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No. 4 July | August 2014

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Building smart and sustainable cities

Dr Hamadoun I. Touré
ITU Secretary-General

Today, half of the world's population lives in cities. This urban population is expected to grow from 3.6 billion in 2011 to 6.3 billion by 2050, according to United Nations estimates.

Coping with rapid urbanization means operating public services, buildings and transport in more innovative ways. This realization led, more than a decade ago, to the concept of the smart city. Today, we see how important it is to emphasize the sustainability of the smart city.

While smart sustainable cities may evolve in different ways according to their location and priorities, the use of information and communication technologies (ICT) will always be essential. These technologies offer innovative approaches to managing our cities more effectively and holistically, through applications such as smart buildings, smart water management, intelligent transport systems, and new efficiencies in energy consumption and waste management.

To help planners and policy-makers realize the vision of smart sustainable cities, the ITU Focus Group on Smart Sustainable Cities has produced a road map and a report on climate change adaption in cities — both discussed in this issue of *ITU News*.

The direct and indirect impacts of climate change on cities affect human health, infrastructure, services, economic activities and social systems. But the severity of the consequences ultimately depends on the level of a city's preparedness, as well as on its ability to cope with — and recover from — both anticipated and unanticipated effects.

Among the ICT tools available to improve urban readiness are radio, satellites, radar and Earth-observation systems. Satellite imagery, grid technology and the use of global positioning systems now make it possible, for example, to track long-term weather movements.

ITU's fourth Green Standards Week, from 22 to 26 September 2014 in Beijing, China, is dedicated to the theme of "Smart Sustainable Cities". Hosted by Huawei in close cooperation with the China Academy of Telecommunication Research, the event takes place under the auspices of China's Ministry of Industry and Information Technology. As a global platform for knowledge-sharing, this year's Green Standards Week raises awareness of the importance of using ICT to build smart sustainable cities and ensure a sustainable future.

We know that using the capacity of ICT to make cities more eco-friendly is vital — not just to the well-being of urban inhabitants, but also for the sustainability of our planet, which is the only one we have. ■

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ISSN 1020–4148
itunews.itu.int
6 issues per year

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Printed in Geneva by the ITU Printing and Dispatch Division.

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Smart sustainable cities

EDITORIAL

SMART SUSTAINABLE CITIES

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Smart sustainable cities

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What is a smart sustainable city?

People move to urban areas in the hope of finding a better job and enjoying a higher standard of living. However, the increasing number of people migrating to cities creates congestion, puts pressure on limited resources (for example, energy and water), and escalates the demand for services such as sanitation, health care and education.

The concept of the smart city emerged more than a decade ago, and a number of cities in the world have jumped on the smart city bandwagon, labelling themselves "smart" in some way or another. But rapid urbanization and the obvious need to develop a sustainable model to support anticipated population growth in cities led the ITU to coin the term "smart sustainable cities" to highlight concerns about resources, and to incorporate characteristics of both eco-cities and smart cities.

But what exactly is a smart sustainable city? To ensure that the sustainability aspect in smart cities is not overlooked, the ITU–T Focus Group on Smart Sustainable Cities has conceptualized the new term, based on an analysis of about a hundred different definitions. The following definition was agreed during the fifth meeting of the Focus Group on Smart Sustainable Cities held on 19–20 June 2014 in Genoa, Italy: "A smart sustainable city is an innovative city that uses information and communication technologies and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects".

Although the role of information and communication technologies (ICT) has not been completely framed, the services where ICT can assist, such as water resource management, energy efficiency and transport infrastructure, are well recognized.

Having a formal, comprehensive definition for the smart sustainable city provides a basis for understanding the common features of smart sustainable cities and developing key indicators. This helps establish an ICT infrastructure, metrics and policies for smart sustainable cities.

"Amidst the challenges posed by rapid urbanization, decision-makers are facing the need to rethink and redefine the way in which infrastructure is built, services are offered, citizens are engaged, and systems linked, with the aim of transforming cities into more sustainable and robust living environments. ICT-enabled innovation is at the core of that transformation," explains Silvia Guzman, Chairman of the ITU–T Focus Group on Smart Sustainable Cities.

Urban planners now tend to lean towards an integrated approach, running cities as an integrated network rather than a set of individual sectors. The aim is to raise the quality of life of inhabitants by combining technological and social innovation, and using ICT to improve the performance of sectors such as transport, energy, urban safety and waste disposal.

What should a smart sustainable city look like?

"The following key attributes of smart sustainable cities are observed: sustainability, quality of life and intelligence. Sustainability relates to governance, pollution, climate change and other factors. Quality of life is about financial and emotional well-being. Intelligence is the implicit or explicit ambition to improve economic, social and environmental standards. Smart mobility is an example," explains Professor Sekhar Kondepudi from the National University of Singapore.

