

CEPIS UPGRADE is the European Journal for the Informatics Professional, published bi-monthly at <<http://cepis.org/upgrade>>

Publisher

CEPIS UPGRADE is published by CEPIS (Council of European Professional Informatics Societies, <<http://www.cepis.org/>>), in cooperation with the Spanish CEPIS society ATI (*Asociación de Técnicos de Informática*, <<http://www.ati.es/>>) and its journal *Novática*

CEPIS UPGRADE monographs are published jointly with *Novática*, that published them in Spanish (full version printed; summary, abstracts and some articles online)

CEPIS UPGRADE was created in October 2000 by CEPIS and was first published by *Novática* and *INFORMATIK/INFORMATIQUE*, bimonthly journal of SVI/FSI (Swiss Federation of Professional Informatics Societies, <<http://www.svifsi.ch/>>)

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ISSN 1684-5285

Monograph of next issue (April 2011)

"Software Engineering for e-Learning Projects"

(The full schedule of CEPIS UPGRADE is available at our website)



The European Journal for the Informatics Professional
<http://cepis.org/upgrade>

Vol. XII, issue No. 1, February 2011

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(published jointly with *Novática**)

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* This monograph will be also published in Spanish (full version printed; summary, abstracts, and some articles online) by *Novática*, journal of the Spanish CEPIS society ATI (*Asociación de Técnicos de Informática*) at <<http://www.ati.es/novatica/>>.



Online Learning

A Reflection on Some Critical Aspects of Online Reading Comprehension

Antonella Chifari, Giuseppe Chiazese, Luciano Seta, Gianluca Merlo, Simona Ottaviano, and Mario Allegra

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This paper was first published, in English, by **Informatica** (Vol. 34, issue no. 4, 2010, pp. 491-495). **Informatica**, <<http://www.informatica.si/>> is a quarterly journal published, in English, by the Slovenian CEPIS society SDI (*Slovensko Drustvo Informatika* – Slovenian Society Informatika, <<http://www.drustvo-informatika.si/>>).

This paper reflects on some important aspects related to online reading comprehension. In particular, it explains the Interactive REading Comprehension (IREC) model that explores the different dimensions and interactions involved in an online reading comprehension process. The components of the model and their impact on the two principal processes characterizing any reading activity on the Web, surfing and comprehension, are described. The final section of the paper focuses on some critical design issues related to the development of a web based tool to support online reading comprehension in relation to the model.

Keywords: Instructional Strategies, IREC Model, Online Reading Comprehension, PISA Programme, Surfing and Comprehension Skills.

1 The Scenario

Today the reading scenario of an adolescent has changed. While on the one hand the book exists as a traditional vehicle for the dissemination and comprehension of knowledge, on the other

hand, the Web represents a new type of reading space.

Knowledge construction on the Web requires the ability to flexibly integrate traditional reading comprehension skills with new strategic knowledge applications elicited by the new reading domain for processing, comprehending and sharing information. More precisely, the Web has become an important resource that extends the

traditional reading comprehension scenario into an open hypermedia and multimedia knowledge space where a set of online comprehension strategies are employed to effectively locate, comprehend, and use the informational contents. When students are engaged in Internet learning and communication activities, reading comprehension is affected by the presentation of the contents to read: mail, blogs, social

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networks, multimedia and hypermedia contents introduce a fundamental change in the architecture of acts of reading. In fact, reading comprehension becomes a more complex, ongoing, self-regulated, decision process which involves choosing from different possible links, possible texts, possible purposes and among different ways of interacting with information [1]. This situation highlights a rapid change in the nature of reading so that the online domain requires a different reading literacy from traditional ones and a change of perspective in the dynamics of reading comprehension. Readers influenced by the information and communication contexts of the Web adopt new ways of reading, locating information, employing a more complex dimension of inferential reasoning strategies to construct meaning. In fact, Leu [2] stated that new comprehension skills, strategies, and dispositions may be required to generate questions, and to locate, evaluate, synthesize, and communicate information on the Web. Thus, reading in Internet

contexts requires the ability not only to construct meaning from a text, but also to construct meaning through flexible and purposeful choices of relevant hyperlinks, icons, and interactive diagrams [3].

