Global Communications Newsletter

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Urban and Rural Telecommunications Development: Identification of a Digital/Broadband Gap in Serbia

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The growth rate of information communication technologies (ICT) in developing countries is accelerating. It is both socially and economically desirable to stay abreast of technological developments, and some newer technologies (e.g., wireless communication) have actually allowed developing countries to "leap-frog" past inadequate infrastructure. However, economic factors have caused the distribution of a new ICT infrastructure to be uneven. In rural areas development is very slow, and a new digital/broadband gap is increasing. The situation is similar to that in the developed world. In early 2009 it was estimated that 30 percent of the rural European population still have no broadband access. Today, there are very limited public data available on the development of the telecommunications infrastructure in urban and rural areas. In this article we present our research on urban-rural technological developments in Serbia. In principle, the research can be generalized to represent the situation in other developing countries.

In Serbia 41 percent of the population have fixed telephone lines, the highest in southeast Europe. 4537 of a total of 4715 rural settlements (about 1 million households) utilize 800,000 fixed lines. Only 4 percent of settlements are urban, but 56 percent of all inhabitants, 59 percent of all households, and 67 percent of all fixed lines are in urban areas. The research focuses on fixed, mobile, and Internet access development.

Fixed telephony penetration is correlated with city population; cities with populations greater than 100,000 have more than 45 percent penetration, cities of 20,000–100,000 have 35–40 percent, cities of 5000–20,000 have around 30 percent, and cities of 200–5000 have 24–28 percent; in communities of less than 200 inhabitants, fixed telephony penetration is less than 21 percent. In rural Serbia results from the recently finalized Universal Service project show that 18 percent of towns have no access to a fixed line, which affects less than 2 percent of inhabitants.

For mobile telephony (9.6 million subscribers, 128 percent penetration) a report from the national telecommunications agency in 2008 indicated that three operators using Global System for Mobile Communications/General Packet Radio Service (GSM/GPRS) technologies cover about 93 percent of the population. However, UMTS technology only covers around 56 percent. Nearly all settlements without fixed phones receive a GSM mobile network signal.

Numerous studies, including a draft of the Serbian Strategy for broadband access, recommend third generation (3G, Universal Mobile Telecommunication System [UMTS]) and other wireless access technologies as the optimal choice for remote, sparsely populated areas. However, two years after commercial launch, 3G radio stations from all three operators (three licenses were issued in August, September, and December 2006) account for 22 percent of all radio stations in mobile networks; 8 percent of mobile subscribers are 3G, and only 0.24 percent of mobile subscribers have mobile broadband. Additionally, a rough analysis of the 3G base station locations of the mobile operator with the best coverage (56 percent) shows that about 60 percent of 3G radio stations are situated in the capital city, Belgrade, and about 70 percent are in four large cities (all with more than 100,000 inhabitants). This means more than 90 percent ofaccess is in urban areas and less than 10 percent in rural parts of the country; UMTS technology, without special government (financial) initiatives, is not an accessible broadband solution for rural areas.

An analysis of Internet connections based on the latest data from the Serbian Statistical Office gave the following results: 47 percent of households in urban areas use an Internet connection; only 22 percent of rural ones do. A comparison of broadband Internet connections (23 percent of households in 2008) shows a significant discrepancy, where 34 and 7 percent of urban and rural households, respectively, have this type of connection.

Due to the lack of official data on broadband coverage, for our research we used a relationship to estimate the asymmetric digital subscriber line (ADSL) and cable modem service accessibility in urban/rural settlements. We found that ADSL modems covered 53 percent (from a total of 59 percent) of households in urban and 5 percent (from a total of 41 percent) households in rural areas. This indicates that 88 percent of rural households have non-broadband connections, which is three times lower than the European average. The situation in broadband access over cable modem access is limited to cable TV (CaTV) networks, which have 861,000 users, or about 11 percent of the population. About 2 percent of the population (151,000 subscribers) use cable modems for broadband Internet access. CaTV is available in all cities with more than 50,000 inhabitants, but only in 70 percent of cities with more than 5000 inhabitants. For rural areas the most optimistic estimate is that only 1/10 of rural settlements have cable television; few have broadband Internet cable modems, and most of these are in suburban areas and tourism areas. For example, the dominant Serbian cable operator, with more than 50 percent of all subscribers, has networks in 30 cities and broadband Internet in 21 cities. Rural areas are not covered; due to economic reasons, this is not likely to change.

