

Global Communications Newsletter

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The SENSEI Project: Integrating the Physical World with the Digital World of the Network of the Future

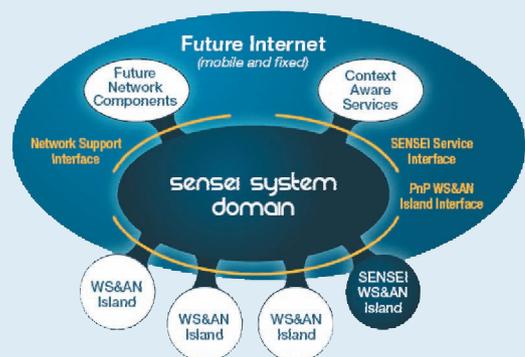
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The Internet extends its reach to the real world through innovations collectively termed the Internet of Things (IoT). The IoT aims at integrating technologies such as radio frequency identification, wireless sensor and actuator networks (WSANs), and networked embedded devices. Recent ideas envision the Internet as an all encompassing infrastructure that connects the physical into the digital world: the real world Internet (RWI). The European project SENSEI plays a leading role within the current efforts to create an underlying architecture and services for the future Internet and to realize the vision of the RWI.

SENSEI (Real World Dimension of the Network of the Future) is an Integrated Project (IP) in the EU's Seventh Framework Programme in Information and Communication Technology (ICT). SENSEI, with a budget over €23 million and an effort of about 1900 person-months, is the biggest IP from Call 1, Challenge 1.1: The Network of the Future. The SENSEI project started in January 2008 and is set to run for three years. The SENSEI consortium involves multidisciplinary expertise split among 19 partners from 11 European countries. The consortium consists of eight industrial partners (Arup, Ericsson Sweden and Ireland, NEC, Nokia, SAP, Telefónica, and Thales), many of them global leaders in their market. The consortium is complemented by two rapidly developing European small and medium enterprises (Ambient Systems and Sensinode), two research centers (CEA-LETI and Consorzio Ferrara Ricerche), six universities (the University of Surrey, ETH Zurich, University Politehnica of Bucharest, University of Oulu, Université Pierre Mendès France, and University of Twente), and a management company (ALMA).

SENSEI aims to create an open business-driven architecture that integrates heterogeneous WSANs into a global framework that facilitates services and applications via universal interfaces (Fig. 1).

The SENSEI system is therefore designed to provide network and information management services to enable reliable and efficient context information retrieval and interaction with the environment. By adding mechanisms for accounting, security, privacy, and trust, it enables an open and secure market space for context awareness and real-world interaction. SENSEI is designed to satisfy the demands of multiple players in the RWI value network. Users desire reliable, secure, and easy-to-use services that are reasonably priced at the same time (e.g., services that protect users' safety at work while optimizing the manufacturing process). However, satisfying users' needs and ensuring sustainable economic success requires



■ Figure 1. Overview of the SENSEI framework.

insights into both the technological potential and the realization of economic value latent in ICT. The SENSEI project therefore created a comprehensive usage scenario portfolio that focuses on both, industrial user and ordinary consumers. This ranges from scenarios like “emergency management” and “safety at work” over “smart plants” to “smart cities.”

One of the challenges the project is tackling is to define an architecture that provides scalability to deal with large numbers of globally distributed WSANs and interoperability of heterogeneous devices and platforms. In addition, another objective of SENSEI is to support information access and control for streaming of large data sets, information management to access real-time data, service continuity for mobile users, and traffic management to minimize the impact on network infrastructure. This implies that SENSEI has to provide means for the unification of metadata and semantics to describe resources and adequate security and privacy mechanisms to make a secure marketplace.

In order to meet this multifaceted interdisciplinary challenge, a large number of experts from multiple domains collaborate in order to integrate existing technologies and innovative approaches into a homogeneous architecture. So SENSEI employs, for instance, service oriented architecture concepts on the current Internet to provide universal interfaces to access heterogeneous sensor and actuator devices. It also uses emerging Semantic Web technologies to enable

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The IEEE ComSoc Sister Society in India: The Institution of Electronics and Telecommunication Engineers

By Madhu V. Pitke, IEEE Life Fellow, India

The IEEE ComSoc's Sister Society in India, the Institution of Electronics and Telecommunication Engineers (IETE, <http://www.iete.org>), has played a key role in the communication development of India. Founded in November 1953, it is the leading professional society devoted to "the advancement of science and technology of Electronics, Telecommunications, Computers and Information Technology." It serves over 69,000 members as individuals and industries/companies through its 55 centers spread all over India and one in Kathmandu, Nepal. There are five broad levels of membership: students, associates, associate members, members and fellows. (Fellow membership is comparable to our IEEE Senior Membership). At present there are around 15,000 engineers as Associate Members, Members, and Fellows. It touches almost every aspect of electronics in India. I have been actively associated with IETE activities in Mumbai since the '60s. One of my first papers was presented at the annual conference in 1960 and was later published in the *Journal of the Institution of Telecommunication Engineers* (the predecessor of IETE).