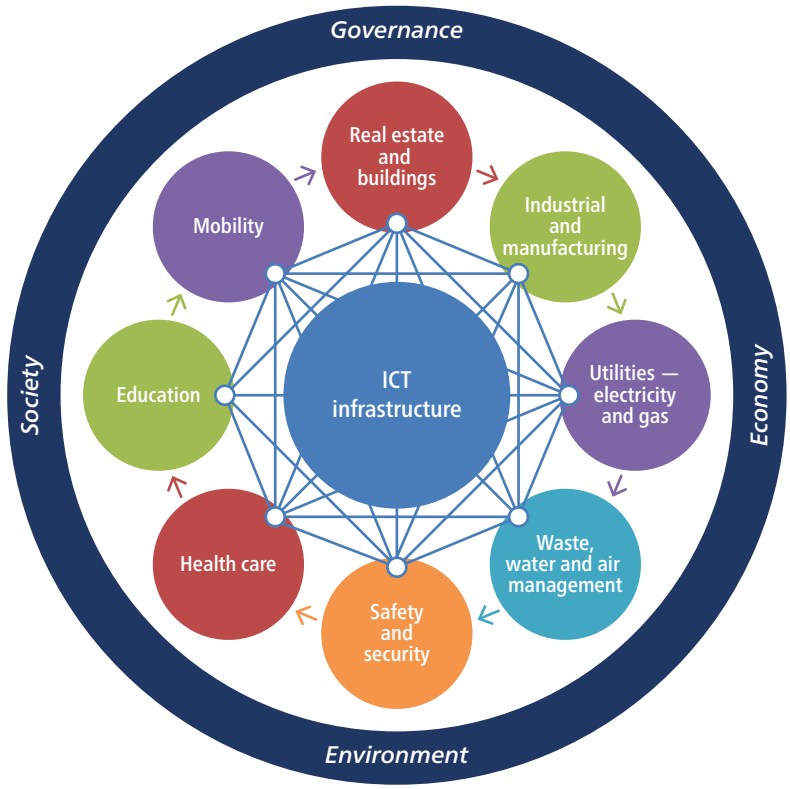
Smart sustainable cities can be assessed using four broad themes, as outlined in the diagram below: society; economy; environment; and governance. Society means that the city exists for its inhabitants.

Functioning smart sustainable cities contain eight physical infrastructure and service elements (as shown in the diagram). Real estate, for example, integrates multiple technologies, such as lighting, safety and renewable energy, and uses intelligent building analytics. Industry aims for zero emissions and develops innovative manufacturing techniques. Energy companies and utilities run a smart grid and wireless communications. Air, water and waste management companies use sensor networks or water information systems. Security is provided through video surveillance. Medical practices give remote health care and use electronic record management. Educational facilities supply world-class digital content and flexible, interactive learning.

ICT infrastructure

"The ICT infrastructure is the nervous system of the smart sustainable city, orchestrating the interactions between the various elements and the physical infrastructure. It acts as a foundational platform upon which the different smart services can operate efficiently and in an optimal manner," points out Professor Kondepudi.

Smart physical infrastructure



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The physical infrastructure components of a city can be thought of as sub-networks of a larger network — a system of systems. They behave like a network in terms of end use characteristics and interactivity with other nodes. This is analogous to an IT or data communications network. Hence ICT-based management processes can be employed, with some modifications, within a city.

The smart sustainable city using the integrated approach tunes itself, sharpening the individual efficiencies of different vertical infrastructure operations, for example real estate, waste and mobility. To maximize their capability, these apparently independent vertical silos need to coordinate with each other.

The smart sustainable city employs the ICT infrastructure in an adaptable, reliable, scalable, accessible, secure, safe and resilient way for a number of purposes. It improves the quality of life of its inhabitants. It ensures higher standards of living and employment opportunities. It improves the well-being of its citizens, for example through medical care, welfare, physical safety and education. It streamlines services that rely on physical infrastructure, such as mobility or water. It reinforces prevention and management of disasters, including the ability to address climate change impacts. It provides effective, well-balanced regulatory and governance mechanisms with appropriate policies.

In summary, the smart sustainable city establishes a sustainable approach that meets the needs of today without sacrificing the ability to meet the needs of future generations. ■


AFP

Climate change adaptation in cities

The role of information and communication technologies

As concentrated hubs of economic activity and people, cities are particularly vulnerable to the impacts of climate change. But cities also have assets that can help to monitor, manage and adapt to those impacts. In that respect, information and communication technologies (ICT) are playing an increasing role in the provision of novel, more sustainable and effective responses to climate change in cities around the world.

For most city councils, the challenges faced within urban contexts are considerable and growing. Today, half the world's population lives in cities, and is increasing yearly. The United Nations estimates that the urban population will grow from 3.6 billion in 2011 to 6.3 billion by 2050, with small cities absorbing over 40 per cent of the expected increase.

Cities in developing countries are particularly vulnerable to the impacts of climate change given their existing development challenges such as poverty, weak infrastructure, environmental degradation, limited resources and capacity constraints.

This article is based on a technical report developed within the Focus Group of ITU's Telecommunication Standardization Sector (ITU–T) on Smart Sustainable Cities. Entitled ICTs for Climate Change Adaptation in Cities, the report explores how ICT can support cities in adapting to climate change.

ICT can help map and reduce risk, monitor change, coordinate disaster response efforts, build capacity, involve communities, and improve the city's resilience to climatic impacts. For example, geographic information systems can be used in local hazard mapping and analysis to help identify evacuation routes and locate vulnerable housing.

The ITU–T Focus Group on Smart Sustainable Cities acts as an open platform for smart-city stakeholders — such as municipalities, academic and research institutes, non-governmental organizations, and ICT organizations, industry forums and consortia — to exchange knowledge in the interests of identifying the standardized frameworks needed to support the integration of ICT services in smart cities. The following are some highlights from the report.

Climate change in cities — Coastal and riverside risk

Climate change affects a wide range of urban activities, including town planning, mobility, buildings, energy, health, waste management and food security. "City sectors are interconnected. A failure in one sector can have a domino effect on others, causing further economic loss," says Daniela Torres of Telefónica.

The geographical location of cities determines the effects of climate change. For example, low-lying coastal zones face the combined threat of sea level rise and storm surges, while cities in hot climates may face longer and more severe heat waves.

Coastal and port cities in low-lying coastal zones are exposed to extreme coastal water level events. An estimated 65 per cent of cities with populations greater than 5 million are located in these areas. Some of them lie below normal high-tide levels and are prone to flooding and storm surges. The most threatened coastal urban environments include deltas, low-lying coastal plains, islands and barrier islands, beaches and estuaries.

