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IEEE WCNC 2009 Explores Newest Advances in Wireless Communications and Cooperative Systems

By Heather Ann Sweeney, IEEE ComSoc, New York, and Lajos Hanzo, Univ. of Southampton, U.K.

Nearly 600 industry professionals, academics, and government officials joined the IEEE Wireless Communications & Networking Conference (WCNC) in April to explore the latest advancements in wireless cellular communications and cooperative systems. In all, more than 550 technical papers, sessions, panels, and keynotes highlighted the future of wireless communications, systems, and applications as well as the newest technologies, applications, market trends, and business implications.

At the invitation of WCNC 2009 General Chair Lajos Hanzo of the University of Southampton, the four-day event held in Budapest, Hungary, officially commenced with an opening salutation from IEEE President John Vig. Citing "the huge momentum in contributions," Vig thanked the Society's worldwide fellowship of members, volunteers, and strategic network of partners, including IEEE Press and Wiley publishers, for their ongoing support, which over the past 57 years helped to make IEEE ComSoc one of the world's foremost technical communications organizations.

Later that evening, John Vig, an IEEE Life Fellow and an active IEEE participant for the past 30 years, joined the Green Radio panel discussion, which was convened and moderated by Lajos Hanzo. The panel included distinguished British Professors Aghvami and McLaughlin as well as Dr. Hoshyar, who collaborate under the recent Green Radio initiative of the United Kingdom's Virtual Centre of Excellence (VCE), also funded by the Engineering and Physical Sciences Research Council (EPSRC). To elaborate a little further, they focused their message on the environmental footprint of digital communication and the development of power-efficient "green" radio systems derived from greener manufacturing and environmentally friendly system architectures.

The second day of the conference included another panel discussion convened by Prof. Kin Leung of the Imperial College of London, N. K. Shankaranarayanan of AT&T Labs-Research, Ross Murch of Hong Kong University of Science and Technology, Victor C. M. Leung of the University of British Columbia, Du Yinggang of Huawei Tehcnologies, and Sam Samuel of Alcatel-Lucent, who addressed the world's continual migration toward an IP-based broadband network. As expected, each panelist elaborated on the increasing demand for seamless global wireless networks and services. In addition to the overall expansion in the number of users, many spoke of the next wave of technologies that are likely to include a new array of multipurpose mobile computing and communications devices supporting multiple wireless standards, higher bit rates, application transparency, and even sliding keyboards and keypads for greater convenience. Also discussed was the advent of license-free wireless networks, which will also play an ongoing role in the continued interconnectivity of the home and workplace, multimedia entertainment, security, healthcare, and numerous other devices and systems.

Throughout the event, numerous senior-level speakers then punctuated the conference agenda with presentations dedicated to advances in wireless technologies worldwide. Andrea Goldsmith, professor of electrical engineering at Stanford University, delivered one of the morning keynotes on "The Next Wave in Wireless Technology: Challenges and Solutions."

During her address, Prof. Goldsmith emphasized the "exponential worldwide growth enjoyed by the wireless communications industry" over the past few decades and "the role of next-generation, high-performance wireless networks, which must be designed to support significant increases in data rates, coverage, spectral and energy efficiencies, reliability with the aid of new networking paradigms." According to her, "The next wave of wireless technology is upon us. Wireless communication systems are increasingly expected to deliver higher data rates (gigabits per second) with low latency and reliable coverage in both indoor and outdoor environments while supporting new services.

"But, there are numerous challenges ranging from the size and cost of devices to the management of interferences at the system level. As a result, we must make more efficient use of the wireless spectrum and create an innovative vision, which treats interference as a friend that can be exploited through cooperation, cognition and cross-layer protocol designs, including sophisticated relay strategies."

Continuing the theme, Gerhard Fettweis, Vodafone Chair at the Technical University of Dresden, then commented on the "Current Frontiers in Wireless Communications: Fast and Green and Dirty," while addressing the future's hottest research challenges. This includes "enabling high cellular data rates with increased spectral efficiency and fairness," "overcoming analog impairments with the aid of sophisticated RF design" and tackling "the challenges of designing 'green radio.'"

"Yesterday, we believed the cellular phone would be the "black hole" of integration, encompassing all wireless standards, allowing communication over an increasing number of air interfaces," stated Fettweis. "Today we see that we were

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Analysis of a Challenge: The Migration to DVB-T in the Northwest of Spain

By Ana Vazquez Alejos, Manuel Garcia Sanchez, and Iñigo Cuiñas, University of Vigo, Spain

The evolution of digital video broadcast terrestrial (DVB-T) has been endorsed mainly by the eagerness to foment the Information Society (IS). DVB-T can be a support for the development of the IS once it facilitates access to a large number of interactive services from homes, which is why it has a large potential to introduce a very important part of the population to IS who now are without this opportunity.