IETE's education and training activities have had the maximum impact on society. It provides opportunities to attain higher technical qualifications to underprivileged students who cannot afford to go to regular engineering colleges and universities. There are about 54,000 such students pursuing diploma and degree programs in electronics, telecommunications, and information technology. These are recognized by the government of India and most universities for admission to M.Tech courses. IETE also conducts an advanced level course (ALC) equivalent to the Master's level. It is currently



The visit of Doug Zuckerman, ComSoc President (third from left), and Roberto Saracco, ComSoc Director Sister Societies (second from left), in 2007 (India Road Show).

exploring the possibilities of establishing centers in other countries in the region. Technical activities in universities and major engineering colleges have Students Forums for organizing and managing technical activities with support, advice and guidance of senior faculty. These include organizing lectures, workshops, seminars, and exhibitions on regular basis, providing a common platform for student members to exchange ideas and information on topics of interest, curriculum, opportunities in higher education and employment, technology trends, and so on. Visits to R&D laboratories and industry centers are also arranged regularly.

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Highlights from the WIRELESS4D '08 Workshop: Bridging the Digital Divide by Advancing Technology for Broadband Wireless Internet Access in Rural and Developing Regions

By Andreas Kassler, Karlstad University, Sweden; Thomas Michael Bohnert, SAP Research, Switzerland

Broadband Internet access is at present available only to a small portion of the world's population, and there is a significant penetration discrepancy not only between different countries, but also between different regions and areas within a given country. In addition, there is growing interest on the local community and municipal levels in getting broadband wireless access, but the number of options regarding network and service providers, as well as price and usage plans, is severely limited. However, affordable broadband for all is a key requirement to bridge the digital divide and bring sustainable development to rural and developing regions as well as to support communities and municipalities. Still today, most of the existing technologies and plans for broadband access fail to address key challenges in terms of cost, deployment, or power consumption in order to bring broadband Internet access to sparsely populated rural areas or the masses in developing countries.

Addressing these key issues was the focus of the 1st Workshop on Wireless Broadband Access for Communities and Rural Developing Regions (WIRELESS4D '08) collocated with the 1st International Conference on M4D — Mobile Communication Technology for Development (<http://m4d.humanit.org/>), which both took place December 11–12, 2008 at Karlstad University, Sweden.

While the focus of the general M4D conference was on multidisciplinary research addressing the social, political, cultural, and educational barriers to bringing ICT into developing

regions, the workshop focused on the technical and economical aspects of enabling (broadband) wireless Internet access in rural and developing areas, as well as supporting communities and municipalities. The overall goal was to bring together researchers and practitioners, and serve as a forum for presenting and discussing state-of-the-art research, exchanging ideas and experiences, and facilitating interaction and collaboration. The workshop was technically sponsored by the EU Network of Excellent NewCom + +. Additional support was provided through the EU Interreg IVB project E-CLIC.

The organizing committee of WIRELESS4D '08 put together a high-quality program including technical sessions, poster sessions, demonstration sessions, and a panel. The program included a keynote speech given by a well-known researcher in the area of wireless mesh networks, Victor Bahl from Microsoft Research, United States. His speech was entitled "White Space Networking and the Commoditization of Pervasive Internet Access" and introduced the audience to a very interesting wireless networking research area at the intersection of white spaces networking, cognitive networking, and mesh networking. The panel was chaired by Victor Bahl and included well-known researchers and practitioners such as Sergio Palazzo from the University of Catania, Italy, Dag Nielsen from Ericsson Response, Sweden, Jan Nilsson from FOI, Sweden,

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Broadbanding Malaysia with WiMAX

By Naim Yunus, DTA Capital, Malaysia

The Malaysian telecommunication scene is undergoing an exciting phase with the inauguration of commercial WiMAX services in the third quarter of 2008.