Inland cities are at risk, especially settlements that are located along rivers. Inland cities will also face an increase in flooding potential as a result of more extreme rainfall events. Equally, changes in climate that reduce precipitation and impair aquifers will decrease water resource availability, especially in semi-arid and arid areas, irrespective of whether the cities are in developed or developing countries.

Direct and indirect impacts

Climate change will have both direct and indirect impacts on cities, affecting human health, infrastructure and services, economic activities and social systems. The extent of these impacts will ultimately depend on the level of the city's preparedness, as well as on its ability to cope with — and recover from — both anticipated and unanticipated effects.

Increased warm temperatures for example can exacerbate the urban heat island effect in cities, with direct impacts on health and comfort, air pollution and water quality. The urban heat island can also in turn generate the need for more cooling, thus increasing energy use and further escalating the effect.

Floods can directly destroy infrastructure, while contributing indirectly to the loss of employment and other income sources of urban residents. Furthermore, cities affected by droughts are likely to directly face water scarcity, waterborne diseases and reduced energy supply from hydropower. Indirect impacts can include reduced water quality and availability, reducing agricultural production and jeopardizing urban food security.

For coastal cities, direct impacts from rising sea levels will include inundation and displacement, coastal erosion and loss of land. Indirect impacts will include changes in the functioning of coastal ecosystems and recreational activities.

Why cities should adapt

Cities are the main engine for growth and development, so they must combat the effects of climate change and adjust to ongoing and future impacts. This is particularly critical in emerging economies. ICT can play a major role in enabling climate change adaptation by helping create a smart, sustainable infrastructure.

Cities that are in the process of becoming smart and sustainable have a huge opportunity to include ICT infrastructure and ICT solutions in their climate change adaptation plans, to respond to climate related events and disasters. Most of the urban infrastructure that will exist in 40–50 years has not yet been built. Therefore cities should include the ICT component in their long-term strategy planning, bearing in mind the need for climate resilient infrastructure.

Why standards are needed

Standardization is essential to build a smart city that can manage climate change. For example, technical standards facilitate the use of public telecommunication systems during disasters. An emergency telecommunication service enables authorized users to organize and coordinate disaster relief operations, ensuring preferential treatment for their communications via public telecommunication networks. This preferential treatment is essential, because during disasters public telecommunication networks often sustain infrastructure damage which, coupled with high-traffic demands, tends to result in severe congestion or overload of the system. In such circumstances, technical features need to be in place to ensure that emergency relief workers have the communication channels they need, with appropriate security and with the best possible quality of service.

To ensure reliable universal access to communication during extreme weather events, the Common Alerting Protocol (CAP) developed by ITU provides a general format for exchanging all-hazard emergency alerts and public warnings over all kinds of networks. CAP allows a consistent warning message to be disseminated simultaneously over many different warning systems, thus increasing warning effectiveness while simplifying the warning task.

Another example is the special ITU–T E.164 country code 888, assigned to the United Nations Office for the Coordination of Humanitarian Affairs. The code 888 is used by terminals involved in disaster relief activities in an area of a country that has been cut off from the national telecommunications system following a disaster.

Building resilience

Both sudden changes in climate and long-term climatic trends will affect a city's resilience — its ability to withstand and recover from climate impacts, and adapt to new circumstances. A report entitled *Resilient pathways: the adaptation of the ICT sector to climate change,* published by ITU in April 2014, explores the impacts of climate change on the ICT sector and the potential for adaptation. It emphasizes the need for resilient pathways of action, enabling environments, and new standards to foster the sector's approach to adaptation.

Cities must improve their ability to bounce back and learn quickly, as well as to plan ahead and implement measures to mitigate harm. They should be ready to benefit from the opportunities that emerge with change.

Radio, satellites, radar and Earth-observation systems are among the ICT tools available to improve urban readiness. Aerial photography, satellite imagery, grid technology and use of global positioning systems now make it possible to track gradual, long-term weather movements. The Global Observing System — which combines sensors with computer processing power — is the primary source of technical information on the world's atmosphere.

The resilience of ICT to the impacts of climate change is crucial. "Both acute and chronic impacts can disrupt the efficiency, operational and cost structure of infrastructure and service providers, and negatively affect millions of users that rely on

highly diffused ICT services around the globe", points out Angelica Ospina, Research Fellow of the University of Manchester.

Involving communities

ICT can strengthen multi-stakeholder communication in any city's process of adapting to climate change. Online training or blogging contributes to the spread of knowledge. Social media can help build public awareness on key issues, support education campaigns, and foster more inclusive stakeholder discussion.

People living in vulnerable areas can use mobile phones to participate in collective mapping exercises, and help identify local priorities for action. They can provide ongoing feedback on risk-reduction initiatives.