With the above data in mind, it is obvious that special attention should be paid to the ICT development in rural areas in order to address the existing digital/broadband gaps lest they become deeper in the future. This will require the government to revise its strategy documents and introduce new investment methods (budget, funds, support for local initiatives, etc.) for ICT development in rural areas instead of generally declaring "economic sustainable market oriented methods." The role of the National Regulatory Agency is crucial in implementing enhanced universal service policy and following its progress.

Promoting Technical Leadership Expertise in Local Chapters: The Distinguished Lecturer Program Experience in North America

By Prof. Yigang Cai, DLT Coordinator, North American Region

One mission of the IEEE Communications Society (ComSoc) is to communicate with its members worldwide by bringing world class technical and management leadership expertise to local chapters. Currently ComSoc offers multiple unique programs for this goal: local chapter initiated lecture programs with local or visited technical speakers; the distinguished lecturer tour program with world recognized experts from academic communities and industry; as well as "virtual" lectures with speakers remotely presenting or recorded lectures offered to local chapters.

In 2009 ComSoc initiated a new distinguished speaker program. This new program aims to take advantage of presentations that leading industry experts and academic speakers make at other events like conferences, industry fora, and business meetings, and ask them to present them at local chapters during their trips. Such distinguished speaker presentations allow us to keep our chapters involved while ComSoc more effectively manages funds allocated to different lecture programs.

Over the years the Distinguished Lecturer Tour (DLT) program has played an important role in bringing technical and business issues to our members in the North America Region. ComSoc North America is the largest region worldwide with 90 local chapters, more than half of which participated in distinguished lecturer tours in 2009. We coordinated 10 distinguished lecturer tours in 2009 with 33 lectures brought to a total of 35 local chapters (see the table below).

As a coordinator of the North America Region DLT program, my job is to engage local chapters to tour among multiple geographically closed chapters. At the beginning of the year, I solicited input from all local chapters that were willing to host a DLT, and identified potential speakers and relevant technical areas. I also asked all distinguished lecturers worldwide whether they were interested in touring the North America Region with particularly interesting locations and topics to be offered to local chapters. I grouped multiple local chapters in one or two regions together with similar interests, and matched them with potential lecturers to create an itinerary for the tour. The interesting part of the coordination is balancing the interested speakers and topics among local chapters in

Tour #	DLs	Region	DLT Title	Date	Chapters
1	Tho Le-Ngoc, McGill University	4 and 5	Advances in Broadband Access Communications	4 May 5 May 6 May 7 May	Southern Minnesota Central Iowa St. Louis Denver
2	Tho Le-Ngoc, McGill University	6	Advances in Broadband Access Communications	18-May 19-May 20-May	Coastal Los Angeles Orange County San Diego
3	Michael Devetsikiotis, North Carolina State University	2	Next Generation Service-Oriented Networks: Modeling, Pricing and Optimization	16-May 18 May 20 May	Baltimore/Washington, DC/ Northern Virginia Pittsburg Columbus
4	Henning Schulzrinne, Columbia University	6	Next-Generation Emergency Calling (NG911)	9 Jun 10 Jun 11 Jun	San Francisco Santa Clara Valley Oregon
5	Prof. fred harris, San Diego State University	3	History of Radio	15 Jun 16 Jun 17 Jun 18 Jun	Coastal South Carolina Atlanta Orlando Jamaica
6	Dr. Bhumip Khasnabish, Verizon	7	Converged Services and a New Generation of Networking	9 Jul 13 Jul 15 Jul	Quebec Montreal Ottawa
7	Prof. Kishor Trivedi, Duke University	5	Performability Modelling of Wireless Communication Systems	17 Aug 18 Aug 19 Aug	New Orleans Central Texas Galveston Bay
8	Dr. Uday Desai, IIT, India	1	Multihop Mobile Wireless Communication	6 Oct 7 Oct 8 Oct	New Hampshire Maine Boston
9	Prof. Abbas Jamalipour, Sydney University	6 and 7	Broadband Mobile Communications	13 Oct 14 Oct 15 Oct	Vancouver Seattle Southern Alberta
10	Henning Schulzrinne, Columbia University	1	VoIP: Not Your Grandmother's Phone Any More VoIP over 802.11 Internet 2.0: Hype or Hope VoIP over 802.11	21 Sep 1 Oct 8 Oct 5 Nov	New Jersey Coast New York North Jersey Long Island

