algorithms based on machine learning, pattern recognition, artificial intelligence, natural language processing, theory of social networks and text/web mining - used for processing and visualization of large volumes of data. Similarly to Big Data, Data mining algorithms penetrate multiple fields of real-life applications, including healthcare, personal physical performance measurement, science and research or even

security and law enforcement. The ultimate goal is to provide insights leading to better planning, decision making and scientific advancement.

The process of knowledge discovery in data – transformation of input raw data into useful information - can be logically decomposed into 4 unique components [6]: *Data Acquisition*, *Data Preprocessing*, *Data Mining* and *Data Postprocessing*. The aforementioned areas can be consequently decomposed into smaller logically interconnected parts, forming the so called data processing models. Data processing models provide a structured approach and guidelines to data mining project lifecycle management. The most accepted data processing models are CRISP-DM, SEMMA (Sample, Explore, Modify, Model, Assess) or DMAIC (Define, Measure, Analyze, Improve, Control). Although all these approaches are essentially governed by the same principles, the following chapter provides an introductory overview of the CRISP-DM, as this methodology was chosen and later utilized to analyze the challenges present in simple bibliographic data evaluation platform design.

2.3 CRISP-DM Methodology

According to CRISP-DM, the data mining procedure can be decomposed into 6 related phases: *Business Understanding*, *Data Understanding*, *Data Preparation*, *Modeling*, *Evaluation* and *Deployment* (Figure 1).
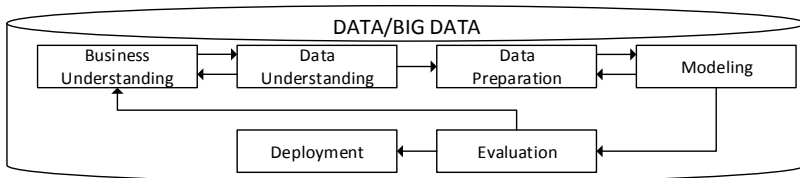

Figure 1: CRISP-DM Data Mining Model

The initial phase of *Business Understanding* determines the project objective from both focus and implementation perspectives, defines the underlying data mining problem and prepares a preliminary plan on how to achieve these goals.

After goal specification, the *Data Understanding* phase proceeds to a group of activities connected with data collection, preliminary data analysis including data quality and quantity assessment (e.g. solution of missing values or detection of data outliers), detection of interesting subsets and formulation of hypotheses about the scale and value of the hidden information.

Data Preparation seeks to transform raw data collected in the previous phase into a final dataset meeting the input requirements of modeling and data mining algorithms. At this stage tasks like table, record and attribute selection, data transformation and cleansing are performed.

The core parts of hidden information discovery and extraction are executed in the *Modeling* phase where various data mining approaches are applied to the final dataset and parameters determining operation of modeling algorithms are being adjusted to provide optimal results. It is imperative to highlight the direct interconnection of this phase with the previous one, as applications of specific data mining algorithm models require specific transformation of the input dataset and thus repetitive execution of the Data Preparation phase in order to meet these requirement.

In one of the most important stages - *Evaluation* - the applied procedures, models and results of data mining are thoroughly examined, with emphasis on the specified project goals.

The final phase of the data mining process is presented by *Deployment* of the proposed solution into real-life operating application environments.

More complex interpretation of the CRISP-DM methodology, with model exercises included, interested reader may find in [7] or [8].

3 Bibliographic data evaluation system design

This chapter aims to cover selected topics and challenges computer scientists can find themselves against when designing a simple bibliographic data evaluation platform. The design itself can be logically decomposed using the CRISP-DM methodology, as the process of data mining presents a crucial part of such systems. Due to limited scope of this paper, just the Business Understanding and Data Understanding stages are described.

3.1 Business Understanding – Platform specification

Bibliographic data evaluation platform design utilizes the principles of applied informatics and provides area for extensive scientific research. The underlying Data Mining process must address multiple challenges. Identification of free and open online sources of bibliographic data. Design of database structures for storage of relevant data required for author/publication prestige and quality rank determination. Extraction of required data by means of Web crawling. Analysis of state of the art algorithmical approaches of rank determination and challenges of practical implementation.