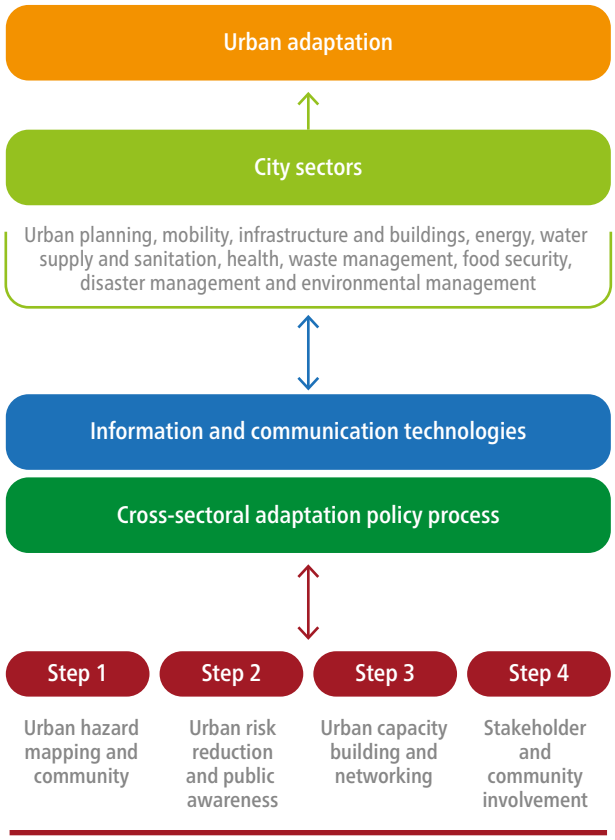
Integrated framework

ITU has designed a framework to help cities integrate ICT into their plans for adapting to climate change and building urban resilience, as outlined in the figure.

This framework is designed bearing in mind that urban adaptation strategies should reflect the interconnection of all city sectors. The framework is intended for municipal authorities to engage the information and communication technology sector in all phases of emergency and adaptation planning (hazard mapping, risk reduction, capacity building and community involvement).

The framework is part of ITU–T Recommendation L.1500, developed by ITU–T Study Group 5 (Environment and climate change). This Recommendation describes a "framework for information and communication technologies and adaptation to the effects of climate change".

Framework for integrating ICT into urban adaptation to climate change



Adaptation checklist

ITU has prepared a checklist (see table) to help inform and assess the integration of ICT into key areas of a city's strategic planning for adaptation to climate change.

Smart sustainable city adaptation checklist

Key areas of ICT contribution	Description
Climate change planning	Integration of ICT in climate change adaptation strategies and planning
Institutional coordination	Application of ICT in the coordination of climate risk management and long-term response across relevant institutions and sectors
Institutional knowledge and capacity building	ICT use to strengthen institutional knowledge and capacity building among city planners and other experts
Climate intelligence	ICT support in communication and exchange of climate information
Informed decision-making	ICT use to inform adaptation decision-making and mitigate uncertainty
Citizen participation	ICT use to improve the quality of stakeholder engagement in decision-making, and to address climate change through participatory processes and social networks
Stakeholder awareness	ICT use to strengthen climate change awareness and education among multiple stakeholders
Resilience building	Integration and assessment of the role of ICT in resilience building across city sectors (such as transport and health)

Key stakeholders

City stakeholders need to join forces in the development of strategies that build urban resilience with the support of ICT tools. These strategies must harness the potential of ICT to improve stakeholders' ability to cope with and adapt to change, and respond to the needs of the most vulnerable.

Key stakeholders include inhabitants from geographically vulnerable areas, industries, civil society, infrastructure management agencies, relevant industries, associations and non-governmental organizations. They can contribute their own expertise in strategic areas such as urban planning, mobility, infrastructure and buildings, energy, water supply and sanitation, health, waste management, food security, and disaster and environmental management.

ICT are at the core of this cross-sectoral collaboration, providing critical tools to strengthen urban planning, capacity building, decision-making and participation amidst the impacts of climate change, and helping to improve the effectiveness of city adaptation strategies. ■

AFP

Smart sustainable cities — a road map

This article is based on a technical report currently being prepared by Silvia Guzmán Araña, as a contribution to the ITU–T Focus Group on Smart Sustainable Cities. The report will be available in October 2014.

World population is growing, and cities are becoming more crowded and congested. Projections suggest that the number of people living in cities will account for 70 per cent of the global population by 2050. In 2007, for the first time in history, the number of people living in cities was larger than the number living in rural areas. Pressure is intensifying on natural resources and on city services such as sanitation and health care, while cities alone consume three-quarters of energy produced.

In order to meet the needs associated with an increasing urban population, cities require innovative approaches to improve the efficiency of all aspects of their operation (for example, public services, buildings and transport), while ensuring a higher quality of life for their inhabitants.

This calls for a new, more efficient city model — the smart sustainable city. To help planners and policy-makers realize this vision, the ITU–T Focus Group on Smart Sustainable Cities has produced a road map of five steps.

Step one: Setting the basis for a smart sustainable city

Smart sustainable cities will evolve in different ways according to location and city priorities, and the use of information and communication technologies (ICT) will be a critical lever in each case. But there will be little progress unless cities that decide to become smart and sustainable have analysed all the implications of this transformation.

The first part of this process is to understand what exactly constitutes a smart sustainable city. This step also entails determining the city's motivation and priorities, identifying the stakeholders that need to be involved, understanding the implications of this transformation for the city's governance, as well as creating the mechanisms needed to ensure continuous citizen participation and feedback throughout the process.

There are currently many different definitions as well as a variety of points of view around the world regarding what a smart sustainable city is, or should be. The ITU–T Focus Group on Smart Sustainable Cities has studied close to 100 different definitions. In June 2014, the group agreed on the following definition: "A smart sustainable city uses information and communication technologies to provide enhanced quality of life to its citizens, improved efficiency of services and sustainable development. Such a city meets the needs of today without sacrificing the needs of future generations with respect to economic, social and environmental aspects."

Equally important in terms of smart sustainable cities is to identify the set of stakeholders and their roles and responsibilities, as well as to define a governance model and leadership strategies for transforming the city. Stakeholders are likely to come from a wide range of fields. For example, municipal or town councillors and local authorities have the role of outlining a long-term holistic vision of the city. National and regional governments define legal frameworks. Utilities and providers of city services procure and use the technology. Information and communication technology companies supply technological solutions needed to integrate city services. Non-governmental organizations raise awareness of people's concerns, and help to engage different groups as part of consultation processes.