One would never think of Galicia as the ideal scenario to deploy a single-frequency network (SFN). But the advantages offered by the DVB-T to bring many of the rural villages and towns the benefits of the IS impelled its introduction despite the technical difficulties.

The special orography of this region located in the northwest of Spain is full of valleys and mountains, as well as windmill installations, all of which make the deployment of a line-of-sight (LOS) targeted digital network a challenge for radio engineers. We have to add broad demographic dispersion and an important number of population centers. This accidental terrain shortens the horizon distance, so the use of micro-repeaters and gap-fillers is absolutely required to ensure coverage in the entire region at a high percentage level. The use of micro-repeaters and gap-fillers constitutes a trade-off between the reduction of expenditure costs and the effects the equipment introduces on network capabilities.

The immediate effect of introducing a gap-filler is the addition of a time delay that becomes non-negligible when several units of this equipment are concatenated. Then the use of GPS synchronized gap-fillers turns into an essential requirement to preserve the guard time interval. No less important is the feedback of the temporal fading that produces critical degradation of the retransmitted signal. Other undesired effects of the use of this type of deviceare the coupling between receiver and transmitter antennas, and the limitation of the maximum power they can manage, which leads to combining several of them to fill a coverage gap.

By the way, the proximity of the sea also affects network planning due to fading, and we cannot forget that Galicia has an extensive coastal area where the most populated cities are located.

In the past, controversy among engineers and authorities on the massive use of gap-fillers led to considering the use of a multifrequency network (MFN) as a solution to provide coverage with the removal of a significant amount of the proposed micro-repeaters and gap-fillers; a solution was even proposed to use gap-fillers re-emitting in a different frequency that corresponds to the incoming signal. Finally, after a period of debates and technical consulting, these solutions were discarded, and the efforts were oriented to improving the network planning strategies, but also the technology of the gap-fillers and micro-repeaters to minimize the additional impairments introduced. Local electronics companies have developed a new generation of specialized equipment dedicated to DVB-T deployment with large worldwide diffusion.

Different mechanisms have been articulated by the administration and authorities to ensure a smooth and reliable transition from analog to digital TV before the deadline established in Spain of 10 April, 2010, the worldwide "analog blackout" when analog TV signals go off the air. One of the more remarkable concerned efforts carried out up to now by the regional authorities has been the creation of a website [1] to show the population the advances in the deployment of the DVB-T network.

Another front of effort consisted of creating "planning models" for the gap-filler installation to be used by installers in order to ensure the quality of the installations. The government of Spain has also elaborated different technical documents providing, among other things, a gap-filler classification: professional gap-fillers (equipped with anti-echo capability and installed by broadcasters, sometimes subsidized by administration) and private/domestic gap-fillers (contracted by small user communities from local installers).

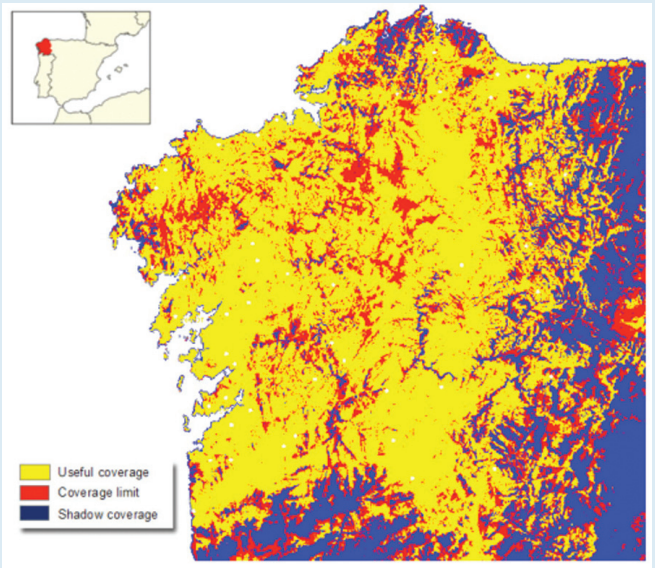

Figure 1. *Plan of DVB-T coverage in Galicia.*

Despite the large number of emitters (51) and micro-repeaters (40) already installed and in operation, ensuring a more than acceptable coverage level of 93 percent (Fig. 1), the quality offered up to now by broadcast providers is not satisfactory and not equal to the conditions (interruption of emission, bad signal quality, sound only in stereo format, etc.). These facts have engendered distrust in end users, so different online awareness campaigns [2] have been designed as the last step to culminate the process, preparing viewers for a smooth switchover.