The total number of citations has been for a long time a relatively objective and accurate indicator used for assessment of scientific importance. The rapid development of BDDM principles discovered several special metrics and alternative approaches: multi-type citation networks [9]; bibliographic network oriented variations of standard Google's PageRank algorithm [10], [11], [12] or approaches based on Belief, Trust and Reputation propagation [13]. Moreover, some algorithms can discover the relations between authors and their publications in order to construct complex social networks.

The PLOS database was selected as source of experimental bibliographic data. PLOS is a nonprofit publisher and advocate of Open Access research, all content is free to access, distribute, reuse and remix. Publications are accessible through Web pages, where bibliographic data, reference metrics, even additional data like author contributions are provided.

The Data Mining tasks were to design a simple database structure fit for bibliographic data storage and create a local copy of the selected part of PLOS database through means of web crawling.

3.2 Data Evaluation

This subchapter introduces the most important concepts behind Web Crawlers required for data acquisition, selected implementation issues all crawlers have to address and a proposal of simple sequential crawler. Moreover, a MySQL database schema proposal for bibliographic data storage with specific information about references is presented, in combination with analysis of unique author identification and language specific related challenges. Definition of Hadoop approaches concludes the subchapter.

3.2.1 Data acquisition – simple Web crawler proposal: Theory described in this subchapter falls into the field of Web Intelligence, Big Data and Data Mining. A thorough introduction to this complex field can be found in [14]. In general, the term Web crawler is referring to a set of programs for automatic retrieval of data from Web pages. The area of web crawling has been identified as the most sophisticated and fragile component of intelligent search engines by founders of Google [15]. Information on the Web is scattered and distributed among multiple pages and hosting providers, thus users can either manually follow hyperlinks or utilize a form of search engine in order to locate and access relevant information. An automatic crawler presents a logical approach, since it can visit many sites, collect and maintain information according to its tasks. In essence, the crawling process represents a graph search algorithm. Web pages/documents present the nodes and hyperlinks the edges of a graph structure. Like Web pages, bibliographic systems can also be characterized as dynamic, rapidly evolving entities and therefore multiple applications utilize crawlers to stay current as additional content is being created or modified. In [10], bibliographical relations between authors, their publications and citations were modeled using a group of graphs consequently utilized for author rank determination.

A simple sequential Web crawler unit proposal is depicted in Figure 2. The process of Web crawling begins with a set of user or machine provided seed URLs (Uniform Resource Locator) inserted into the URL frontier. The core part of crawling represents an iterative execution of the Data acquisition core functions - URLs are picked from the frontier; web page content is fetched via HTTP (HyperText Transfer Protocol); retrieved pages are parsed; new URLs are extracted and delivered by the URL delivery unit to update the frontier and finally the extracted data is delivered by the Data delivery unit to be stored in a disk repository, standard relational or distributed Hadoop database. This simple process is cyclically repeated until a stop criterion is met – typically either a sufficient amount of visited pages, a specified amount of data gathered or achievement of other objectives. The proposed model was implemented in PHP.
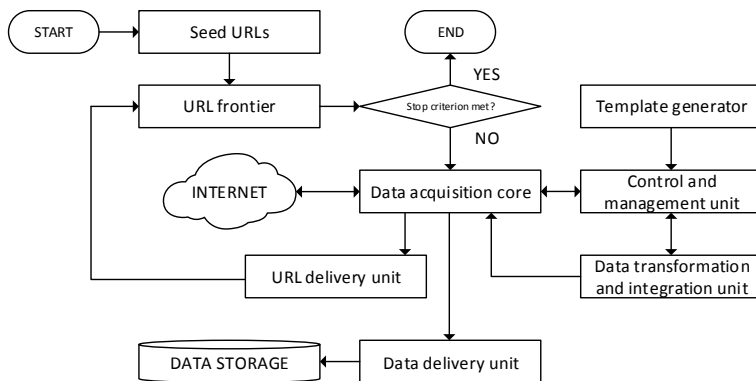

Figure 2: Sequential Web Crawler unit proposal

It is imperative to have the ability to process multiple seed pages at once, via multiprocessing or multithreading approaches and the ability to access system resources in an asynchronous way. The URL Frontier (Figure 2) contains the set of unvisited URLs and typical crawlers store it in the main memory in order to achieve highly efficient processing. This approach is enabled by availability of affordable memory cards and multi-core processors. Standard crawlers consume network, CPU and

disk resources, each having a possible bottleneck created by bandwidth, CPU speed and disk seek/transfer time limitations. The most popular approach of overcoming this challenge is through concurrent execution of processes or threads. Multiprocessing may be easier to implement than multithreading depending on the programming language and platform, but it also has higher overhead due to process management by the operating system. Basically each thread or process represents an instance of an independent crawler and their concurrent operation follow the standard parallel computing model. Therefore the access to a shared resource pool has to be carefully synchronized.

