Broadband Infrastructure in the Region of Slavonia and Baranja (Croatia)

Review

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Abstract *– This paper examines issues concerning the development of broadband infrastructure in the region of five counties in Croatia that make up Slavonia and Baranja. It also examines the state of telecommunications in the region today and presents potential models of the development of a broadband network. A new "Slavonian model" of developing a broadband network has been proposed. In this model, new infrastructure investors are to be found among local administration units.*

Keywords *– Broadband, IT communications, Communications infrastructure, Fiber optics, FTTH, GIS, Slavonia and Baranja*

1. INTRODUCTION

New information and communications technology (ICT) is the foundation for the development of economy and knowledge society. Information and knowledge have taken the place of capital as the foundation of individual and social growth and development. An expansion and accumulation of understanding and knowledge depends on the setup of a developed communications network for a quick and efficient transfer of information. Development of fast access networks today has the same revolutionary effect that development of a traffic network or a power grid had some 100 years ago. Services converge in the direction of a digital world, they are universally accessible on all equipment, be it personal computers, smart phones, digital radio or HD television. Forecasts state that digital content and applications will be almost entirely delivered via the internet by the year 2020 [3], [5], [9].

According to the results of a study undertaken for the EU [13], an increase in the number of broadband users influences the GDP growth, with the increase being more important in a country that is more developed. Estimates show that a GDP growth of 0.47% is possible in countries where broadband access is less developed, 0.63% in countries where broadband development is robust and 0.89% in countries that have the most developed broadband – where all the possibilities of a "knowledge society" are used.

In 2010, the European Commission initiated the "Digital Agenda for Europe" as one of the key initiatives foreseen by the strategy "Europe 2020". At the end of 2011, the Croatian Government published a Strategy for the development of broadband access in the Republic of Croatia between 2012 and 2015 [10], as well as the implementation program for the Strategy for the development of broadband access in the Republic of Croatia [11] for the period from 2012 to 2013. Faculty of Electrical Engineering Osijek (hereinafter referred to as: "ETFOS") hosted an expert gathering with the participation of Minister of Construction and Physical Planning of the Republic of Croatia as well as representatives of the Croatian Post and Electronic Communications Agency

(hereinafter referred to as: "HAKOM"), whose goal was to prepare the local community for the implementation of this strategic document whose end result would be comparable to the technological advance achieved with electrification undertaken in the last century.

In this gathering, it was mentioned that this technological advance has some specific characteristics unique to Croatia; namely, the act that regulates Electronic Communications Infrastructure (hereinafter referred to as: "EKI") has not foreseen that the investors in this infrastructure could be local administration units which were, on the other hand, foreseen as investors by the Agenda. In the meantime, HAKOM proposed and the Government passed a Regulation on the Measures of Development of Electronic Communications Infrastructure and Other Related Equipment [12], which regulates the aforementioned legal uncertainty. Another problem encountered in the initial phase was inadequate physical planning documentation based on which the construction of local infrastructure would be planned.

The third potential slowdown in the process would be unsolved property rights issues on real estate on which EKI construction was foreseen. It was also discovered that updated strategic documents referring to the development of local communities for which future requirements are planned do not exist. A team was then formed at the Faculty of Electrical Engineering in Osijek that immediately began preparing documents based on the strategy of broadband access.

A conceptual design of the "Slavonian Network" was to be realized in 5 counties of Eastern Croatia (Osijek-Baranja, Brod-Posavina, Virovitica-Podravina, Požega-Slavonia, and Vukovar-Syrmia) as a pilot project. These counties represent 22.1% of the Croatian territory with a population of 800,000 inhabitants in 998 settlements, incorporated in 22 cities and 105 districts.

The initial investment is estimated at €21.5 million. The project has been a candidate for the Program of Preparation and Implementation of Development Projects Acceptable for Financing from EU Funds in the year 2013. Ministry of Regional Development and EU Funds of the Republic of Croatia decided at the end of 2013 to approve technical assistance for the project in the phase of preparation. For the project to be rationally managed, it is necessary to develop an IT database, which includes all parameters that can influence business decisions. Important characteristics of such system are modularity and 24-hour access to information. Modularity includes data classified in databases of information providers that are used in creation of detailed projects.