However, faced with this situation, the International PISA (Programme for International Student Assessment) assessments on reading comprehension skills of European adolescents reveal a worrying image of "poor" readers lacking in basic cognitive strategies such as locating information or creating a mental overview of the text, connecting the meaning of one sentence to the meaning of another, using previous knowledge to try to clarify and connect meanings of words and phrases. Besides, readers find difficulty in comparing, contrasting or categorising information, inferring which information in the text is relevant to their task, critically evaluating or hypothesising and drawing on specialised knowledge [4]. As result of this data there is a clear need to study more carefully technological and methodologi-

cal aspects of online reading comprehension processes.

In the next sections the Interactive REading Comprehension (IREC) model and a definition of online reading comprehension are introduced. Then, the different dimensions and relationships involved in the model and its applications to support online reading comprehension are described.

2 The IREC Model

The need to study the complex relationship between web tools and reading processes is particularly urgent in the current contexts in which new tools, often on line, are being developed and the hypertext is becoming the main structure of many learning materials in use in the classroom, in substitution or in addition to the traditional textbook. The enhancement of the reading proficiency of students by means of specific web-based learning tools and the development of a new literacy related to the hypertextual structure of web contents are two different goals, which are often not clearly distinguished. The

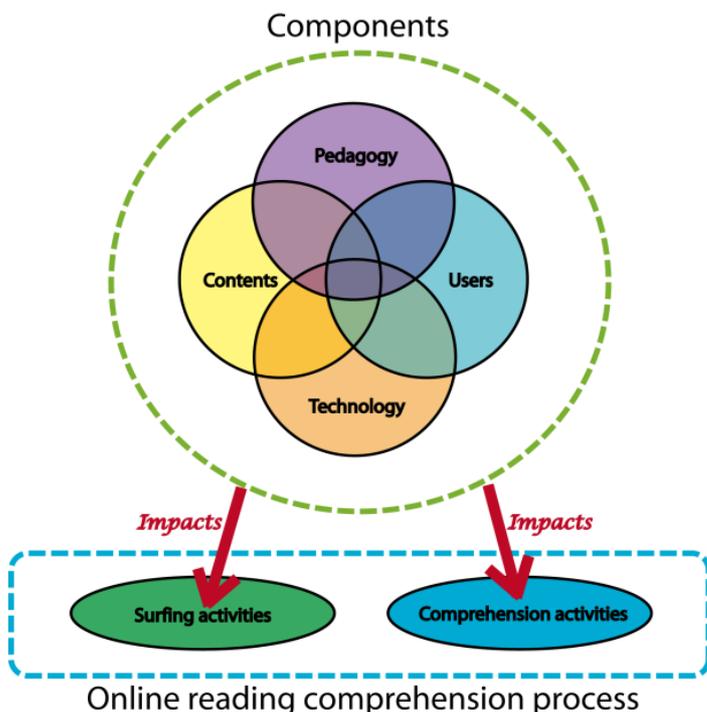


Figure 1: The IREC Model.

IREC model aims to deal with these two problems in a unitary framework, in which the text structure and the tool design are taken into account jointly and evaluated from a more general point of view. More in depth the model is inspired by theories about the design effectiveness of learning tools or devices aimed to support users' learning processes and social interactions [5][6][7], by research into instructional strategies [8][9][10] and also by novel studies of reading comprehension processes on the Internet [1][2][11][12].

It is possible to draw together the different theoretical approaches to produce the Interactive REading Comprehension (IREC) model (Figure 1) which describes a number of different situations related to the learning design in a technologically mediated environment. To evaluate interactions between the learning activities and the technology in use, it is necessary to take into account four interrelated components:

- Pedagogical component;
- Technological component;
- Content component;
- User component.

The weight of the single components and the reciprocal relations be-

tween them establishes the idiosyncratic nature of each different approach. More precisely, the model has a flexible structure depending on the type of domain of use. In fact, by selecting one of the four components it is possible to define a specific domain in which the model can be applied.