Distinguished Lecturer Program

(Continued from previous page)

the tours, and keeping costs to a minimum. To achieve this, I communicated with local chapter leaders as single points of contact. I worked out timeframes and itineraries with local chapters and lecturers, and finalized speech topics and budget. I try to balance the yearly tours within the overall ComSoc budget but covering all seven regions of North America. I worked with local chapters to best utilize the DLT program to combine the lecture with local IEEE, ComSoc, and sister society activities. In the Greater Washington, DC area three local chapters (Baltimore, Washington, DC, and Northern Virginia) coordinated the lecture of Professor Michael Devetsikiotis of North Carolina State University in one location. It not only saved expenses, but also strengthened ties among the three chapters and their members. I also arrange tours for distinguished lecturers from outside the North America region, for example, Professor Abbas Jamalipour of Sydney University, Australia, and Professor Uday Desai of the Indian Institute of Technology from the Asia/Pacific region. A tour of the New York and New Jersey chapters was arranged for Professor Henning Schulzrinne of Columbia University, in which only car or public transportation was needed for him to reach local chapters.

It was recognized by chapters the hosted DLT in 2009 that all distinguished lecturers are excellent speakers. The Maine chapter wrote a thank email to Dr. Uday Desai for his excellent presentation and emphasized that they normally do not get as large a crowd, but his talk was exciting enough to attract undergrads and grad students as well as faculty and engineers. The Ottawa chapter wrote a thank email to Dr. Bhumip Khasnabish for giving a wonderful and informative presentation on the very dynamic topic "Converged Services and NGN." Chapter chair Wahab Almuhtadi got much feedback from attendees expressing their satisfaction with the presentation, and the lecturer's dynamic engagement and open discussion with the audience.

ComSoc president Dr. Douglas Zuckerman and Membership Development Director Dr. Shri Goyal presented the service award to North America Region DLT coordinator Dr. Yigang Cai at the IEEE IM2009/North America Region East RCCC meeting in Long Island, NY, June 4, 2009.

The New Jersey Coast chapter appreciated Professor Henning Schulzrinne's presentation, which attracted local professionals who might be considering joining IEEE.

Overall, ComSoc's North American Region conducted a successful Distinguished Lecture Tour program in 2009, and benefited local chapters and members. The Region will engage local chapters, and continue the effort to promote a variety of lecture tours and speaker programs in 2010 in more cost saving and efficient ways.

ComSoc Portuguese Chapter: 2009 Activities

Luis M. Correia, Instituto Superior Técnico, Technical University of Lisbon, Portugal

In 2009 the ComSoc Portuguese Chapter continued the activities of organising seminars jointly with IST — Technical University of Lisbon (taking advantage of this university's initiatives) and providing, through its website (http://chapters.comsoc.org/Portugal), a permanent list of conferences in the communications area, allowing an improvement of the information flow among the Portuguese technical and scientific community working in the area.

On 17 March, a seminar on "Future Internet" was held with three speakers: João S. da Silva (Director, Directorate for Convergent Networks and Services, European Commission) addressed "The Future Internet — Opportunities for Europe"; Prof. Luis M. Correia (IST — Technical University of Lisbon) addressed "A Perspective into the Internet of the Future"; and Guilherme Alves (Product Manager, Ericsson) addressed "The Evolution of Broadband in Telecommunications Networks." The seminar was attended by more than 120 people.

Individual talks were also held: "Cisco Self-Defence Networks," Pedro Fernandes and João Custódio (System Engineers, Cisco), 14 April; "Mobile Phones on Board," Gonçalo Carpinteiro (Specialist Engineer, TAP Maintenance and Engineering), 12 May; "Evolution towards UMTS HSPA+", Marco Serrazina (Network Engineer, Vodafone), Dec. 15th.

