MEETING REPORT

Communication technologies – the challenges ahead*

Today the term 'ubiquitous computing' is more frequently encountered in scientific papers than science fiction novels. Researchers predict that the total information traffic by 2015 will be 522 exabytes, or 522 billion gigabytes, 95% of which will be video content. The estimated growth in mobile traffic will reach the staggering figure of 6600%. At the same time, academic researchers and industry giants in the field of networking, communications systems and telecommunications services are organizing more conferences than ever before in an attempt to predict and define the most important challenges faced by their community in the dynamic and fast changing information and communication technologies (ICT) environment.

The Third International Conference on Communication Systems and Networks (COMSNETS 2011), was a part of the global effort. The COMSNETS Society, which is first of its kind in India, was formed in 2008 with the idea to enhance India's relations in the field with institutions from all over the world through a series of events, the major one being the COMSNETS conference itself. Given the short history of the conference which was first held in 2009, the chairs of its third edition were confident and proud to claim that 'COMSNETS is the leading networking conference in this part of the world, a world-class gathering of academic researchers, industry practitioners and business leaders'. To create a fruitful dialogue and interaction between Ph D students and leading researchers in the field from all over the world, COMSNET 2011 also hosted three workshops during the first two days of the 5-day event. The workshop themes covered important aspects and applications of communication technologies with a focus on networked healthcare, advanced research and development in wireless communications, and adaptive and reconfigurable intelligent networks.

*A report on the 'Third International Conference on Communication Systems and Networks (COMSNETS 2011)' organized by the COMSNETS Society, co-sponsored by IEEE and held at The Chancery Pavillion Hotel, Residency Road, Bangalore, India during 4–8 January 2011.

COMSNETS workshops

The networked healthcare workshop (NetHealth) brought together academicians, representatives from Wipro, CISCO, GE Healthcare and Microsoft R&Ds, as well as enthusiastic Ph D students, and provided a platform for everybody to express their views and exchange ideas for the role communication systems can, and should play in eradicating existing drawbacks, and further improving the efficiency of the healthcare system in India. The workshop boasted with varieties of interactive sessions that included invited talks, paper and poster sessions, an industry exhibition and panel discussion on social networking, health, policy and privacy issues in the Indian context of emerging network assisted healthcare.

S. K. Mishra (Tele-Medicine School of India, Lucknow) presented a comprehensive historical overview of telemedicine initiatives in India, undertaken by government agencies, research institutions and the private sector. The geographical expansion of various successful pilot projects like OncoNet-India and Teleophthalmology-India, and the increasing number of institutions involved in the development of relevant technologies, indicate the prevailing need to incorporate telemedicine in the national healthcare policies, as well as concentrate more on improving telemedicine infrastructure to reach out to the most remote and isolated parts of the country. It was stressed several times throughout the workshop, that the issues of vast and diverse Indian landscape with predominantly rural population, the shortage of skilled labour and the poor penetration of healthcare infrastructure must be tackled with advanced technological solutions in the area of mobile healthcare, diagnosis and consultation via video conferences, remote surveillance of disease outbreaks, patient-centric personal health record system, remote pre-screening and more. Most of the speakers from India and abroad made a strong case for using the Indian cultural and social context as a guiding framework, rather than just borrowing existing concepts and ideas that might have worked well in other parts of the world. India should build its e-health around the pervasive and quickly accepted mobile technologies, television and the existing strong social network. A number of challenges were identified during the workshop, including development of robust methods for evaluation of telemedicine techniques, the need to efficiently integrate e-health into the existing healthcare system, the need to provide security and confidentiality in the new era of mobile health, and stimulate fast adoption of the new technologies among healthcare providers, private practitioners and stakeholders. The need for a holistic approach to research and development in the area of e-health, where communication engineering science is married to social science in a way that not only improves healthcare but also empowers people and encourages their participation in the process was emphasized by all.

The workshop on intelligent networks (IAMCOM) focused on adaptive and self-sufficient wired and wireless systems of the future. On the one hand, the multilayered infrastructure and the continuously improved functionality of communication systems make them increasingly complex and difficult to manage. On the other hand, the demand for quality of service (QoS), seamless network uptime, robust performance, immediate availability and high reliability is higher than ever before. To address these issues, the research community in the field of communication technology has recently put serious effort in developing software and hardware algorithms that can build in adaptive features into the systems such that they are self-recovering, self-configuring and self-healing. Such network systems are of particular importance in the military, automotive, aerospace, e-commerce and smart grid domains. The panel session stimulated a provocative discussion about the research challenges in designing cyber-physical systems (CPSs). A CPS is the next level communication system where the focus is on the interaction and strong integra-

tion between the computational system and the physical world.