The components interact and have an impact on the Online reading comprehension process where two princi-

pal activities (sub-processes) must be distinguished:

- getting one's bearings (surfing process);
- constructing meanings (reading comprehension process).

Since this study aims to explore the design issues related to development of web based tools to support online reading comprehension, the "technological" component can be considered as fixed. In this particular representation of the model, shown in Figure 2, specific assumptions are made for each component: the pedagogical component is represented by the instructional strategies supported by the Web tools; the user component describes the adolescent reader's characteristics in terms of prior strategic knowledge and prior contents knowledge; the content component refers to the structure of learning materials, hypertexts and multimedia; finally, the technological component, which in this case has been extrapolated, consists of the design characteristics of a web tool and it is represented by an oval inside a dotted line including the other three components.

The IREC model stresses the relationships between these three components, and their impact on the two principal processes underlying the online reading comprehension process, namely the surfing and comprehension activities.

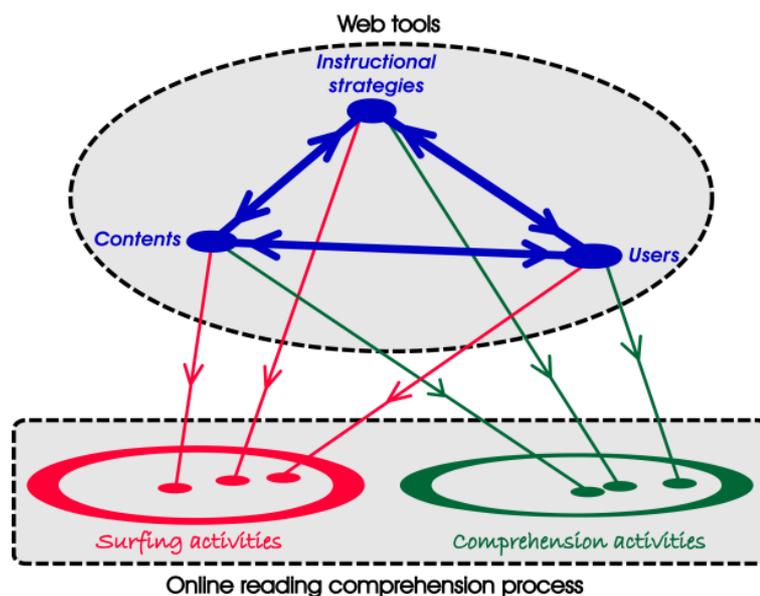


Figure 2: The IREC Model for designing Web Tools.

The model is based on the most recent theories according to which skilled readers are able to balance both the demands for comprehending and for orienting themselves in hypertexts [13]. This concept must be borne in mind while providing instruction, planning the contents to study and evaluating user characteristics.

The next section focuses on the Web tool features and how the features can be suitably developed according to the interaction with the characteristics of the three components.

2.1 Instructional Strategies

This component identifies the relationship between a chosen instructional model (peer tutoring, collaborative learning, reciprocal teaching, etc.) and the technological choices/functionalities of the tool which are needed to enhance the online reading comprehension process. So, it is important to focus the design efforts on the key instructional principles which make offline and online reading significantly different. The Texas Education Agency [10] states that instruction is effective if it is based on modelling processes and is well organized, explicit, intensive and long lasting, and if students are made aware of text organization and are motivated to read widely. In other words, the informed educational paths are much more powerful than blind ones, especially when the purpose is to stimulate metacognitive learning.

2.2 Users

This component guides the construction of users' profiles in terms of the proficiency level of online reading comprehension. The profile takes into consideration different aspects, such as prior strategic knowledge, prior contents knowledge, motivation, social and communication skills, planning skills, etc. Proficient online readers are able "to manage their strategic action as a part of a complex metacognitive domain". An independent reader is like a mental manager who plans his online reading strategy with awareness and implements strategic activities (e.g. asking and responding to questions, constructing meaning according to links chosen during surfing, critically

evaluating the credibility of a source) [14]. The knowledge of an initial proficiency level assists in the construction of a more precise user profile and the provision of more effective metacognitive training activities.