Another seminar, on June 5th, on Mobile Communications was organised, essentially aiming at students about to graduate, but open to industry as well. Speakers came from industry (TMN, Vodafone, and Motorola): João Ramos, Alexandre Coelho, and Pedro Tareco; as well as the Portuguese Telecommunications Regulator (Anacom), Miguel Henriques, giving a perspective on the foreseen evolution of technology and services for mobile and wireless communications. The event was well attended by more than 60 people, the majority students.

Lisbon was also the host for a Distinguished Lecturer Tour, on 8 June, by Prof. Anthony Ephremides (University of Maryland, College Park, United States), who gave a talk on "Cooperation at the Network Level." Additionally, two other foreign colleagues gave talks as well: on 26 June Prof. Gabriel Maciá Fernández (University of Granada, Spain) talked about "Mobile Networks: Traffic Scenarios Explained," and on 6 July Prof. Behnaam Aazhang (Rice University, Houston, Texas, United States; CWC/University of Oulu, Finland) addressed "Context Aware Wireless Networks: A Physical Layer Perspective."

The average attendance of these talks was around 50 people. During 2010, the ComSoc Portuguese Chapter is continuing to pursue the same objectives: participation in Distinguished Lecturer Tours and the organizzation of seminars on a monthly basis with speakers from industry and academia.

10 Years of the IEEE Colombian ComSoc Chapter

By Carlos Andrés Lozano Garzón, Chair, Colombian ComSoc Chapter Universidad de San Buenaventura, and Jose David Cely Callejas, ComSoc LA Director, Universidad Distrital Francisco José de Caldas, Colombia

In Colombia the field of telecommunications is one of the fastest growing industries and therefore one of the greatest economic contributions to the country. Because of this, the number of professional engineers working in this area has been increasing. Given this context, the Colombian Communications Society Chapter in the last 10 years has sought to establish itself as a coordinatior between business, academia, and government through the different initiatives promoted by it.

Abbas Jamalipour (left) and Stefano Bregni (right), keynote speakers at IEEE LATINCOM 2009, Medellín.

Thanks to the visit of Roberto De Marca and Steven Wenstein in 1998, the idea to establish a chapter of the society in Colombia between members and students was planted. In fact, the first step was the formation of a Student Branch Chapter of Communications Society at Universidad Distrital Francisco José de Caldas. In 1999, after the visit of Celia Desmond, the members undertook to consolidate the group and send the application form for formation of the Society chapter. At the end of 2000 the approval letter for the chapter was received. Some of the members who signed the application were Leonor Wilches, Aldo Forero, Alfonso Lombana, Renato Cespedes, Mario Castaño, Andres Lombo, Alexander Amaya, and Jose David Cely, among others.

Today the chapter comprises nearly 500 professional and student members, and has 10 student chapters formed and many others under construction in the major universities of the country.

Several speakers from all corners of the world, including speakers from the Distinguished Lecturers program of the Society, have visited such cities as Bogota, Cali, Popayan, Medellin, Bucaramanga, Barranquilla, and Cartagena. During this time Roberto Saracco, Hikmet Sari, Stefano Bregni, Gabriel Jakobson, Vijay Bhargava, Lajos Hanzo, Abbas Jamalipour, Mehmet Ulema, and Andrea Goldsmith, as well speakers visitors from Campinas University (Brazil), including Nelson Fonseca and Fabio Verdi, Yang Xiao from Alabama University, Anna Scaglione from the University of California, Davis, and Miguel Labrador from South Florida University, shared their knowledge with members and inspired us to improve the profession.

But the chapter has not only focused on bringing international speakers; it is also dedicated to developing the country's professionals in the field so that they too will be distinguished lecturers. Through the Days of Communications done in conjunction with the student chapters of the society in the country, there is a small group of national speakers who support the work of the chapter.

In 2007 the Chapter started a new challenge as it organized the first version of the Colombian Communication Conference, COLCOM 2007, held in September of that year in Bogota. This conference was a successful activity at a good technical level and with many attendees. The second 2008 version was in Popayan, Cauca, focused on stimulating, promoting, and spreading the development of the management, technological, normative, and regulatory knowledge of communications in Colombia. Its technical program allowed the academic and industrial community to show their advances in research and improvement; it also opened a space for discussion about the impact of communications in our community. In 2009 the Chapter sponsored the first IEEE Latin American Conference on Communications, LATINCOM 2009, which was held in the friendly and warm city of Medellin.