Multilateral organizations promote smart sustainable city initiatives, providing funds and expertise. Information and communication technology industry associations promote the development of smart sustainable cities. Academia educates professionals and studies new initiatives and trends. City inhabitants and visitors pay for smart sustainable city services. Specialist consulting firms benchmark progress. Standardization institutes develop a common language for all stakeholders and define key performance indicators.

In terms of governance, decision-makers should consider forming a supportive cross-sectoral body that can provide continuous support to city councils in the design and implementation of smart and sustainable cities.

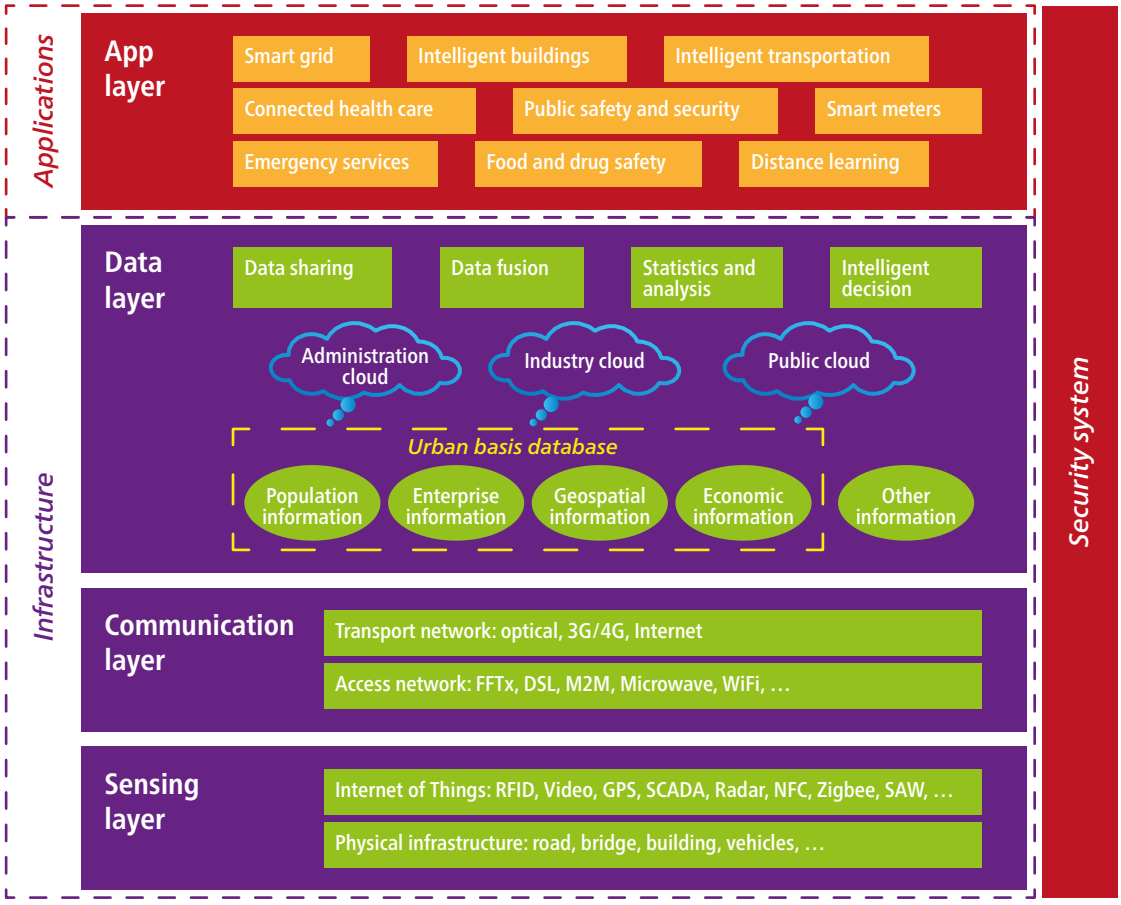
Setting the basis for a smart sustainable city also involves identifying and implementing effective mechanisms for citizen engagement. Citizens are the ultimate beneficiaries of smart sustainable city functionalities, which aim at increasing access to and efficiency of city services in order to improve the well-being of urban residents. It is crucial to ensure transparency and accountability in regard both to investment in service provision, and to the impact of services on the quality of life of citizens. This calls for the use of ICT-enabled mechanisms for citizen engagement and participation (such as social media tools and crowd sourcing).

"It is crucial to provide city inhabitants the chance to be actively involved. People can act as 'citizen sensors', providing valuable data and a continuous cycle of feedback, and coming up with exciting new ideas", suggests Silvia Guzmán Araña. As part of citizen engagement and inclusion, city councils need to provide training and good public access to information and communication technologies, acknowledging that there are persistent gaps in terms of skills and access to these technologies.

Step two: Defining and funding smart infrastructure

Smart sustainable cities need investment in information and communication technology infrastructure. It makes sense to use pre-existing networks to minimize costs. Whether new or already installed, the infrastructure can be categorized as comprising four layers (Figure 1). First, the sensing layer is composed of radio-frequency identification (RFID) devices, sensors, sensor networks, and other detection and monitoring technology. Second, the communication layer consists of large-capacity, high bandwidth and highly reliable optical and wireless broadband networks. Third, the data layer is made up of local authority, business and other data centres engaged in data processing, data mining and related activities. Finally, the

Figure 1 — Architecture of a smart sustainable city



Source: Technical Report on ICT Infrastructure for Cyber-Security, Data Protection & Resilience.

application layer contains a set of applications using data collected and processed by other layers, accessed by a variety of terminals.