2.3 Contents

This component regards two principal aspects: the first aspect is technological and related to the structure of information in terms of its level of multimodality and hypermodality. In fact, it is a central design issue and takes into account some well-known aspects such as modularity, linearity, multimodality, granularity, interactivity and the different characteristics of texts (narrative, informational, scientific, etc.). The second aspect is educational, regarding important guidelines for developing learning materials consistent with the students' level of proficiency and with their personal perception of meaningful information so as to provide a rich context for learning. According to Baker [9], if the material is essentially meaningless to the student, he will have a great deal of difficulty in retaining it. On the contrary, if the student perceives the logical structure of the material, he will be better able to learn from it.

2.4 Online Reading Comprehension Process

The online reading comprehension process applied by the user is a complex set of strategies employed to construct meaning. More precisely, two levels of strategies are employed: a first level of cognitive strategies for orienting oneself in hypertext reading and for comprehending textual information, and a second level of metacognitive strategies employed for monitoring and checking the efficacy of reading comprehension and surfing processes.

Traditionally, reading comprehension is a complex active process of constructing meaning that is interactive, strategic and adaptable [10] It is interactive because it involves not just the reader but also interaction with the text in which reading takes place [15]; it is strategic since readers have goals that guide their reading and they use

different cognitive strategies and skills as they construct meaning [9, 16] it is adaptable because readers change the strategies they use as they read different kinds of text or as they read for different purposes [17]. At the same time, we define the surfing process as a complex, active process of constructing paths and finding directions. It is interactive because it involves hypertext links through which browsing takes place; it is strategic because surfers have information to find that orients their choice of links and they use different cognitive and metacognitive strategies and skills while they are following a path; it is adaptable since surfers change their strategies according to the design characteristics of different content structures. The combination of these two processes employed by students during the comprehension of online contents gives a new meaning to the acts of reading. This is because hypertext readers need to become competent both in constructing meaning and also in the employment of strategies for managing the different aspects of the surfing process [1].

3 The Interaction among the Studied Components

The main intention of the IREC model is to stress the relationships between the components, and their impact on the two principal processes characterizing any study activity on the Web : surfing and comprehension.

In particular, regarding the three components considered above, pedagogy, users and contents, while it is sufficiently clear that the choice of an instructional model must be the result of careful evaluation of the characteristics of both the users and contents in use, it is less evident that the assessment of users' proficiency should be made according to the instructional model applied and the structure and organization of didactic materials. In the same way, the content design is influenced by user characteristics: the contents can be developed to satisfy different user profile and different reading proficiency levels. So, different contents could be developed for supporting the learning of specific

strategies such as locating information, creating a mental overview of the text; connecting the meaning of one sentence to the meaning of another. Moreover the instructional strategies can affect the level of interaction of the content in terms of personal, reciprocal and collaborative construction of meaning on the Web. Finally, the users' characteristics, in terms of prior knowledge, motivation, cognition and metacognition strategies, mental managing, proficiency and mastery, have to be taken into account in order to establish a suitable level for the teaching topic and the structure of the contents, and to plan the learning activities.

But the model also wants to emphasize that these characteristics are not static, they evolve over time and so some specific tools are needed to keep pace with this evolution. Generally, this aspect is discussed in relation to the rapid changes in information and communication technologies. The development of new techno-based systems appears to be a major stress factor in the educational environment, with teachers and students running a non-stop race to acquire the latest novelties. Little attention is paid to the parallel evolution of pedagogical methodologies, users' behavioural habits, multimedia and hypermedia languages. One of the reasons why the diffusion of some technology based educational tools has also been possible is due to the increasing familiarity of learners and teachers with new modalities of interaction as well as the development of pedagogical approaches based on, for example, simulation and visual knowledge management.

But the evaluation of the relationships between the components is not sufficient. It is also necessary to recognize how these components impact on surfing and on comprehension activities. For example, any decision aimed at improving the surfing process might have a negative effect on the comprehension activity, and vice versa. So, web tools designed to facilitate the storage of web pages, a typical surfing feature, might limit the students' ability to identify the main concepts of a

text, an important comprehension activity; likewise, tools designed to organize the contents graphically, a useful reading comprehension activity, might hamper orientation on the Web, a surfing aid for monitoring surfing behaviour.