In contrast to model simplicity, the complexity of Web crawling is high, since in practical implementation multiple aspects have to be considered, e.g. network connections, fetching, parsing, stopword removal and stemming, link extraction and canonicalization, crawler traps, effective page repository, scalability, process concurrency and last but not least crawling ethics and regulations by both national and international law.

During fetching, the crawler works in position of a Web client, sending HTTP requests to hosting servers for required pages and reading the replies. It is important to maintain connection timeouts, in order to prevent unnecessary waiting periods introduced by processing of large pages or replies from slow servers. Moreover, detection of redirect and repetition loops; effective error-checking and exception handling has to be implemented, since program code is repeatedly applied to potentially billions of remote servers. Presently the most predominant and efficient programming interfaces for Web page fetching are Java, Python, PHP and PERL. These high-level programming interfaces however carry the risk that detection of lower-level problems can become a challenging task.

The term parsing implies to URL extraction from hyperlinks and more complex analysis of HTML (HyperText Markup Language) code or XML (Extensible Markup Language) documents. The DOM (Document Object Model) represents the document structure in form of a tag tree. The DOM trees of both HTML and XML documents are built in a linear fashion. Many pages/documents generated by a variety of content management systems can however miss some of the required tags, contain invalid tag nesting or missing attribute names and values. At this point, robust crawler systems apply a preprocessing step [16] to clean up the HTML content prior to parsing procedures. The HTML parsers in languages like Java or Perl are becoming more precise, scalable and robust. Though, a growing portion of information is stored in different formats – plain texts, PDF (Portable Document File) documents, MS Word documents, different kinds of interactive presentations or even image, audio and video files. URLs need to be carefully processed and additional filtering step may be required to exclude certain types of links pointing to irrelevant data.

Interesting challenges arise with the existence of crawler traps – web sites with dynamically created content and links modified based on the sequence of actions taken by the browsing user or crawler which may result into purposeful infinite crawling loops.

Data acquisition can also provide information about the security of bibliographic data networks. At this point it is important to mention some of the most popular security countermeasures against unwanted content data mining. An insertion of fictive fraud control data represents a countermeasure enabling the discovery of data theft. The automatic data miner is unable to discover these records, however their later incorporation or public dissemination enables the data source originator to identify data thefts. Another countermeasure is utilization of increasing time delay penalization, based on detection of unusually large amount of requests generated even in case of registered users. A study of privacy preserving Data Mining can be found in [17].

3.2.2 Data storage – MySQL database model proposal: Based on the minimalistic scale and system requirements from Business Understanding, it is sufficient to use a standard SQL database for data

storage. However, an implementation of a real-life system processing Big Data would probably require the usage of Hadoop approaches, which are shortly described in the following subchapter.

The proposed structure of the database is depicted in the following Figure 3. The database is composed of 5 tables, namely Authors, Publications, Relations, References and Sources.
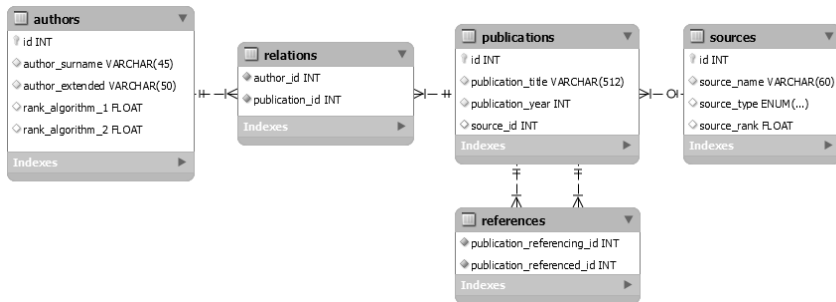

Figure 3: Database schema proposal for bibliographic data storage inspired by [10]