Different regional governments in Spain have approved orders to subsidize the acquisition of DVB-T satellite decoders for those areas that will remain without TV broadcast services due to the switchover, so the residents in "shadow areas" (1.5–9 percent) can receive the DVB-T signal via satellite — but not currently in Galicia. The required receivers are likely to cost about €130 for familiar households and €300 for communities. We have to mention that one of these decoders is fabricated by an electronics company located in Galicia.

After a long road full of obstacles, the migration to DVB-T in Galicia passed the first phase (July 2009), although with some objectives postponed for the next phase (December 2009). A deadline date extension for the total switchover is not expected. Some studies show that DVB-T penetration in Spain is around 66 percent, superior to the European average of 48 percent [2]. In any case, it will be necessary to take measures to surpass the limitations of the present DVB-T network: lack of processing capacity of the decoders, and limited interactivity compared to other digital communication media due to the weakness of the return channel.

Once the DVB-T network is optimized, the next step consists of extending it to offer broadcasting of DVB-H signals. However, we will discuss that in a future article.

References

[1] http://www.tdtgalicia.es
[2] http://www.impulsatdt.es

A Brief History of Communications Translated into Thai

By Poompat Saengudomlert and Keattisak Sripimanwat, Thailand

The Thai version of *A Brief History of Communications: IEEE Communications Society — A Fifty Year Foundation for the Future* was successfully translated, published, and distributed. The original book, written in English, was published in 2002 by the IEEE Communications Society.

A Brief History of Communications presents a brief history of important events such as the development of the telegraph, telephone, long distance communications, radar, satellite, and wireless communication systems. In addition, the book contains the creation of IEEE ComSoc and interviews with respected figures in the communications sector together with fragments of discoveries and important work of these people. It also includes important events in communication technologies in the form of an archive.

Cover of the Thai version of A Brief History of Communications: IEEE Communications Society — A Fifty Year Foundation for the Future.

The translation of *A Brief History of Communications* was initiated as an effort to celebrate the 30th anniversary of the IEEE Thailand Section in 2007. The efforts were supported by several Thai government agencies and private companies such as Aeronautical Radio of Thailand (AEROTHAI), Asian Institute of Technology (AIT), DTAC, Electricity Generation Authority of Thailand (EGAT), Institute for the Promotion of Teaching Science and Technology (IPST), Loxley, Metropolitan Electricity Authority (MEA), National Electronics and Computer Technology Center (NECTEC), National Science and Technology Development Agency (NSTDA), National Telecommunication Commission (NTC), Provincial Electricity Authority (PEA), Samart Telcoms, and Thailoil. The translation was done by Ms. Nattira Sukprasert (NECTEC/NSTDA), Dr. Alisa Kongthon (NECTEC/NSTDA), and Dr. Poompat Saengudomlert (AIT), with Dr. Keattisak Sripimanwat (NECTEC/NSTDA) as Editor.

During the handover ceremony of the Thai version of *A Brief History of Communications*, organized by NECTEC back

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Attendees at the handover ceremony.

Report of the 16th International Conference onTelecommunications

By Luis M. Correia, ICT 2009 TPC Chair, Lisboa Instituto de Telecomunicações, Portugal

The 16th ICT — International Conference on Telecommunications, http://www.ict09.org, was held on 25–27 May, 2009, in the city of Marrakech, Morocco.

In the past few years, there has been growing interest in integrating standalone wireless networks with infrastructured ones to create more adaptable and robust communications systems. Moreover, the world of telecommunications is continuously adopting new Internet technologies, and there has been a trend toward decentralized and self-organizing network architectures. Furthermore, security of communications systems is becoming of paramount importance in these contexts. The Technical Programme of ICT 2009 has reflected such trends.

The opening session had two keynote speakers. The first was Dr. Taieb Debbagh, Secretary General of the Moroccan Ministry of Industry, Trade and New Technologies; he addressed the Moroccan strategic plan for Information and Communication Technologies for 2009–2013, as well as the current status. The second was Dr. Mike Walker, Director of Vodafone Group R&D, United Kingdom (he could not attend due to unforeseen problems, and was replaced by Prof. Rahim Tafazolli, University of Surrey, Guildford, United Kingdom); the talk described the emergence of wireless broadband technology with emphasis on the potential ubiquity of Long Term Evolution (LTE), and presented recent results of the performance of the technology from a user perspective as measured in precommercial field trials.