The infrastructure of a smart sustainable city is a labyrinth of technologies and equipment. These range from data centres and cloud computing platforms to sensors, terminals and gateways. Stakeholders involved in strategic planning for infrastructure range from providers of information and communication technologies to telecommunication operators, and from financial institutions to regulators. Compliance with relevant laws and regulations is essential. Funding can come from a range of sources such as general taxation, utility allowances, advertising, subsidies and corporate donations.

Step three: Creating smart sustainable services

Information and communication technologies can improve smart city services, making them more efficient and interactive. Strategic planners need to decide which existing services to upgrade in this way. For instance, smart water management systems use information and communication technologies to generate economic savings, as well as to improve service and wastewater management, and flood and storm water control. Smart pipes, geographic information systems, smart meters and cloud computing are among the tools and technologies used in this way.

Smart transport means moving people and goods more efficiently and sustainably. This may require machine-to-machine communications, Wi-Fi and RFID technologies, and global positioning systems (GPS), for example, for real-time traffic flow information. Capabilities include vehicle monitoring and road infrastructure surveillance, making it possible to cut travel times and reduce the number of traffic accidents.

Smart waste management systems may track waste to monitor its movement, optimize collection routes, and collect and share data throughout the waste cycle. Smart healthcare management may carry out remote diagnoses and treatment, and provide online medical services and remote patient monitoring systems. Machine-to-machine communications are critical for these to work.

Smart education may mean creating a personalized learning environment for adults and children or providing teachers with new ways to design learning activities. Smart security may provide predictive analysis and criminal pattern identification to improve the safety of citizens. Smart buildings may use data to improve building energy efficiency, reduce wastage and optimize water usage.

Smart sustainable services may also play a major role in improving city adaptation to climate change and disaster readiness. They will depend — for a holistic city view — on command and control systems shared across multiple city departments, such as energy, waste, transport and security.

Step four: Monitoring progress

Key performance indicators must be used by city authorities and stakeholders to assess how city services are progressing. They also help in evaluating how modifications affect a city, as well as allowing for comparisons between different cities. "Planners have a range of options to choose from. They must use key performance indicators to monitor performance and efficiency gained", says Ms Guzmán Araña.

Evaluation principles include integration, comparability, independence (indicators in the same category must be independent) and simplicity (simple, intuitive concepts and calculations).

Step five: Ensuring security

Information and communication technologies provide security and help manage risk, but they also need to be protected. Risks to these technologies include cyberattacks and information theft for instance. Smart sustainable city development means optimizing data security and electromagnetic field management.

Vulnerabilities to the information and communication technology architecture need to be studied. Security analysts need to consider a wide range of threats to information and communication technology systems.

Equipment security, anti-virus technology, firewall and database backup technologies are all ways to better protect the infrastructure.

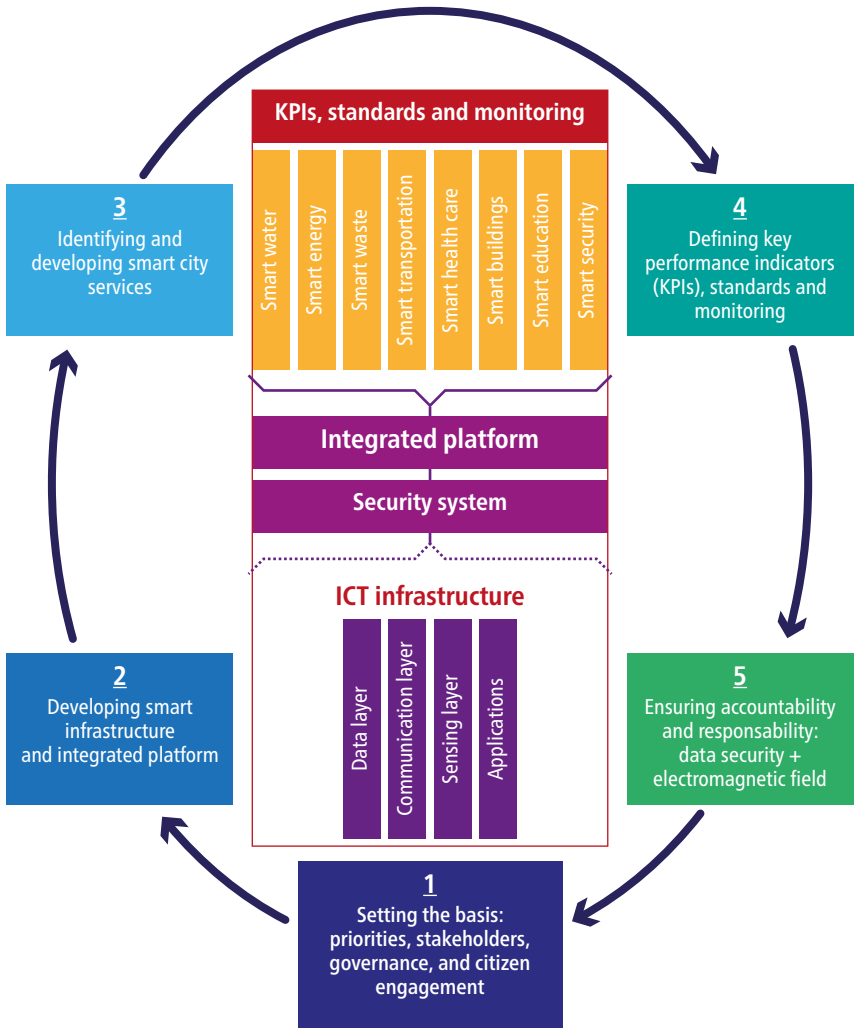
Smart city security infrastructure must include a centre for monitoring emergencies and disaster tolerance, managing and evaluating security, and ensuring identity management.