In 2007 the Malaysian Communications and Multimedia Commission (MCMC, www.skmm.gov.my) awarded WiMAX licenses in the 2.3 GHz band to four aspirants with Packet One (P1 WiMAX), Asiaspace Dotcom (Amax), and Bizsurf (Y-Max) getting nationwide concessions, while REDtone-CNX Broadband (REDtone) is being restricted to the East Malaysia states of Sabah and Sarawak. These licensees commenced the services in August 2008, with at least 25 percent of the Malaysian population having access to WiMAX by the end of 2008 and 40 percent by end the end of 2011.

By the deadline, only P1, Amax, and REDtone had managed to launch their services, while Bizsurf has yet to do so. This raised the question of whether their license would be revoked in addition to fines imposed for the failure to meet the commitment. The only thing disclosed is that they plan to work with Xohm, Sprint Nextel's WiMAX business, to roll out their services.

The main reason for MCMC to award the licenses to newcomers rather than mainstream telcos is ostensibly to open up broadband service provisioning currently monopolized by incumbent Telekom Malaysia (TM) via its ADSL service called Streamyx. Since TM owns 95 percent of fixed lines, one naturally assumes that it also owns virtually all wired broadband customers. Such a scenario can result in less than satisfactory services due to minimal competition.

In mid-2008 broadband penetration for Malaysia stood at a dismal 18 percent. Under this bleak scenario, the Malaysian government has decreed that by 2010 at least 50 percent of households must have broadband, wired or otherwise. To achieve this, the country has been divided into three zones with broadband services at 10 Mb/s–1 Gb/s at up to 2 Mb/s, and in rural areas probably up to 1.5 Mb/s.

TM has been handed the exclusive task of providing the 10 Mb/s–1 Gb/s service in the nation's major economic areas in direct competition with the WiMAX newcomers. In other areas where up to 2 Mb/s is deemed sufficient, it is a free-for-all among the WiMAX and 3G/HSDPA operators and ADSL Streamyx. The rural zones are also open to any broadband provider, and the expectation is there will be funding from MCMC via the Universal Service Provision (USP) regime.

In August 2008 P1 was first off the block to sign up subscribers, deploying Alcatel-Lucent technology. Its parent company, Packet One Networks, is a subsidiary of Green Packet, a publicly listed firm specializing in the provision of wireless and telecommunication networking products and solutions. In essence P1 is not a complete newcomer, but the transition from infrastructure player to an operator is interesting to watch.

REDtone followed suit in Kota Kinabalu, using Motorola technology. REDtone has been a significant player in the Malaysian telecommunication scene and is regarded as a leader in IP-based discounted call business, garnering 35 percent of the local market.

A few days later Amax launched its service, also in the Klang Valley (the area covering Kuala Lumpur and its vicinity), with technology from Huawei. Owner Asiaspace Dotcom is another telecommunication infrastructure company (known for leasing towers to cellular companies), but has dabbled with terrestrial digital broadcasting.

Now, half a year on, the euphoria over the WiMAX launch-

es is more or less over. The dust has settled somewhat, and the three operators are frenetically rolling out their networks and ramping up subscriber uptakes while reviewing their strategies, figuring out what has worked and what has not. Unfortunately the fourth licensee, Bizsurf, is still nowhere to be seen.

P1 has expanded its Klang Valley coverage significantly and has even started service in the southern city of Johor Bahru, which neighbors Singapore. In mid-February service commenced in Penang. By then P1 could claim to have WiMAX presence in the three main economic powerhouses of Malaysia.

Amax has increased coverage in the Klang Valley too, albeit at a slower pace than P1. They say their focus is on quality infrastructure first before aggressive marketing. Meanwhile, REDtone has expanded to the other East Malaysia city of Kuching, but nothing really spectacular or worth mentioning has happened there.

Still, nobody is revealing the number of WiMAX subscribers so far. Back in August 2008, P1 predicted 100,000 sign-ups within 12 months. Contented early users have reported sterling performance of the services, but whether this is going to continue is yet to be seen since as more people sign up, the service could degrade first before more capacity is added to alleviate the problem. This cycle has been experienced before with cellular services and is bound to happen again with WiMAX.

A key question now is, with a plethora of broadband providers — the WiMAX providers making aggressive moves, TM's Streamyx chugging along, the 3G/HSDPA cellular companies unsure if their fickle services are best for mobile or fixed wireless — will the aim of making 50 percent of Malaysian households accessible to broadband by 2010 be realized?

At the rate broadband is being marketed, that target seems unlikely. Marketing broadband is about selling what comes through the pipe right into people's homes. What people care about is whether broadband can offer anything of interest to them, and how much they have to pay for it. Success in selling the right contents to the right people should be key to increasing broadband penetration, and this is lacking.