Additionally, there were four invited speakers who addressed various aspects of mobile and wireless communications in a dedicated session: Prof. Hikmet Sari (SUPELEC, Paris, France) gave a talk on "MIMO Techniques and Full Frequency Reuse in Mobile WiMAX Systems"; Prof. Kaveh Pahlavan (Centre for Wireless Information Network Studies/Worcester Polytechnic Institute, United States) addressed "Location Awareness for Everyday Smart Computing"; Prof. Matti Latva-aho (Centre for Wireless Communications/University of Oulu, Finland) talked about "Challenges in Future Broadband Radio Access, Cooperative Communications and Self-Organizing Networks"; and finally, Prof. Hamid Harroud (Al Akhawayn University, Ifrane, Morocco) presented "Context-Based Services Discovery in Mobile

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wrong: for example, DVB-enabled phones have only a modest market share, and UWB is currently out. A better insight into the factors deciding the success or failure of the diverse solutions is needed. The 'wireless roadmap' of the past gives us researchers valuable input towards understanding what sort of solutions will be needed in the future as well as the challenges that will no doubt keep future generations of researchers busy."

In addition to the keynotes, IEEE WCNC featured another high-end panel discussion on "Autonomics for the Future Internet." During this panel, academics and researchers debated the evolution of a Self-NET designed and developed from a network of cognitive self-managed elements to create a trusted self-governed future Internet offering enhanced computing capabilities and other beneficial properties.

Other significant presentations were offered through the conference's exemplary tutorial program, which focused heavily on cooperative communications and new technologies that are increasingly enabling the seamless transmission and collection of complex data and information from nearly any location at any time. This included detailed reviews of game theory, cooperative multiple-input multiple-output (MIMO), cooperative localization and channel modeling for mobile-to-mobile networks, and more.

As for next year's event, to be held in Sydney, Australia, from 18 to 21 April, 2010, IEEE WCNC 2010 General Chair Abbas Jamalipour of the University of Sydney began the recruitment process in Budapest with a brief presentation highlighting the scenic beauty of Darling Harbour and the many international pubs, restaurants, hotels, entertainments, and tourist attractions awaiting 2010 attendees. For more information on potential topics and paper submission guidelines, interested parties are urged to visit www.ieee-wcnc.org/wcnc. The IEEE WCNC 2010 Call for Papers deadline is 18 September, 2009.

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in August 2008, Mr. Naris Srinual, President of the IEEE Thailand Section, presented copies to all the supporters of publishing the book. All supporters then donated 4600 copies to IPST for its further activities with school libraries in Thailand. A total of 6000 copies of the book were published. They have been distributed free of charge to ComSoc members, schools, and universities nationwide.

The book was also produced in an ebook format (http://www.nectec.or.th/Optical&Quantum/ComSoc), which is useful for students and the general public. Since its first appearance, the book has been mentioned and recommended by local authorities, distinguished academicians, and the news media. Its distribution has also served to increase public awareness of the IEEE Thailand Section.

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Environments."

Besides these keynote and invited speakers, the Technical Program also included the usual technical sessions based on submitted papers. The response to the Call for Papers was good, and after the review process, around 50 percent of the papers submitted were presented in oral sessions. The conference brought together distinguished individuals from academia and industry to discuss and exchange ideas in various fields of telecommunications; authors originated from Europe, Asia, North America, and Africa, revealing the real international flavor of the conference. The review process involved 125 colleagues from the various technical areas, which enabled most of the papers to have three evaluations, providing quite good confidence in the results of the review process, and was a show of the high standard of the conference.

ICT's co-founders were Prof. Hamid Aghvami (CTR, King's College, London, United Kingdom) and Prof. Farokh Marvasti (Sharif University of Technology, Tehran, Iran). This year's edition had Dr. Mike Walker as General Chair and Prof. Hamid Aghvami as Executive Chair. The Technical Program Committee Chair was Prof. Luis M. Correia (IST/Technical University of Lisbon, Portugal), with Dr. Mischa Dohler (CTTC, Barcelona, Spain) and Prof. Rahim Tafazolli as Vice-Chairs. IEEE sponsored the conference via Region 8 (there was a booth at the conference), and quite several members of the TPC and Organizing Committee, as well as attendees, were members of IEEE ComSoc, which shows its importance and spread in the telecommunications community.

Marrakech is a land of culture and history; hence, it was a perfect place to host ICT 2009. Next year's edition, ICT 2010, will be held in Doha, the capital city of Qatar, on 4–7 April. Do attend.