Receiving the award for Best Chapter in the Latin American Region at GLOBECOM 2008, New Orleans, Louisiana, United States.

The Colombian ComSoc student community is very active and enthusiastic; they are the work force for all activities, not only as logistic volunteers, but as organizers and promoters for all professionals and professors. In this way the volunteers promote the participation of young people's involvement in all activities.

It is important to note that in recent years the chapter has won the Best Chapter in the LA Region in 2003, 2006, and 2008, and Best Chapter in the World in 2006. These awards have encouraged the continued work of the volunteer group.

Ten years of continuous work have enabled us to position the chapter in our country and our region. Our work continues, and this year we are organizing the second IEEE LATINCOM in Bogotá on 14–17 September. We look forward to your participation. For more information please consult http://chapters.comsoc.org/colombia/latincom/

A Report on European Wireless 2010

By Luciano Lenzini and Marco Luise, University of Pisa, Italy,
Albert Banchs, University Carlos III of Madrid and IMDEA, Spain
and Christoph Mecklenbräuker, Technical University of Wien, Austria

The 16th European Wireless Conference, technically co-sponsored by IEEE ComSoc, took place in Lucca, Italy, in April 2010, hosted by the IMT Institute for Advanced Studies (http://www.imtlucca.it/), a post-graduate school recently founded in Lucca. European Wireless is a long established conference that focuses on research and development related to the current and next generations of wireless and mobile networks. It was first set up in 1998 as a European conference, and very quickly grew to international fame.

One of the key objectives of research in wireless communications, and notably the main one in fourth-generation cellular/mobile networks, is full integration of wireless segments into the all-IP pervasive and ubiquitous network of the future, regardless of the nature (wired or wireless) of the physical media. Along this context, the 2010 edition of the conference revolved around the main theme of "Towards the Future Internet."

To achieve the above objective, the conference featured a total of 12 sessions comprising a wide set of topics in wireless networking ranging from physical layer aspects up to the networking layer. In addition, the conference program also included three keynote speeches from leading researchers in the field as well as a panel with very strong industry participation.

The first keynote speech was given by Sajal Das, program director at NSF. Sajal's talked focused on wireless sensor networks, and the challenge that the scarcity of resources, the high degree of uncertainty, and the distributed operations and control pose in these networks. He examined unique uncertainty-driven research challenges and some novel solutions for information-intensive (multimedia) wireless sensor networks in the areas of data quality, aggregation/fusion, dissemination, routing, coverage and connectivity, trust, security, and privacy. He concluded his talk by pointing out some future directions of research.

Andrea Goldsmith, from Stanford University, gave the second keynote speech of the conference. Her talk focused on the next generation of high-performance wireless networks and the requirements for new paradigms on extreme energy efficiency and/or reliability. She explained the breakthroughs required in wireless component and system design, as well as cross-layer optimization between applications and their underlying networks. These design challenges were described along with recent innovations in wireless technology.

The third keynote speech was by Michele Zorzi from the University of Padova. Michele's talk focused on underwater acoustic networking research. He exposed the fundamental differences between underwater acoustic propagation and terrestrial radio propagation, which call for new criteria for the design of communications systems and networking protocols. In his talk he gave an overview of the main challenges posed by the underwater acoustic propagation environment, with special emphasis on networking and protocol design issues, and provided novel insights that are useful in guiding both protocol design and network deployment.

The conference panel focused on the future of IMT-A-based technologies, which are expected to become one of the central components of future wireless networks. It was chaired by Prof. Bernhard Walke, from RWTH Aachen University, and a number of leading experts from industry and academy were invited as panelists. Andrea Goldsmith highlighted some recent advances in multiple-input multiple-output (MIMO)-orthogonal frequency-division multiplexed (OFDM) multiuser communications that will serve as crucial building blocks in supporting the requirements of IMT-A. Zhongrog Liu, from Deutsche Telekom, focused on the requirements from the operators. Claudio Cicconetti, from INTECS SpA, discussed the strengths, weaknesses, opportunities, and threads of 802.16m. Matti Kiiski, from Nokia Siemens Networks, described the main performance enhancements of LTE-A as well as the implementation constraints and overheads. Vieri Vanghi, from QUALCOMM, highlighted the fact that a performance leap in wireless networks will come from network topology, and that LTE-A is about improving spectral efficiency per unit area. Last but not least, Michael Meyer from Ericsson presented some measurement results and gave an outlook on the LTE advanced features.