The *Authors* table contains the list of all authors found at or referenced by the source of the crawling process. Each author is assigned a unique identification number serving as the table's Primary Key (PK) and a field for extended information (e.g. formatted full name etc.). Finally a number of fields for ranks calculated by selected algorithms during CRISP-DM Modeling phase are incorporated. The *Publications* table contains relevant information about publications. Basic version should contain at least the publication title and year. Each record is associated via foreign keys with the *Sources* table. The *Sources* table contains additional, often optional information about the sources of publications stored in the *Publications* table – thus enabling the application of more complex and sophisticated analytical rank determination procedures. The *source_type* field utilizes an enumerated variable to specify the data source type (e.g. conference paper, journal or e-publication). The *source_rank* field could utilize metrics from internationally accepted ranking systems. The *References* table contains the relations between referencing and referenced publications, directly bound by foreign keys with *Publications* table. Last but not least, the database must contain the *Relations* table specifying the authorship/coauthorship of publications bound with values of both *Authors* and *Publications* tables. The proposed database structure can be dynamically redesigned to monitor and provide all data necessary for bibliographic reference evaluation and rank determination.

Bibliographic data present multilingual content. The design of the database schema should also take into account this characteristic of the dataset. When analyzing non-English data, it can contain different punctuations and language specific symbols. Therefore it is important to accordingly modify the character set of the database. Otherwise, data may be corrupted right from the moment of their incorporation into the database used by the rank determination procedures.

Another important challenge directly associated with language related characteristics and limitations is the identification of unique authors. The most primitive approaches working exclusively with surnames would come across significant problems as people can share the same surname, in some specific cases even names or years of birth. Journals and conferences often utilize different document templates, some may preserve language specific symbols like punctuation and some instructs authors to provide English equivalents of their names without punctuation. The complexity of this problem

significantly rises for publications in native languages like e.g. Chinese, Japanese or Russian language which are using specific symbol sets. A universal algorithm should include a special data mining step enabling the identification of authors regardless of the language or character set used in publications. The aforementioned considerations led to incorporation of *author_name_extended* field inside the *Authors* table, which contains author's given name(s), middle name(s), abbreviations or different language equivalents. In future work, the table could be expanded with the date of birth identifier, allowing a more granular identification of unique authors.

3.2.3 Data storage – Hadoop approach: The simple database model presented in the previous subchapter can be stored and processed locally. However, the situation changes rapidly with significantly rising amount of data. Effective processing of Big Data also requires knowledge of Hadoop principles and effective implementation of both basic and advanced principles of distributed computing. Distributed algorithms must be able to iterate over large number of unique data records, to extract useful information from the processed records, to sort and aggregate intermediate results from multiple often strongly geographically distributed workstations in order to generate the final output.

The key idea of scientific research in this area was to provide a functional abstraction of these operations, which gave birth to Hadoop and MapReduce. The term Hadoop is used to refer to a two layer software framework for distributed processing of big datasets across large computer storage clusters – a distributed file system HDFS (Hadoop Distributed File System) and an effective algorithm execution engine MapReduce. MapReduce can be considered a simple programming model working on top of HDFS file system, providing effective means for data scheduling, data distribution, computation and intermediate result synchronization. Interested reader can be familiarized with the concept of Hadoop in [18]. More information, including similarity search, data stream processing, search engine technology, high dimensional dataset clustering and different algorithms of machine learning applied in Hadoop can be found in [19].

4 Conclusion

The areas of bibliographic data processing, authors' prestige and scientific publication impact determination present an interesting and complex research area providing a wide spectrum of different approaches and challenges connected with state of the art science of Big Data and Data Mining.

In this paper, the fields of bibliographic data acquisition and storage have been addressed in compliance with CRISP-DM data mining project management methodology. Furthermore, an operational model of a simple sequential Web crawler and selected implementation challenges have been presented. The data storage section has provided a general proposal of simple MySQL database schema able to store bibliographic data required for prestige and quality rank determination. Due to the fact, that bibliographic data presents an instance of Big Data, standard relational database approaches are ineffective and thus definition of Hadoop approaches have been provided at the end of Section 3.

Different approaches to Hadoop implementation, selection and modification of rank determination algorithm provide further venues for future research. The ultimate goal of the authors is to design a simple, yet effective open source implementation of bibliographic data evaluation platform.