All these relationships have different impacts on the design of web tools to support on line reading comprehension processes, so the design has to be a multi-level activity, involving different professional figures, such as teachers, pedagogues, psychologists, and technicians. But many solutions can arise from theoretically based observations of on line learning practices. In this respect the IREC model may prove to be a useful tool to distinguish the most relevant variables and dimensions involved in a web-based learning experience.

4 Conclusions and Discussion

The rapidity of technological change and the increasingly frequent use of Internet for educational purposes have increased the learning demands for comprehension and for thoughtful navigation.

The added value of the model presented can be ascribed to a systemic design perspective in which the characteristics of each component interact dynamically. Any variation of the intrinsic value of a component affects not only the characteristics of other components, but also the design domain. In this context the level of proficiency in reading comprehension affects not only the selection and construction of specific contents and instructional strategies but also design choices to enhance the empowerment of each component.

Focusing attention on the technological characteristics that a web tool requires for supporting online reading comprehension more effectively has the advantage both of stimulating theoretical research in this field and inviting a reflection on design and implementation issues, so that the technological solution represents an effective support, enabling students to become proficient readers during on line surfing.

From a theoretical point of view, it is necessary to investigate the processes that regulate online reading behaviour and in particular cognitive and metacognitive strategies, social competences and the effects of content structure on reading comprehension. It is also essential to find new indicators to measure levels of reading proficiency more accurately. Equally important is a reflection on comprehension instruction to promote students' cognitive scaffolding.

From a technological point of view, the IREC model suggests a reflection focusing on the following design choices: setting out a clear purpose for the intended tool; identifying a target and defining user profiles; identifying an instructional comprehension model and evaluating how it could be applied in a web-based environment; balancing surfing and comprehension features according to the established goal; including motivational features/activities to promote greater user participation [18].

Consequently, some of the following features could be implemented into a web tool: aids for monitoring all online comprehension behaviour such as reflection and annotation tools, cognitive and metacognitive prompts; aids to improve the research for information such as choosing keywords, identifying the best query results, evaluating web credibility; aids for organizing contents graphically such as conceptual maps and flow charts; aids for managing web page storage such as history, bookmarks/social bookmarks; opportunities for students to self-assess their knowledge; aids to promote a shared understanding of the goals for metacognitive activities and so on.

In conclusion, the IREC model could provide a starting point for further research discussion about the nature of online reading comprehension and the development of new online reading comprehension tools.

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Successful Centralisation in Two Steps

Interview with *Sasa Dulic* and *Predrag Stojanovic*

Milenko Vasic

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This interview was first published, in Serbian and English, by **inforeview** (December 2010 issue). **inforeview**, <<http://www.inforeview.biz/engleski/jisainfo/infoe.html>> is a bimonthly magazine published, in Serbian and English, by the Serbian CEPIS society JISA (*Jedinstveni informatički savez Srbije* – Serbian Information Technology Society, <<http://www.jisa.rs/>>).

In this interview an experience of implementation of an IT centralized environment in the National Employment Service of Serbia (NES) is described.

Keywords: Centralisation, eGovernment, National Employment Service of Serbia, NES.

The National Employment Service of Serbia (NES) and the Serbian company SBS have cooperated for years, and through their most recent project, they managed to centralise its IT environment. The idea was considered before as well, but the prices and acquiring of communication lines made the concept hard to realise. However, during 2009, it was concluded that the conditions were created, and that the realisation of the project can begin.

Predrag Stojanovic, Sales Director at SBS, said that SBS cooperated with the NES on a part of that information system, while the project of realisation was realised within tender where the solution of this company was chosen as the best. *"We are pleased to say that we realised the project in the first half of December."*

Sasa Dulic, the Head of the IT department in NES, explained that the project that has just been finished is considered to be the top of the overall development of information system, which has lasted for more than a decade. *"After the completion of this work, everybody realised that the operations of the NES are inconceivable without an information system. We are a large institution with over 2000 employees*

in 32 branches, with offices that cover 178 points in Serbia. This gives the image of the project. Central operative database of the NES is available from each point. We are one of few state institutions that can boast with the information that we have more computers than employees, and we should mention job searching clubs, computer classes, self-services..."