European Wireless panel. From left to right: Bernhard Walke, Michael Meyer, Matti Kiiski, Andrea Goldsmith, Vieri Vanghi, Claudio Cicconetti, and Zhongrog Liu.

In addition to the regular oral sessions, the conference also included a number of invited sessions that focused on specifically relevant and novel topics in a particular area. The topics of the invited sessions included areas such as opportunistic networks, green communications, mesh networks, and cognitive radio, among others. By grouping a set of well-known experts in each of these topics, the special sessions greatly contributed to the success of the conference.

We hope that the European Wireless conference has fulfilled the expectations of the participants. The success of this conference relied on the work and commitment of the speakers and panelists, who gave high-quality presentations, as well as the participation of the attendees, who triggered many lively discussions. The full program of the conference is available at http://www.europeanwireless2010.org/, and the presented papers are included in the IEEExplore database.

Fixed Communications in the Republic of Serbia Are Entering Competition

By Milan Jankovic, Executive Director, Republic Telecomunication Agency, Serbia

Commitment of the Republic of Serbia to become a member of the European Union directs it to adhere to a reform agenda called "Employment, Economic Reform and Social Cohesion — Towards a Europe of Innovation and Knowledge," which defines three key elements:

1. Creation of a single European information space, by encouraging the development of broadband access and the development of new multimedia contents
2. Strengthening innovation and investment in the further development of information and communication technologies
3. Increasing availability and possibility of using information and communication technologies in all regions of the European Union

	2005	2006	2007	2008
Number of users	2,527,300	2,719,400	2,854,550	3,084,872
Penetration (%)	33.70	36.30	38.01	41.14
Digitalization rate (%)	83.60	88.60	93.31	95.52
Revenue from telephone services (millions)	370	426	414.10	413.00
Investments (millions)	83.90	62.50	165.90	64.70

The basic indicators of fixed telephone network development in the 2005–2008 period in the Republic of Serbia.

The total revenues from telecommunications services in the Republic of Serbia in 2007 amounted to €1.47 billion, and €1.61 billion in 2008, whereas telecommunications' share in the total gross domestic product (GDP) incresed from 4.7 percent in 2007 to 4.87 percent in 2008. Total revenues from fixed telephony traffic services in the Republic of Serbia in 2008 amounted to €413 milion, which is about 2 percent lower than €414.1 milion in the previous year. However, what was worrying was the fact that the investments made in fixed telephony in 2008 amounted to €64.7 million which was a decrease of 44 percent from 2007. Decrease in investments in fixed networks affects the development of all telecomminications, since fixed networks may be used for transferring other services as well, such as mobile services and Internet. The number of unmet requests for new fixed-line connections, which amounts to over 150,000, poses an additional problem. Table 1 illustrates the basic indicators of fixed telephone network development in the 2005–2008 period in the Republic od Serbia.

The Internet market, in particular broadband Internet, is a rather important aspect of Serbian society too. According to various studies on the relation between broadband Internet and the gross domestic product (GDP) carried out in recent years worldwide, an increase in the number of broadband connections has a direct impact on the increase in GDP. Broadband telecommunications represents the basis for the provision of services that contribute to societal development as they increase the availability of public administration services for the population, influence learning processes, provide faster and quality enhanced services in the field of medicine, facilitate trade and e-commerce, and encourage the development of rural and distant areas. The Internet can also contribute to CO_2 emission control and positively address the issues related to climate change by enabling people to work from their homes and thereby decrease the volume of traffic, which is, once again, an important prospect for the developing country.