The Fifth Annual Workshop on 'Wireless systems: advanced research and development (WISARD)' was running parallel to NetHealth and IAMCOM workshops. The workshop had a dynamic and engaging programme which included several invited talks by renowned people in the field from academia and industry, two paper sessions and live demonstrations of novel wireless sensor network systems developed by the Indian Institute of Science (IISc) in collaboration with various research groups around the country. A first-of-its-kind platform that is used to link spectrum analysers around the world was presented by Microsoft Research India, raising hopes for better real-time measurements of licensed spectrum utilization, and advances in the effectiveness of the under-utilized spectrum usage. The rest of the invited talks covered technical topics like interference management and energy efficiency in wireless networks, as well as more general areas like the importance of social media in the uplifting of people from the bottom of the pyramid. The paper sessions focused mainly on optimal configuration, energy-efficient algorithms and management in wireless sensor networks. For the first time this year, WISARD hosted a Ph D forum that included sessions on 'How to do quality research?', 'How to read/write a paper?' and 'How should a young researcher manage his/her time?'

COMSNETS conference

The unique feature of COMSNETS 2011 was its commendable diversity in terms of its technical programme, professional background and nationality of speakers, institutions and organizations representing academia, industry, government and public policy agencies and, of course, Ph D students. The three days of the conference were fully packed with: (i) paper sessions on network topologies and algorithms, wireless systems and protocols, network architecture and systems, etc.; (ii) twelve keynote lectures on important topics from leading people in the field; (iii) demos and exhibits, where industry and academic researchers showcased novel industrial application and research prototypes in the areas of energy efficiency, traffic monitoring, cloud computing, consumption management and file security; (iv) a poster session, and (v) three engaging panel discussions on opportunities and challenges in smart grids, bridging the connectivity divide, and emerging research topics in communication systems and networks.

In the course of the conference, the medley of research topics slowly converged and crystallized into several major themes and trends that were identified as a starting point, and a driver for current and future research endeavours in the field of communication systems and networks. It was clear that communication traffic, and video in particular, will rise steadily and rapidly in the coming years. The effects of such increase on the consumer end, ISP, and communication infrastructure with its limited resources were analysed from different angles. Key technology innovations were proposed in the area of network architecture and router platform design that can help create the foundation of the future Internet infrastructure. Various research efforts towards achieving better traffic management and congestion control that will ultimately reduce the price and energy per bit were presented and discussed.

The rise in information flow will invariably require expanded infrastructure that can support it. During the conference, the research community focused its discussions on: (i) novel network topologies that can take advantage of particular socio-cultural, geography-specific patterns and conditions; (ii) new network algorithms that can improve the network resilience and self-recovery capabilities in a dynamic environment with constantly added complexity and hierarchical levels; (iii) improved network power management techniques on both hardware and software level that can help optimize and reduce energy consumption of all devices involved in the network and (iv) the urgent need to improve existing network measurement models and quality metrics used for managing, configuring and designing networks.

The increased functionality of mobile devices drives an enormous demand for and dramatic shift towards wireless networks and technologies. A large portion of the technical programme in COMSNETS was dedicated to wireless technology. Improved mobile connectivity, network reliability, energy efficiency over wireless connections, understanding specificities of wireless network topologies like ad hoc wireless networks, mesh networks, multihop networks, etc. were just few of the topics that attracted large audiences during the conference. Issues related to handling the increased multimedia traffic over the limited radio spectrum drew much attention from the conference delegates.

Some of the other themes that dominated the technical content of the conference involved: (i) the trend to monitor and control the world via wireless sensor networks; (ii) the latent potential of cell phone databases to serve as a tool to measure and analyse human mobility patterns and behaviours, and the enormous effect these can have on business, sustainable infrastructure, marketing and security models; (iii) in the rising era of ubiquitous computing, the need for novel network and system models that can guarantee personal data security and integrity, and (iv) network security issues related to WiFi, e-commerce and banking applications.