What are the advantages of centralisation?

Dulic: Centralisation has a range of advantages when compared to the previous system. Now we have many new possibilities. For example, we will be able to provide a whole range of new services via the Internet. I do not want to say that hasn't been possible until now, but it was very complicated. With this, the story of eGovernment becomes the reality. The National Employment Service will certainly in the next period be heading in that direction.

Are you satisfied with the way the project was completed?

Dulic: SBS has been cooperating with the NES for a long time, and we are satisfied with the quality of their work and the devotion they show. They won this job at the tender, in a fair competition with other partners and they completed it successfully in time.



The Interviewees

Sasa Dulic (right), is Head of the IT Department in the National Employment Service of Serbia (NES). <<http://www.nsz.gov.rs/>>

Predrag Stojanovic (left) is Sales Director at the Serbian company SBS. <<http://www.sbs.rs/>>

The Interviewer

Milenko Vasic is journalist at **inforeview**, magazine of the Serbian CEPIS society JISA. <<http://www.inforeview.biz/engleski/jisainfo/infoe.html>>

How did the process developed?

Stojanovic: The realisation of the tender lasted for two months in the last quarter of this year. We knew that we could use a tender for the system centralisation, since we had taken the preparatory actions before that. We pre-

pared the system and collected the data together, which helped us determine if it was actually possible, and that it wouldn't cause problems in operations of NES. In other words, we reviewed those real options and possibilities even at the end of 2009, and then we performed some actions that brought to making the decision about the centralisation. When the decision was brought and the tender was announced, we had already been ready to realise it.

Dulic: That preparation actually included a partial centralisation of the existing system, which, through this project, is now completely centralised. The NES has 32 branches and all of them are working under one database. Before, each branch was working with its own database, while the data would be replicated every afternoon and evening and sent to one central reporting base. The idea to put it all under one database is as old as the information system, but certain conditions, primarily those related to the telecommunication and hardware didn't allow that until recently. However, regardless of the fact that over time we acquired powerful hardware and secured good communications, we weren't sure how powerful hardware we needed to obtain, and what it should have been like to be able to guarantee that it would work in a centralised manner without losing performance. We decided to do that in two steps. The first step was partial centralisation, where we allocated 32 branches to 5 regionally connected servers. When we were sure it was working using that hardware, through this project, we centralised those 5 regional servers into one.

What preceded the making of decision to perform centralisation?

Stojanovic: The last decade of XX century was the period of decentralisation. That trend has probably ended. Thinking about the concept applied in the National Employment Service, I read some analyses and found the information that in 2010, 45% of IT environment is centralised, 48% is a combination of distributed and centralized environment, while only 7% is distributed. Both cen-

tralised and decentralised forms have their pros and cons. For example, in decentralised IT environment, it is easier for innovativeness to occur, while the centralised system is more scalable and easier to manage. Since the state institutions are centralised themselves, we thought it would also be good for the IT environment. That is why we analysed the complete infrastructure in the sense of required hardware (servers), communications, applications, maintenance, administration, and we offered a centralised solution.

How will it reflect on the operations of the National Employment Service?

Dulic: It will undoubtedly reflect on its functioning. For example, when the branches had their own databases, our employees kept records on unemployed people only for the territory they covered, and if an employer would contact them, looking for a specific workforce that is not available at the territory of that particular branch, they couldn't access the information of other branches. Now they have conditions for interregional mediation. Our adviser in Belgrade now has the database from the whole Serbia at his disposal. Since the migration of the workforce is more and more frequent, this aspect will become significant. Through this project, all regions are now connected.

One of the preconditions was developed communication network, is that right?

Dulic: Certainly. Our modern infrastructure was created over time through projects which preceded this one, and is able to satisfy the most recent requirements. We tested its communication capacities through recently mentioned partial centralisation, so there wasn't any risk in completing the full centralisation of the system.