From 2005 onward, there have been significant changes in the Internet market in the Republic of Serbia, in particular in the structure of the end users' Internet connections and the amount of revenues generated by Internet services. In 2008 the number of broadband connections exceeded that of dial-up for the first time, although if the access is observed by different technologies, dial-up is still the most common technology. However, the decrease in dial-up connections in the past years indicates the growing needs of users for easily accessible contents of a higher quality offered by broadband access. This is further confirmed by the fact that the number of broadband connections in Serbia reached 490,000 in 2008 (55 percent of the total number of Internet connections), twice as many as in 2007. The most common broadband access is ADSL, and the whole infrastructure for the access to the end user is owned by Telekom Srbija. In addition to technologies mentioned above, Internet connection can be enabled through cable modem or a network developed and built by cable operators, through wireless using the licence free frequency bands around 2.4 GHz and 5.8 GHz, through UMTS (3G) mobile operators' networks, or through code-division multiple access (CDMA) technology.

However, if 3G mobile network subscribers are excluded from the total number of broadband subscribers, broadband penetration amounts to 6.57 percent, which is still below the average in both Southeast Europe of 7.74 percent, and the European Union (EU27) of 22.9 percent.

Strategy for the development of broadband access in the Republic of Serbia by 2012 defines the strategic aim to be realized by that year: achieving broadband penetration (bit rates not lower than 4 Mb/s for fixed networks and 512 kb/s for mobile networks) of at least 20 percent of the population, or 1,200,000 subscribers.

Having in mind the existence of only one operator in the fixed communications market, decrease in investments in networks and services, as well as the digital divide between urban and rural areas, the procedure for the issuance of the second license for public fixed telecommunications networks and services was accelerated. Only one company, Telenor of Norway, submitted a valid offer in time and offered €1,050,000.00 for the one-off second fixed operator license issuance fee. On 22 January 2010, RATEL made a decision to grant the licence to Telenor, which marked the end of the bidding procedure. The license is issued for a period of 10 years with the possibility of renewal for an additional 10 years. The new operator has to launch commercial services within one year from the day they were granted the license.

Thus, Serbian fixed communications have entered the competition phase. Services to be offered to end users should be packages (voice, date, video, mobile) that require broadband access. The new operator in the fixed line business is committed to heavily invest in the infrastructure, €100 milion within five years in order to cover 80 percent of population and compete with the incumbent. Market competition launched by the new entrant for end users will result in new opportunities (carrier selection, etc.), better quality of services, and lower prices.

Wireless Internet for Rural Schools in Quindío, Colombia

By Diego J. Castiblanco Rey, Jessica A. Buriticá Cortés, Camilo H. Gómez Castro,
IEEE ComSoc Student Chapter of Universidad de los Andes, Bogota, Colombia

This article summarizes the work executed by an international coalition between student groups from Colombia and Spain with an awareness of the need of third-world countries for a functional communication infrastructure, as a means for improving education quality, and hence providing underprivileged children with new opportunities for growth. The coalition consisted of students from the IEEE ComSoc Student Chapter of Universidad de los Andes,[1] Bogota, Colombia, and AUCOOP[2] from Universidad Politècnica de Catalunya (UPC), Barcelona, Spain. The project was financially supported by the Department of Electrical and Electronics Engineering of Universidad de los Andes and by the Center for Cooperation and Development of UPC.

The main objective of the project is to provide Internet service to a set of schools located in a rural zone (Quimbaya, Quindío, Colombia) with steep terrain and dense vegetation which makes it difficult to carry a signal from a distant source. These conditions led to the selection of three schools from an initial target of five due to time and budget restrictions, for the installation of multiple intermediate points was required to avoid natural obstacles.

The first stage of the project was recognizing the geographical conditions in the zone where the network had to be installed in order to find a feasible solution. After a thorough exploration of the rural zone, two points were chosen because of their height and proximity to the initial and end nodes, La Frontera and Trocadero, as shown in Fig. 1. Toward carrying the signal to the terminal points, a specific telematic design was proposed. The design starts with a router acting as an access point (with an Internet connection provided by Quimbaya City Hall), and its generated traffic is spread through a net of nodes configured as repeaters, which allow the signal to arrive at all its destinations by handling the steepness of the terrain.