Nevertheless, Malaysia is on the right path in creating a more competitive environment in the provisioning of broadband services. In this respect MCMC must also be proactive and pragmatic, and sensitive to consumer gripes and complaints. Avenues must be created for more players to participate in the mission to give 50 percent of the population broadband by 2010, and the award of the WiMAX licenses in 2007 should go a long way toward this objective. For broadband beyond 2010, the strategy developed by MCMC must incorporate lessons learned thus far, and expectations among all stakeholders, consumers in particular, should also be well managed.

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and Nicolas Chevrollier from TNO, the Netherlands. It resulted in a lively discussion about technologies, economics, and social implications of broadband access for developing regions.

WIRELESS4D '08 received a total of 51 submissions by authors from 26 different countries. After a thorough review process, 14 papers were selected for oral presentation. Two papers were invited from leading researchers in their fields. Finally, 19 posters were selected especially to give young researchers the chance for interactive discussions, including demonstrations. The result of this process was a high-quality technical program consisting of five sessions presenting the latest research results. Session topics included research areas such as "Networking for Communities, Rural and Developing Regions," "Wireless Mesh Networks," "Long Distance Wireless Networks," and "Opportunistic Networks." Two presentations from Argentina and the Philippines were given remotely using online teleconferencing facilities. About 120 attendees from all over the world enjoyed the events of the conference and workshop as well as Karlstad in cold Swedish winter weather. The attendance at the sessions was always high, even on Friday afternoon, which demonstrated the attractiveness of the workshop program and the quality of organization provided to the attendees. Also, as a novelty, a mobile conferencing guide was offered to attendees, which allowed the conference participants to use their mobile phone to plan session attendance, or contact other people attending the sessions online.

We hope that WIRELESS4D '08 fulfilled the expectations

of the authors and workshop attendees. The success of this workshop relied on a strong team, and we would like to thank everyone on the organizing committee, especially the program committee, for their hard work and high-quality reviews. Finally, we would like to thank the WIRELESS4D '08 community for entrusting their work to us. Given the enormously positive feedback we received during the workshop, we are currently discussing the succession of this event in 2009.

SISTER SOCIETY IN INDIA/continued from page 2

IETE's membership (regular members are called corporate members) includes professionals from almost every major institution that is engaged in some form of electronics related activity. These include, apart from university departments and R&D centers, members from government departments connected with telecom, broadcasting, railways, defense, police, security, and so on. A number of activities are conducted to serve this vast community. Periodical publications include the *IETE Journal of Research*, *IETE Technical Review*, *IETE Journal of Education*, and *IETE Newsletter*. Apart from the annual conference, several regional and sectional conferences, workshops, and seminars are organized on a regular basis covering almost every aspect of electronics and telecommunications. Numerous awards and prizes have been instituted to recognize exceptional contributions and achievements. IETE is striving for new initiatives for partnership with industry, academia, and government, raising telecom and IT related issues to the national level and exploring new avenues of resource generation.

A very important factor in popularizing IETE is its very affordable membership fees that are in line with national income levels: around \$5 for annual membership and around \$60 for lifetime membership! Members also receive a couple of publications. This is one of the serious problems faced by organizations such as IEEE ComSoc in expanding their activities in India. IEEE ComSoc has signed a memorandum of understanding with IETE as its Sister Society. Doug Zuckerman, Nim Cheung, Shri Goyal, and Roberto Saracco have met with IETE President S. Narayana to discuss sister member collaboration. Thanks to KTV Reddy who chairs the IETE Center in Mumbai and is also a member of the National Council, we have been able to launch a major program for joint activities. A number of lectures and seminars were conducted with joint sponsorship in 2008. These are expected to be expanded and strengthened this year. There is lot of synergy between the two institutions; with the right approach, there is no reason a strong, sustainable, mutually beneficial relationship cannot be established.

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automated reasoning of context information, resource discovery, and composition.

After one year of extensive research, in which the project analyzed the state of the art of resource, context, and information modelling and processing, WSAN middleware and frameworks, and WSAN islands, a portfolio illustrating the scenarios has been created, and the first reference architecture is now defined. In the remaining two years the project will now shift its effort to the actual design of the enablers for the RWI and the implementation of a pan-European test platform enabling large-scale experimental evaluation of the RWI vision and field trials.

For more information about this large-scale and unique research initiative toward the future Internet, we would like to encourage the interested reader to keep up to date at <http://www.ict-sensei.org>

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