This is the same logical concept as with geographic information systems (GIS) whereas 24-hour access is provided by the web server. The authors of this paper and their associates have developed a web interface using available public databases, which enabled rational planning and planning of development of electronic communications infrastructure.

2. BROADBAND ACCESS IN CROATIA

A. THE IMPORTANCE OF BROADBAND ACCESS IN CROATIA

Broadband services development enjoys a special importance in the economic development of Croatia and especially for the development of knowledge society in Croatia. Newest broadband services (Internet education, social networking, HD television, teleworking, etc.) require adequate transfer capacities (more than 20 Mbit/s) which can be achieved by means of optic access infrastructure and adequate new generation wireless technologies.

It is therefore necessary to create adequate conditions for investments in cable and wireless networks of the new generation and primarily to enable space conditions which do not limit further development of these networks. As the process of constructing electronic communications infrastructure and related equipment in a mobile communications network has been slowed down due to an absence of required space conditions, it is necessary to encourage planning of these networks in the coming years. This includes a change in urban development plans. Figure 1 shows a growth analysis of density of subscribers in broadband access in Croatia [8].

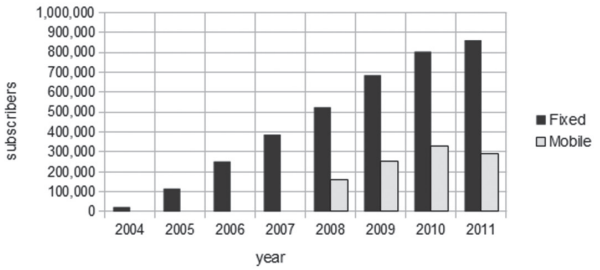

Fig. 1. Number of broadband subscribers in Croatia

Exponential growth in the number of connections is presumed for the period from 2004 to 2011. It was at a rate of 147 or an index of 56,611 (2004 = 100). Exponential growth in connection points of broadband Internet access can be observed in the observed period; the index (2004 = 100) is 5,150, meaning that the yearly

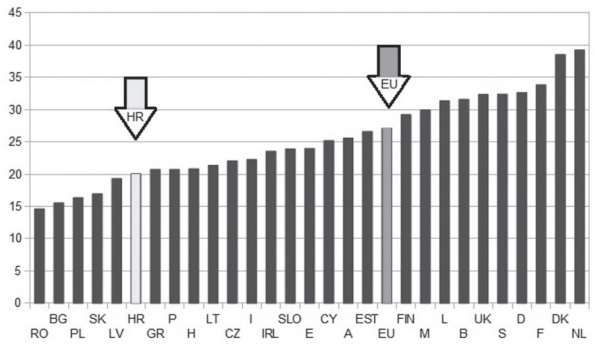

Fig. 2. Density of broadband access in EU and Croatia

growth rate is 75.6. But, compared with EU countries, Croatia lags behind in this area of technological development, as shown in Figure 2.

B. BROADBAND FRAMEWORK

Broadband services are a crucial infrastructural condition of general development (economy, public administration, social services and a population's standard of living). It should be emphasized here that development of broadband services also represents an opportunity for economic and technological development of local companies and new jobs to local population. Such development of broadband services is a complex technological process and also an important investment operation so its realization must (by nature of things) be undertaken in a number of mutually dependent steps: 1. Construction of a distribution network, 2. Organization of distribution of existing services, 3. Consumption and education of consumers, 4. Development of new applications.

3. A MODEL OF BROADBAND NETWORK DEVELOPMENT IN SLAVONIA AND BARANJA

C. PROJECT "SLAVONIAN NETWORK"

At the end of 2012 (after a series of gatherings and preparation activities), Faculty of Electrical Engineering in Osijek (ETFOS) initiated the "Slavonian Network" (hereinafter referred to as: "SN") project, which deals with development of broadband access to the Internet in five counties of Eastern Croatia – Figures 3 and 4. The basic framework of the project is given here [6].