As usual, the panel discussions provided a venue for intense and interesting dialogue over issues of contemporary significance. This year, COMSNETS hosted three panel discussions, one for each day of the conference. The panel on 'Smart grids: opportunities and challenges' developed around the rise in Indian economic power. Can smart grid technology solve the pressing problems of poor electricity infrastructure, losses, load shedding and blackouts during peak power consumption? Two opposing trends were competing with each other – 'dumb network – smart appliances' trend where focus is on design and market introductions of smart appliance that would replace the existing ones, or 'smart network–dumb appliance' trend that looks into the design and integration of smart power grid networks while keeping the appliances as they are. The enthusiasm of some panelists who envisioned a variety of opportunities for smart grid to optimize energy consumption was curbed by others, who expressed the opinion that India is not ready to focus on smart grids given some of the serious infrastructural gaps in the power grid system.

The panel discussion on 'Bridging the connectivity divide' addressed the issues of poor penetration of communication infrastructure in rural India and the challenges posed by the regularly spaced but sparse rural population, exhaustion of the

2G spectrum, unclear policies in terms of utilizing white spaces in the sub-GHz licensed spectrum, and the high cost needed to maintain base stations given the poor existing supporting infrastructure. The issues of technology adoption, poor education, multiple language environment and the need to empower the rural population were acknowledged as important in finding a long-term, sustainable solution.

COMSNETS ended with a provocative panel discussion on emerging research topics in communication systems and networks. It was largely believed that many disruptive trends like rapid growth of mobile communications, increase in traffic, cloud computing and social networking would impact the current and future network systems in fundamental ways. Future research challenges mentioned during the panel were cell-phone data mining, design and deployment of wireless sensor networks, interconnectivity between heterogeneous networks, design of self-organizing complex networks, networks supporting new communication styles, more efficient distributed networks and computing, and steps towards pervasive computing.

Clearly, a multitude of opportunities and challenges lie ahead. COMSNETS will continue to meet annually to discuss and shape the fast-changing world of communication systems and networks. The Fourth COMSNETS will be held in Bangalore during 3–7 January 2012.

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MEETING REPORT

Second state-level S&T conference*

The second state-level science and technology (S&T) conference was held at the Indian Institute of Science (IISc), Bangalore on the theme, 'Initiatives for Human Resource Development in Science and Technology'. C. N. R. Rao (Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore), while inaugurating the meet emphatically said that focus should be on the training of teachers to create better manpower in science. Rao strongly felt the need for a five-year programme exclusively aimed at training science teachers. He also said that participation of individuals in science is important. He explained that there is nothing like 'pure' and 'applied', but only science that is being applied and science that is yet to be applied. The first S&T conference was held in 2010 on the theme 'Science and Technology for Sustainable Development' at the same venue.

Besides teacher training, other strategies for human resource development in S&T were discussed. Though the INSPIRE programme of the Department of Science and Technology (DST), Government of India (GOI), is an already existing scheme, it was proposed that more such measures should be taken in adequate numbers. Universities and higher education institutes need to expose the students to scientific work. A greater number of researchers (Ph Ds) is also required. It was suggested that the twelfth Five-Year Plan, which is to begin in 2012, must focus on improving the human resources of the institutions engaged in science education and research. Virtual classrooms and finishing schools to train the students must be included in the education system. School curriculum, which at present leads to rote learning, must be made flexible. At the higher education level, enough freedom needs to be in place for selection of combinations of science subjects.

The conference also desired for industry and academia to work together. It was put forth that industries should not recruit based on brand name, but on talent. The use of information and communications technology in education, science communication and rural development was presented. Some programmes for technology-enhanced learning, such as the National Programme on Technology Enhanced Learning, Reforms and Technology Assisted Education for School Curricula, National Mission on Education through Information and Communication Technology, etc., initiated by leading Indian institutions in collaboration with the Ministry of Human Resource Development, GOI, were described. While highlighting the role of women in science, it was brought to the notice of the participants that India though has the highest number of qualified women in S&T, it has very less women researchers. The need for refresher courses for women with break in scientific career and the lack of awareness about the schemes initiated by DST, were recognized.

*A report on the second state-level science and technology conference held during 26–28 May 2011 at the J. N. Tata Auditorium, Indian Institute of Science, Bangalore, and jointly organized by the Karnataka State Council for Science and Technology, Vision Group on Science and Technology and the Department of Science and Technology, Government of Karnataka.

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