In order to achieve a reliable network with the best signal-to-noise ratio (SNR), a telecommunications tower and several masts had to be designed and installed. The first mast was installed in Trocadero with the purpose of repeating the Internet signal provided by City Hall toward La Frontera, from where the signal is carried to its final destination. Other masts were installed in each of the schools with the aim of improving signal acquisition. Finally, the telecommunications tower had to be installed in La Frontera to minimize the loss of SNR caused by the dense vegetation of the zone. To conclude, antennas were installed in every school, where routers were also placed to assign IP addresses to the LAN, and a series of tests were performed to check connectivity, upload and download speeds, point-to-point signal power, and transmission and reception speeds.

FIGURE 1. *Geographical representation of the network problem (Quimbaya, Quindío, Colombia).*

FIGURE 2. *Staff group of the RedQuimbaya project (members of the IEEE ComSoc Student Chapter of Universidad de los Andes and AUCOOP, Spain). From left to right: Albert Llongueras, Alvaro García, Saúl García, Camilo Motta, Diego Castiblanco, Jessica Buriticá, Camilo Gómez, Daniel Castiblanco, and Daniel Abia.*

As a result of the social awareness of student groups such as the IEEE and AUCOOP members, and their cooperative work, three schools benefited by obtaining the Internet source from the nearest town, 2.36 km from the first location, and utilizing two intermediate nodes between schools to finally form a six-node network. As a final result, about 300 children are now enabled to access information available in the Internet, enhancing their education. The project is expected to continue, with the goal of providing maintenance and extending the benefits to other communities. Projects like this represent opportunities for engineering students to apply technical solutions in real contexts and to make a contribution to general interest social issues.

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First Edition of Thai Telecommunications Encyclopedia

By Kamol Kaemarungsi and Keattisak Sripimanwat, Thailand Chapter Chair
National Electronics and Computer Technology Center (NECTEC), Thailand

On November 27, 2009, the first edition of *Thai Telecommunications Encyclopedia* (*TTE*) was officially revealed to the public at the Rama Garden Hotel in Bangkok, Thailand. The ceremony was held during the event celebrating the 125th anniversary of IEEE which was arranged by IEEE Thailand Section on 26 and 27 November, 2009. This telecommunications encyclopedia is the first of its kind for Thailand, which is a completely free version in the Thai language (with an English abstract). The main objective of this encyclopedia is to promote better understanding of engineering and technology in various fields of telecommunications for Thai society. This easy access knowledge body will be a major source of study, research, and reference. The implication of such an encyclopedia will certainly strengthen the ongoing development of human resource and advancement of the country.

The creation of this encyclopedia was originated by a group of Thai electrical engineering professionals in 2002. Eventually, this first edition is a result of expansive collaboration among many contributors such as academic lecturers, researchers, students, and practical engineers from the industry who are experts or actively involved in telecommunications engineering. In particular, the editorial team laboriously took over a year to collect, revise, edit, perform artwork, and put together all important historical and contemporary materials to create this telecommunications knowledge portal. In this first phase it was created in three formats: a web site, an e-book on DVD, and a hardcover book.

FIGURE 1. *Illustration of the hard cover version.*

Currently, the book spans 848 pages in which it contains 86 chapters including more than 500 glossaries, 300 illustrations, 40 tables, and bibliographic entries. The materials cover history, developmen,t and basic concepts of major telecommunication technologies. Each chapter is presented in a less rigorous format in order to be easily accessible by readers with minimum backgrounds and begins with a relevant glossary for each chapter. Basically, each chapter leads the reader through a foundation in the technical aspects of technology, the development of technology, and the explanation of applications or related standards. Most chapters also contain relevant milestones of particular technology. The book is divided into three volumes on general topics in telecommunications, the fundamentals of telecommunication science, and telecommunication technologies.

FIGURE 2. *Part of editorial and managing team in Thai IEEE 125th anniversary.*

This encyclopedia was organized and published by Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology association (ECTI) of Thailand. It was co-sponsored by NECTEC and the National Telecommunications Commission (NTC). Finally, the IEEE Thailand Section provided the technical and other necessary support for this work. Majority of the book & DVD versions have been freely distributed to libraries in schools and academic institutes around the country. The online version is also accessible at www.ecti.or.th/TTE. In 2010 which is the beginning of the second phase, the editorial team is planning to create a new edition of online encyclopedia using Web 2.0 technologies and expand the material to cover even more telecommunications technologies and much more history of Thai Telecommunications.

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