Fig. 3. Five counties of Eastern Croatia

Problem description: The number and density of broadband internet access points in Croatia is significantly below the average of EU Member States (HR=20.07%, EU=27.16%), and these figures are even lower in five counties of Slavonia and Baranja region (with the exception of Osijek). Such a condition in modern times makes social and economic development, efficient functioning of public administration as well as inclusion of the region in modern communication both domestically and with users in other EU countries impossible.

Goal of the project: To enable broadband internet access in 75% percent of communities in five counties of Slavonia and Baranja region by 2015.

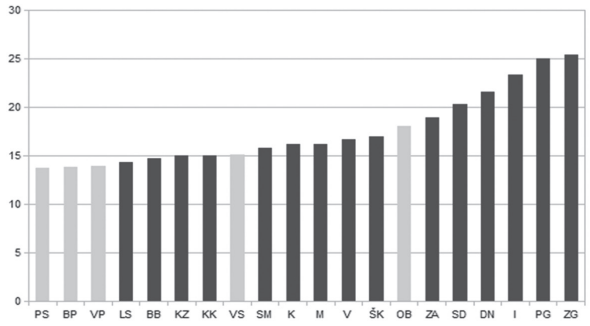

Fig. 4. Broadband access density - five counties of Slavonia and Baranja region, Eastern Croatia

Final beneficiaries of project results: (1) Population of five counties in Slavonia and Baranja, (2) Public services in five counties in Slavonia and Baranja (health, education, social services, public administration), (3) Economy in five counties in Slavonia and Baranja.

Economic benefit as a result of project realization, an estimate: Economic benefit (direct and indirect) of project realization would be: (1) more efficient functioning of public administration, (2) better business results of economic subjects, (3) increase in the population living standard, (4) development of new businesses based on broadband access. Finally – realization of the project on this basis only will contribute to a minimum 0.7% GDP growth in Slavonia, starting in 2015.

Due to its technological characteristics and the speed by which new knowledge is doubled, the process of development of broadband access is multi-phase with increased interdependence of all phases.

D. INTERDEPENDENCE OF BROADBAND ACCESS DEVELOPMENT PHASES

Keeping in mind 1) the technological and organizational difficulty of this process, 2) the state of affairs in the region (urban development plans and other problems of administrative nature, economic backwardness), and 3) the financial framework of necessary investment in the realization of the project "Slavonian network", the unification of all social, expert and financial potentials in the region is necessary. Therefore, the consortium SN is to be created. It should, in turn, adjust the proceedings and coordinate the execution of crucial stages of this project. The following institutions and organizations would participate as founding members of the consortium: a) five counties of Slavonia and Baranja region, b) Faculty of Electrical Engineering in Osijek, c) Panon - Institute for Strategic Studies, and d) telecommunications operators interested in the development and usage of the new network.

E. PROJECT MANAGEMENT BY THE CONSORTIUM

The beginning of realization of the "SN" project is conditioned upon the following: a) the resolution of ownership issues of approx. 10,000 land proprietors through whose land the telecommunications infrastructure should pass or is passing, b) the updating of urban development plans in 127 local communities - cities and districts, c) the introduction and updating of a registry of lines, and d) the creation of local funds, which would serve as initial sources used for financing necessary processes.

The construction of optical infrastructure demands significant financial means, as construction costs make up more than 65% of investment costs. Approximately the same situation is found with the structure of costs for the construction of other communal infrastructure - sewage, wastewater removal, electricity, steam ducts and gas. As this infrastructure does not interfere with the functioning of optical infrastructure, common development is recommended wherever possible, which will in turn significantly reduce the expenses for developing the optical network as well as other urban installations.

F. UTILITY CADASTRE

Utility Cadastre contains basic technical features concerning ownership data. The liberalization of the telecommunications sector caused the infrastructure operator with public authority to disappear, which in turn makes urban development plans more difficult to create. The unification of requirements and the coordination of electronic communications infrastructure, which must be foreseen in the urban development plans, was taken over by HAKOM [4].