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Togaf and Archimate tool on the communication between business and IT

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Abstract

Document describes the enterprise architecture framework Togaf and modelling tool Archimate. First chapter is about Togaf s detail view, on his main part Architecture development method (ADM). In second part we will focus on the Archimate. Archimate is graphically tools on modelling Togaf architecture. This tool will be use on example modelling simple case study in third part.

Keywords: togaf, archimate, framework, uml, phase, process, tool, diagram

1 Introduction

TOGAF is a framework — a detailed method and a set of supporting tools — for developing enterprise architecture. It may be used freely by any organization wishing to develop an enterprise architecture for use within that organization. The original development of TOGAF Version 1 in 1995 was based on the Technical Architecture Framework for Information Management (TAFIM), developed by the US Department of Defense (DoD). TOGAF defines ''enterprise'' as any collection of organizations that has a common set of goals. For example, an enterprise could be a government agency, a whole corporation, a division of a corporation, a single department, or a chain of geographically distant organizations linked together by common ownership. The term ''enterprise'' in the context of ''enterprise architecture'' can be used to denote both an entire enterprise — encompassing all of its information and technology services, processes, and infrastructure and a specific domain within the enterprise. In both cases, the architecture crosses multiple systems, and multiple functional groups within the enterprise.

2 Togaf

TOGAF is an architecture framework. TOGAF provides the methods and tools for assisting in the acceptance, production, use, and maintenance of an enterprise architecture [1]. It is based on an iterative process model supported by best practices and a re-usable set of existing architecture assets. Architecture framework is a foundational structure, or set of structures, which can be used for developing a broad range of different architectures. It should describe a method for designing a target state of the enterprise in terms of a set of building blocks, and or showing how the building blocks fit together. There are four architecture domains that are commonly accepted as subsets of an overall enterprise architecture, all of which TOGAF is designed to support:

- **Business Architecture** defines the business strategy, governance, organization, and key business processes.

- **Data Architecture** describes the structure of an organization's logical and physical data assets and data management resources.

- **Application Architecture** provides a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization.

- **Technology Architecture** describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services.

2.1 Architecture development method ADM

ADM describe of operational process of Togaf framework. Main idea is on foundation united analytically and management method UML, Prince2 and ITIL – change management. The basic structure of ADM is on the Figure 1.
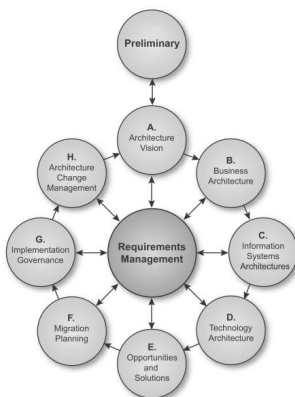

Figure 1: Structure of ADM

2.2 The phases of ADM

Preliminary Phase - is about defining ''where, what, why, who, and how we do architecture, enable executives, planners, architects, and engineers to coherently co-ordinate, integrate, and conduct their activities. The enterprise architecture framework provides the strategic context for this team to operate within.

Architecture vision - The Architecture Vision provides a first-cut, high-level description of the Baseline and Target Architectures covering the business, data, application, and technology domains. Vision describes how the new capability will meet the business goals and strategic objectives and address the stakeholder concerns when implemented.

Business vision - framework differentiates between the functions of a business and the services of a business. Business services are specific functions that have explicit, defined boundaries that are explicitly governed. Techniques to enable the definition of an organization's business architecture are:

Process modelling (BPMN), use case analysis (use case diagram from UML) and structure analysis (class diagram UML).

Information system architectures – this step is about data management. Include analysis data migration, defines goals system his service with data and how data entities are utilized by business functions, processes, and services.

Technology architecture – complete view on the technology layer which we use in framework. Enables the logical and physical application and data components and the Architecture Vision

Opportunities and solution - Generate the initial complete version of the Architecture Roadmap, based upon the gap analysis and candidate Architecture Roadmap components from Phases AV, BV.

Determine whether an incremental approach is required, and if so identify Transition Architectures that will deliver continuous business value.

Migration planning - The focus of Phase F is the creation of an Implementation and Migration Plan in co-operation with the portfolio and project managers.

Implementation governance - information for successful management of the various implementation projects is brought together. Realization of business value and benefits, and to minimize the risk in the transformation and migration program.