Smart sustainable city guiding framework

The five steps outlined above are closely interrelated and complementary, and information and communication technologies act as the glue that integrates all the other elements into a foundational platform, as illustrated in the smart sustainable city guiding framework in Figure 2.

According to this framework, the design and implementation of a smart sustainable city is a dynamic process that involves two main clusters of activities: a series of key components (shown at the centre of the figure); as well as complementary/inter-related stages (depicted as five boxes, forming a circle around the key components). "The framework highlights the different attributes that make a city smart and sustainable. It is action-oriented, seeking to address the need for practical recommendations that can help guide and inform the development of smart sustainable city strategies", explains Angelica Ospina, Research Fellow at the University of Manchester.

Figure 2 — Smart sustainable city — guiding framework



Challenges

Smart sustainable city strategists face a series of obstacles, including the fact that cities are commonly managed with a silo approach. A more holistic vision and strategy is needed in order to close gaps and ensure coordination between city departments.

In developing countries, the existing infrastructure is scarce and the connectivity rates low. That means there may not yet be the foundations for a smart sustainable city. These foundations include broadband networks or communication networks for sensors.

Not enough is known about the technologies used, both because of the novelty of the field and because of corporate protective policies. This calls for more knowledge-sharing. More experts are required in this emerging sector, as few have experience of smart sustainable cities. Sustainability is another challenge that demands a long-term, better-integrated and non-linear approach to management.

An additional challenge to smart sustainable city strategies is related to funding. "Since the financial crisis a few years ago, cities and other organizations have had difficulty finding investors. This is partly attributable to the lack of business models that provide a return on investment", points out Daniela Torres of Telefónica. Smart sustainable city planning must clearly integrate strategies for job creation in order to attract new businesses. The whole range of advantages associated with building a smart sustainable city needs to be clearly identified and effectively promoted in order to motivate active engagement and support by its inhabitants.

Conclusion

"Very few smart sustainable cities have been constructed so far. Further experiences and novel approaches are needed, building on the transformative potential of information and communication technology tools", explains Cristina Bueti, ITU.

It is important to set a clear baseline definition at the start of a smart sustainable city project. Key performance indicators must be used throughout the project for it to be successful. The full engagement of stakeholders and council authorities is essential as priorities are defined and long-term strategies developed. An inclusive concept such as that of the smart sustainable city requires expertise from a multi-sectoral and varied range of stakeholders, including active citizen engagement.

The effectiveness of smart sustainable city strategies requires a holistic, articulated approach that is not solely based on technological and infrastructural aspects, but primarily on improving the citizen's well-being. As Ms Guzmán Araña explains, "Installing smart technologies alone will not improve city services. This is about strategy. New technology needs to be complemented by intelligent management. Strategists will need to define how technologies and the information collected will be used. One core characteristic of the smart sustainable city is the breakdown of silo-based city service management, and the integration of services to improve the quality of life of citizens". ■


Vodafone Qatar

Smart transport: a game changer for modern cities?

Contributed by Vodafone Qatar

One of the mega trends over the past century has been humanity's move towards building and living in cities. As many as 60 per cent of the world's population will live in cities by the year 2030, according to the World Health Organization — and this rapid urbanization is putting unprecedented pressure on city infrastructure, services and the environment.

This new set of pressures for city managers and planners has spawned the growing phenomenon of "smart cities", which look beyond traditional city planning to find ways of giving people a place to live that is environmentally, economically and socially sustainable. Smart cities aim to save energy, give people clean air to breathe, make the traffic flow smoothly and keep the city running, among other things.

Needless to say, smart cities require a technology backbone to be able to work. Smart city technologies use communication networks to gather information, and intelligent management systems then use that information in numerous ways: to ease traffic congestion and reduce accidents; to reduce energy usage; and to provide information to citizens about

everything from finding a parking spot to using less electricity.

For cities such as Doha, in Qatar, that is an irresistible combination. With a list of ambitious projects lined up in preparation for the 2022 FIFA World Cup and Qatar's National Vision 2030 and beyond, growth is the name of the game. And with an estimated 500 new citizens a day streaming into this Arabian peninsula State, it is now more important than ever for Qatar to make the best use of rapidly changing technology to ensure that its infrastructure delivers an improved quality of life to its citizens.

The number one challenge is by no means unique to Qatar. Road congestion is an increasing pressure faced by urban planners around the world, and the problem is only going to get worse. In Qatar, private-car ownership already stands at 500 vehicles per 1000 people, and is growing at an estimated 14 000 vehicles per month, leading to some roads becoming heavily congested at peak times.

While Qatar is rapidly building public transport systems — including a multi-billion dollar metro rail system — and new highways to ease the congestion in the run-up to the 2022 World Cup, experts constantly view the physical infrastructure as not being enough. Smart transportation is one of the biggest game changers in the world's cities, and the intelligent use of smart traffic management systems is crucial to ensuring that all transport systems are synchronized and that traffic runs smoothly.

To collect the real-time information needed to do this takes a massive network of sensors that are attached to everything from cars to traffic signals. This is called machine-to-machine (M2M) technology, which — in simple terms — connects things to the Internet, transforming them into intelligent devices that exchange information.

By connecting vehicles with traffic management and road infrastructure systems, authorities can start doing some smart traffic management based on the latest traffic and road safety information. For example, the ability to route traffic around road incidents before congestion begins is critical to alleviating many urban traffic jams.

Suddenly, road signs can become intelligent providers of information that can give drivers real-time updates on road conditions. Commuters will be able to get up-to-date information on their transport, and drivers will have the chance to choose the best route possible to get to work faster and with lower fuel consumption.