The information regarding the number and the length of lines in communities indicates that most of the local administration units cannot create and maintain a line registry in an economical way. It would therefore be logical to create a line registry for a number of local administration units or for the entire county. The law states that the technical section of the lines registry can be organized separately from the local administration in one of the suitable forms (corporation or a surveying engineer) by entrusting these affairs to the surveying enterprise.

G. CADASTRE

Legal obligation for the utility cadastre in Croatia was introduced in 1973. Conditions for surveying the infrastructure lines [1] were created in former Yugoslavia in 1969. A surveying coordinate system was adopted in 1992. as Gauss – Kruger projection with three initial points (X, Y) and vertical (Z) systems based on the tide gauge in Trieste, meaning that a foundation for the utility cadastre exists.

Initially, the goal of the utility cadastre was to prevent cutting of infrastructure lines, avoid damage and fulfill conditions for acceptable management of space. The register was required by the Cadastre and the owner of infrastructure simultaneously. The law prescribed that the utility cadastre should contain every surveyed line (Y, X, Z). Since 1999, the utility cadastre is mandatory for both local government and the infrastructure owner.

In order to conduct business legally, the infrastructure owner should resolve property rights. Routes of lines have been built within traffic corridors in 70% of cases, and private property accounts for 30%. Data on ownership in Land Registry is based on Land Cadastre. Accuracy of Land Registry, based on Austria-Hungarian standards (on more than 80% of the Croatian territory) makes the situation even more complicated.

Croatian infrastructure is 30-50 years old, it requires reconstruction and does not fulfill new standards of environmental protection. Electronic communication infrastructure is technologically outdated and needs to be modernized. Geographic area referred to in this paper is experiencing a demographic deficit, so enlargement of infrastructure outside today's boundaries is not planned.

The utility cadastre should enable rational renovation of infrastructure and solve property rights issues between real-estate owners and infrastructure owners. Exchange of information about placement of infrastructure with GIS is simple. Only through multiple usage of information gathered by surveying can we achieve rationality in managing infrastructure systems. Hence, authentic data is a must for any development of the utility infrastructure cadastre. Since involvement of various data is foreseen, we find that a multidisciplinary approach to data management is the most economic solution.

The main problem in modeling this project is the authentic and accurate data for Infrastructure Mapping. There are commercial and open source software solutions, Fig. 5. Commercial software usage is dominant in Croatia (76%) close to the level recorded in the USA and Canada (close to 100%). On the other hand, open source software dominates in the EU countries (54%) [2]. The reason is very simple; one can adapt software to his/her own needs. Which software to use? Here we offer some possible solutions.

Fig. 5. Commercial GIS as a tool for Spatial Data Infrastructure

Free software used in Spatial Data Infrastructures (SDIs) is widely available. There are also software companies that started developing free spatial software for their own products that can be used in SDIs. A lot of spatial data was stored in different standards or formats, which in turn creates difficulties for users accessing such data for their specific usage.

Fig. 6. QGIS Open Source – Osijek, telecoms infrastructure – ETFOS

For effective usage of SDIs, it is possible to use free GIS software. With GIS client application, almost everybody can display, query, and analyze spatial data and spatial services. Open Geo-spatial Consortium (OGC) plays an important role [7] in spreading and processing of spatial data, Fig. 6.

H. IT SUPPORT FOR THE REALIZATION OF THE BROADBAND ACCESS STRATEGY

Recently, network access to GIS is becoming more and more popular. Representation of dynamic maps over the Internet is becoming a rising challenge. Croatian government, as well as local administration, upload digital maps on their web sites for public use more and more often. Trading companies wish to inform their potential customers of the location of their stores. In creating GIS maps, a tendency is observed to simplify access to information to users without necessary prior knowledge.

By simply marking desired processes, the users actively participate in presenting and exploring information by using interactive maps through advantages offered by the existing internet explorers.

A large amount of money is invested in GIS programs for their research and development, so that new, advanced possibilities can be offered to the market. This concerns primarily processing 3-D geographic data as well as web projections based on geo-referenced data. This is especially the case in development of distributed technological systems of processing a large amount of data as well as processing of geographic data in real time.