Change management - The goal of an architecture change management process is to ensure that the architecture achieves its original target business value. This includes managing changes to the architecture in a cohesive and architected way. This process will typically provide for the continual monitoring of such things as governance requests, new developments in technology, and changes in the business environment. When changes are identified, change management will determine whether to formally initiate a new architecture evolution cycle.

3 ArchiMate and ADM

ArchiMate is modelling language and graphically tool enterprise architecture. Notation this language is on the based on Business process notation BPMN and Unified modelling language UML. Include for describing the construction and operation of business processes, organizational structures, information flows, IT systems, and technical infrastructure.

ArchiMate 2.0 consists of the ArchiMate Core (the core language), that focuses on the description of the four architecture domains defined by the TOGAF standard (business, data, application, and technology architectures, as well as their inter-relationships), and extensions to model the motivations for the architecture, and its implementation and migration planning. [2]

The Motivation Extension concepts in ArchiMate support the Requirements Management, Preliminary Phase, and Architecture Vision phases of the TOGAF ADM, which establish the high-level business goals, architecture principles, and initial business requirements. It is also relevant to the Architecture Change Management phase of the TOGAF ADM, since the phase deals with changing requirements.

The Implementation and Migration Extension of ArchiMate adds concepts to support the implementation and migration of architectures through the Opportunities and Solutions, Migration Planning, and Implementation Governance phases of the TOGAF ADM. (On this place is time return to figure 1 and compare details with figure 2.)
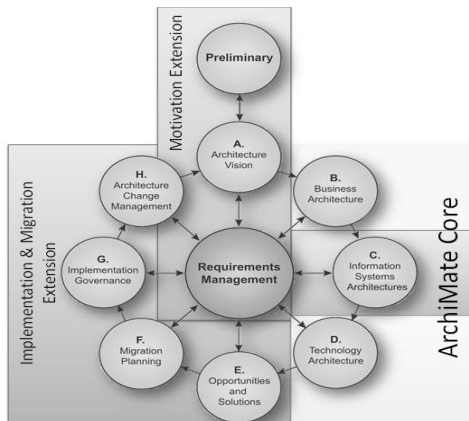
Figure 2: Connection between Archimate and Togaf ADM [3]

3.1 Concept of ArchiMate

The core language consists of three types of elements and three types of layers

- Active structure elements

- Behaviour elements

- Passive structure elements (objects)

These three aspects – active structure, behaviour, and passive structure – have been inspired by natural language, where a sentence has a subject (active structure), a verb (behaviour), and an object (passive structure). In addition to the three elements, ArchiMate makes a distinction between an external view and internal view of a system by defining *service* and *interface*.

Layering must be the mirror of TOGAF ADM process and include this layer. Every layer have own colour for better assignment to ADM phase. [4]

- **Business Layer**- offers products and services to external customers, which are realized in the organization by business processes performed by business actors
- **Application Layer**- supports the Business Layer with application services which are realized by (software) applications
- **Technology Layer**- offers infrastructure services (e.g., processing, storage, and communication services) needed to support applications, realized by computer and communication hardware and system softwar

The elements and layers are foundation of Archimate enterprise framework. This framework is organized in area "nine cells".

Table 1: Archimate framework

	Passive structure	Behaviour	Active structure
Business			
Application			
Technology			

4 Simple case study

This case deals with possibility operating machines to order lunches and small meals for students. Automats must have function for order, meals, drinks, cancellation orders and claim order.

Now we will modelling necessary business process, business function, application and technically structure with the archimate framework in enterprise architect tool.

Business process shows us Locations where there are actors who identify same time as a customer. The customer is associated with the process of identification, further purchase order creation, its Cancellations.
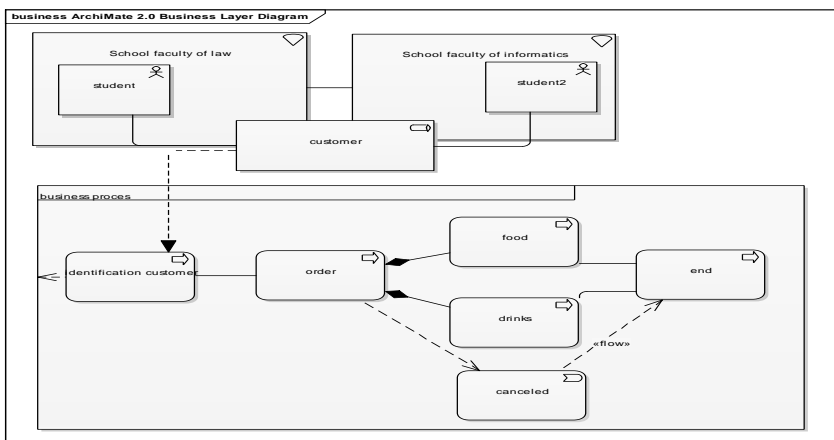