Stojanovic: In any case, the changes applied weren't connected just with the communication system, but with Intel-based hardware and software, which are now more reliable. A few years ago, one such project was hardly conceivable, if at the same time one wanted to be sure that the envi-

ronment would enable the institution of such class and significance to work efficiently. Now it is possible.

With the centralisation, your data processing centre at Gundulicev venac became a strategic point, since, unlike the previous solution, now all the data is practically stored there. How will you take care of it?

Dulic: Yes, that centre is now a strategic point, and the National Employment Service will take special care of it. We are already thinking about forming another centre next year, which would serve as a backup in case of any problems. Since according to the law changes, the headquarters of the NES is moving to Kragujevac, that other centre could be made in that city. So, this is not the end of the development of the system, but actually a beginning of a new cycle.

Do you already have any ideas for the new cycle?

Stojanovic: The possibility of applying some other technologies arises, for example SAP, which couldn't have been applied in the previous distributing system. Now we have the infrastructure built, and it can be upgraded with new technologies. This is a big step forward for further improvements of IT environment of the NES. In the last two to three years, it has made a giant step forward related to IT technologies, and now it has a system it can be proud of. Many things were done here in the right time and with the right choice, leaving the ability for further upgrade.

What can you tell us about the implemented hardware?

Dulic: The hardware is properly balanced, no excessive parts were used. The main problem in this project was exactly that – choosing the hardware which supports various tasks without the performance drop, or should I say, the one which would be faster than the previous hardware.

Stojanovic: Existing big central computer was substituted with a group of servers with Intel processors and VMware software for virtualisation.

Apart from the IBM storage, the system contains one more storage system, together with previously bought magnet tracks for storing backup copies. The database is still DB2, the same one that was used before, and there are also various tools – Tivoli Cognos... In other words, everything used here is applied in a system based mostly on IBM's equipment. We tried to build the configuration which corresponds to our real needs and which offers better performances than the previous system.

What business changes now occur?

Dulic: The National Employment Service is changing in business sense as well. From a service which was called Employment Bureau, and which looked stereotypical, with counters with the sign "Break", it turned into a modern service, intended not just for unemployed people, but for employers as well. We offer to our clients services that are not only increasing in number, but are becoming more complex in terms of IT support. We are expected to react quickly. The previous two years were marked by the economic crisis, everybody worked less, while the employment services worked more. The Government reacted to the crisis by increasing the number of services for unemployed people, which resulted in larger quantities of data and greater number of requests by minimum of 40%.

Stojanovic: IT is expected to provide more and be faster, and in order to meet the expectations, you must perform an analysis and determine which parts of business processes can be improved, and the management promoted by using different system that is capable of responding to increased demands. The National Employment Service managed to implement a model which can do more than the previous one, and that trend can continue thanks to this projects through which the system was centralised.

Has this project helped you also meet the necessary prerequisites for what is set to be a condition for state institutions for their future operations?

Dulic: Yes. What we have done

stands in front of every other institution that wants to follow the roads defined by strategies for development of information society and state administration. When I promised at the beginning of this year that we will have a single database, that seemed almost impossible, but it, however, became a reality. We have a system which works on average with 15.000 people daily. Unfortunately, few know what the purpose of this institution is. That stands for unemployed people, and particularly for employers. They don't know what we have to offer, thus they are slaves to the old habits. Some even say that few have managed to find a job through the Employment Bureau, although anyone can easily find positive examples.

Stojanovic: I can name a positive example right now – my wife found a job thanks to the information she received from the National Employment Service!

What would be the final conclusion?

Dulic: The system we used before, now works in a completely different way, and in the meantime, there weren't any obstacles. It works better and now is able to perform actions that weren't available before.

Stojanovic: This was an excellently planned project, which the National Employment Service realised in the right way, and thanks to the tender victory, SBS got the chance to participate in it, which it did with pleasure. We think that we contributed to creating an IT solution which is acceptable according to all criteria, from the choice of infrastructure, to the services provided. The National Employment Service becomes an example for other institutions, and has an ability to advance, develop in the right direction, and provide unemployed people, employers and the staff with more accurate, timely, reliable, and relevant information.