I. IMPLEMENTATION OF NEW WEB DATA REPRESENTATION

When choosing 24-hour data access and showing a need to involve the biggest number of users possible, "Open source geo site" supported by MapGuide Open Source becomes an optimal solution. Map and registry plans updates can be verified by examining the digital ortophoto plan (DOF5). The same is used by HAKOM for maps of areas of broadband access availability, Fig.7. It is also possible to use Google Maps and Street View.

Fig. 7. HAKOM, a broadband access area interactive map

Excessive demand from IT can lead to unrealistic expectations and interpretation of available data, when the quality of available date should be primary. Visualization of data can point to possible illogical quality of information within the database that should be paid special attention. Previous experience confirms a possible discrepancy between image and reality. This is a common misconception concerning GIS technology. A user often gives up before adjustment of presented data takes place, because he/she wants a perfect representation of required database. This is why IT support in this phase is destined to experts that can create strategy and set priorities based on information presented.

One of the first assignments of local administration in these five counties would be to collect and update the existing information necessary for the creation of a Slavonian model of construction of the FTTx broadband network.

J. WHY FTTH IS A FUTURE PROOF TECHNOLOGY

FTTH is often referred to as 'future proof'. All of its advantages are translated into a more reliable network, with lower operation and maintenance costs [13]. There exist other alternatives such as mobile wireless networks and satellite connection, but they should be promoted for their strengths rather than as a direct substitute for FTTx, wired broadband connections [14].

Wireless technologies, although advantageous in areas where the installation of a cable network would be difficult, have a major disadvantage in that the wireless link, which offers access to end users, can often become overburdened in case a large number of users wishes to access the wireless network at the same time.

This can result in lower access speed, meaning that additional investment in cable infrastructure supporting the wireless network would be required. Successful

creation of a wireless network is therefore conditioned by high costs [15], much like satellite networks, which are especially suitable only for some points hardly covered by existing terrestrial or wireless networks.

At the moment, the information is spread between local administration and state- and privately-owned companies. A significant problem would be receiving relevant information from telecommunications operators. Up to this day, they show no will to invest in the construction of a new FTTx network, unless economic gain is to be achieved. Since it is a duty of local administration to support development of a fiber network on its entire area, this attitude of operators has to change. This is why the participation in the project of all telecommunications operators, who in the end should be using the network by offering new services (although under the control of local administration) would be welcome. The mission of local administration is also the construction, maintenance and offering of its capacities to all broadband providers under equal terms.

The basis for the model, by which the local community would have transparent access to SDI information, are open source GIS programs and databases. Preparations for this approach have begun at the Faculty of Electrical Engineering in Osijek by creating new courses, which prepare higher-education personnel for working in the domain of construction and implementation of optical network broadband access. There also exists cooperation with companies prepared to conduct design and development by using latest technologies and according to wishes of local administration. Faculty of Electrical Engineering offers concrete support through counseling and supervision in the creation of development models (Slavonian Network).

4. CONCLUSION

Deepening of knowledge today is dependent upon the development of a modern communications network for a fast transfer of information.

The number and density of broadband internet access points in Croatia is significantly below the average of EU Member States (HR = 20.07%, EU = 27.16%): These figures are even lower in five counties of Slavonia and Baranja (with the exception of the city of Osijek).

Croatian government accepted the goals outlined in the Digital agenda for Europe and implemented a strategy for broadband access development for the period 2012 – 2015, which should enable broadband access to 75% of communities by 2015.

At the end of 2012 (after a series of gatherings and preparation activities), Faculty of Electrical Engineering in Osijek initiated the "Slavonian Network" project, which deals with the development of broadband access to the Internet in five counties of Eastern Croatia. Bearing in mind the technological and organizational difficulty of this process, the unification of all social, expert and financial potentials in the region is necessary. That is why the consortium SN is to be created.

The implementation of this complicated program is based on a digitized database of a) a registry of telecommunications infrastructure, and b) the utility cadastre, which are developed successively and updated on the county level. This digitized database is to be maintained on Open source platforms.

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