Figure 3: Business process layer

Business functions will show us as appropriate to link the business layer with motivational value. The advantage is that the application framework functions we can incorporate into Business layer. A different colour (in this case green) shows us the link to the next layer.
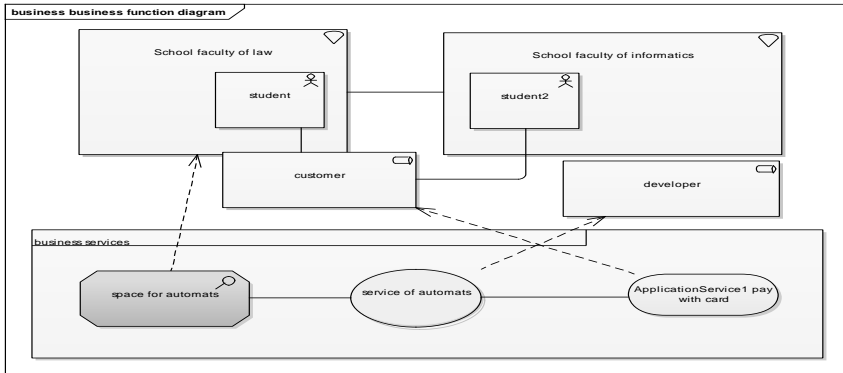
Figure 4: Business function

Business function (represented in yellow) Framework allows continuous connection with the application layer. CONTAINS creation requirements, customer management, as well as reports claim.

Via interface complements the architecture of application modules such as web applications, or human resources module. Componenta in this layer will be part of a technological layer, which will be integrated into the LAN network which will be database, web and application servers.
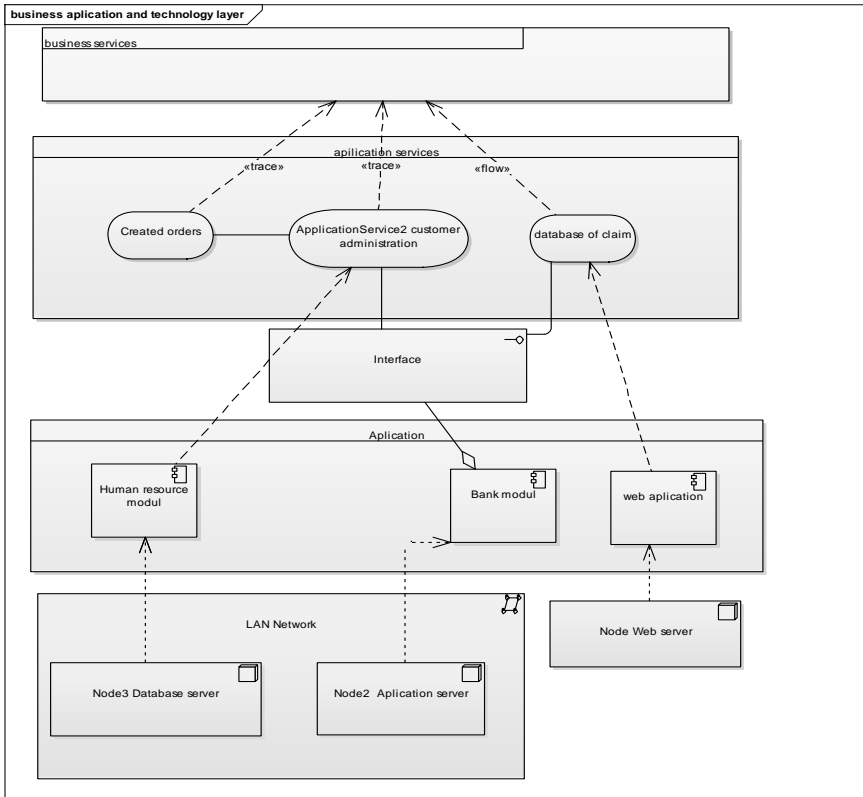
Figure 5: Application and technology layer

5 Conclusion

On the base this case, we are showed three ways of building enterprise architecture. Togaf and his tool Archimate are connection between ideas of top management and IT management. Top management can use on the description his goals business layer with business process notation (BPMN). Next step must be description of request. This step is about uses second technical layer and UML notation – great language for business analyst. Mapping of implementation is task for third Application layer. Inside this layer is place for displayed connection between servers, applications and process. Togaf is chance on the dialog management and IT.

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ABSTRACTS

QR and barcodes as a new educational tools

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Abstract

Traditionally teaching has relied on the world of learning being divided into subjects (geography, biology, religion, mathematics etc.). Teaching tools (authorized syllabuses, text books, computer tools, games etc.) have reflected this stratification of knowledge. There is much evidence in all cultures worldwide that it is a useful concept. It can be limited for innovative or lateral learning, which is – after all – of what most common life situations consist, and for which we prepare our students. In some situations, however, this stratification based on subjects is not very helpful. Instead it could be useful to develop teaching tools that are not subject based, but use as entry keys consumer goods or other keys to things, events, etc. as that form less structures to the world of learning than conventional syllabuses. From the entry point the user can choose pathways through very large sets of digital knowledge bases to suit the level (e.g. school level) suitable for personal interests or guided searches for knowledge. These searches can traverse traditional subjects, include knowledge not normally considered in school environments and lead to a broader-based education for an increasingly complex world. It will also allow students to include aspects of knowledge which may not be taught as part of normal syllabuses, thus stimulating their desire for school learning. This approach, which may conveniently use bar codes or QR-codes, now present on many consumer items, and also found in many other contexts, requires intelligent search routines in selected sources of existing knowledge, in which digital encyclopaedias and search engines are key factors. It may also stimulate the construction of new knowledge bases, analogous to the old-fashioned writing of textbooks.

As part of this presentation some examples of how this approach may work will be discussed, with examples drawn from a simple consumer item and a code on a building or in a book or flyer.

The concept was originally developed for countries and situations where textbooks were out of date, missing, expensive or politically biased, and was originally conceived in the context of computers and computer networks. In an increasing number of countries lower-cost smartphones, mobile broadband services and local WiFi may constitute alternatives. It is foreseeable that this ICT-development will merge further and offer powerful low-cost solutions.

ICT in education in Norway – an overview

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Abstract

The Norwegian government has an agenda of a Norwegian digital society, an open digital society where both the administration of the country, its schools and the whole private and public sector moves towards integrated digital solutions. The educational sector, right from Grade 1, plays a crucial role in this transformation that Norway will have to undergo within 1-2 decades, from a mixed economy centred on oil to a knowledge-based society. The Norwegian Centre for ICT in Education, a part of the government structure, plays a central role in developing educational strategies and tools and to evaluate the relevance of new technologies in education. Norway has 10 years compulsory education, with 615 000 pupils and 60 000 teachers in 3 000 primary and lower secondary schools, and 200 000 and 25 000 teachers in 430 upper secondary schools. ITC competencies form one of the pillars of syllabus development.

Research show that 4 out of 5 students in the educational ladder (lowest grades excluded) find it easier to learn subjects when supported by ITC. 8 or 9 teachers out of 10 find ICT supportive for their work. But the IEA ICILS Study of Norway in 2013 indicated that there is a low utilization of ICT in schools and that e.g. 75% of 9th graders use ICT at home but they acquire their ICT skills outside the schools. Teachers reported that they themselves lacked competencies in ITC. Effective use of ITC in schools requires Infrastructure and administrative efficiency, Digital literacy, Digital competence for better learning, Strategic leadership of ITC, Research, policy, plans, framework and knowledge base. One of the World's first integrated identity system where students and teachers can use the same username and password for a wide variety of public and private information systems and information sources. All students in upper secondary schools get a grant from the government to buy a computer (limited choice), so all such students have a computer. The system allows sharing of all public and private educational resources (but the private sector is not overenthusiastic). It is funded from central and local government sources. We believe Norway is well placed for a further thrust into ICT for education, which will also involve periodic renewal of ICT resources as technologies evolve.

Innovative Methods in Education and Research