This is not some futuristic vision: it is already happening. In the United Kingdom, mobile operator Vodafone worked with a company called Mobius to create an urban traffic management system that warns drivers of potential problems, gives real-time updates at bus stops to indicate routes and travel times, and even provides traffic light control that reacts to changing traffic patterns and adapts to provide better traffic flow.

This experience is already paying off in other parts of the world. In Qatar, Vodafone is partnering with one of the country's leading taxi companies to create a wireless network that enables better taxi fleet management, and features GPS, a language translator, entertainment content and mobile payment capabilities.

The next step forward will be vehicle-to-vehicle (V2V) technology, an active safety system that sees vehicles "talking" to each other to exchange basic safety data, such as speed, position and projected path, to help avoid collisions taking place. V2V technology, which is already being piloted across the world, has the potential to avoid 70 to 80 per cent of crashes that involve unimpaired drivers.

What is the ultimate in smart transport? The driverless car, perhaps? While this is probably some 10 to 15 years away, top car brands are already attempting to create the world's first driverless car. Back in 2010, Google logged more than 140 000 miles in a self-driving car. These cars represent the automobiles of the future — but until then, we will simply settle for a smooth drive home. ■

World regulators meet in Bahrain

Capitalizing on the potential of the digital world

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From left to right: His Highness, Sheikh Ali bin Khalifa Al Khalifa, Deputy Prime Minister (in the centre), representing the Patron of the 14th Global Symposium for Regulators; Dr Hamadoun I. Touré, ITU Secretary- General; and in the back are: Brahima Sanou, Director of the ITU Telecommunication Development Bureau and François Rancy, Director of the ITU Radiocommunication Bureau

World regulators meet in Bahrain

Capitalizing on the potential of the digital world

The 14th Global Symposium for Regulators (GSR-14), organized by ITU's Telecommunication Development Bureau and hosted by the Government of Bahrain under the patronage of His Royal Highness Prince Khalifa bin Salman Al Khalifa, Prime Minister of Bahrain, was held in Manama, Bahrain, from 3 to 5 June 2014. The first two days were dedicated to the Global Regulators-Industry Dialogue (GRID) with the private sector, while the third day was for regulators alone.

More than 700 specialists from 113 countries worldwide registered to attend the event, which also attracted around 80 high-level participants, including government ministers, heads of regulatory agencies and industry chief executives.

Opening ceremony

Opening GSR-14 and welcoming participants, Sheikh Fawaz Bin Mohamed bin Khalifa Al Khalifa, Minister of State for Communications, Bahrain, stressed the vital importance of information and communication technologies (ICT) in today's globalized world. He said that in in Bahrain, the ICT sector contributes over half a billion dinars (USD 1.24 billion) directly to the country's economy, generating 4 per cent of total gross domestic product (GDP). He underlined the role of the Global Symposium for Regulators in serving as a forum to discuss new regulatory approaches, enhance existing ones, and helping to implement them.

In his keynote address, ITU Secretary-General Hamadoun I. Touré said that in today's digital world, ICT regulators are increasingly taking on tasks beyond their traditional roles, and working to foster the development of services to deliver sustainable and inclusive social and economic development. Dr Touré added that ITU, through the work carried out by its three Sectors — Radiocommunication, Telecommunication Standardization and Telecommunication Development — is committed to assisting Member States, particularly in identifying the best strategies for success, taking into account their national circumstances and requirements.

Brahima Sanou, Director of the ITU Telecommunication Development Bureau, reflected on the progress made since the creation of the Global Symposium for Regulators 15 years ago. At that time, mobile penetration worldwide was just 12 per cent, and mobile broadband was not even available. According to ICT data newly released by ITU, the number of mobile subscriptions will reach almost 7 billion by the end of 2014, showing a tenfold increase over the past 15 years. Behind the statistics lie real human stories of people who nowadays are able to use mobile devices as their daily tools of communication, data transfer and much more.

In introducing the overarching theme of GSR-14, "Capitalizing on the potential of the digital world", Mr Sanou pointed out that consumers today increasingly have to deal with new challenges arising from innovative technologies, devices, online services and applications. In a globalized, interconnected and increasingly complex environment, consumer education and empowerment are critical to enabling users to benefit fully from the potential of the digital world.

Dr Mohammed Al Amer, Chairman of the Telecommunications Regulatory Authority of Bahrain and GSR-14 Chairman, said that regulators had to find ways of ensuring that citizens can enjoy the full array of benefits of the digital world in an informed, responsible and safe manner. He stressed that this can be achieved only through effective and smart regulation targeted at empowering consumers, redefining responsibilities, and creating the conditions for data-driven economies to flourish.

Opening Debate — Redefining responsibilities in a data-driven digital world

Opening the debate on redefining responsibilities in a data-driven digital world, Mr Sanou stressed the importance of addressing the new issues raised by the evolution of the information and communication technology sector. The digital world is exciting, but also challenging, in terms of its synergies and competition, innovation and disruption, and new value chain. This is a world where stakeholders need to be willing and able to act together and build new relationships based on trust among all parties. Without trust, the tremendous opportunities of the digital world cannot be fully exploited.

As a backdrop to the debate, Mario Maniewicz, then Chief of Infrastructure, Enabling Environment and E-Applications Department in ITU's Telecommunication Development Bureau, gave a presentation on "The digital revolution — Are we ready?" The presentation focused on the digital revolution sweeping the information and communication technology sector. It highlighted the move to a hyper-connected world, where trillions of information bits are streaming along the digital highways and where consumer value is the focus of attention. This is good news for those who are connected. But half the world population still has to be brought online, and light touch regulation — complemented by both strong enforcement powers and sound co-regulatory alternatives — will be needed to achieve this.

Moving into the debate, Mr Sanou moderated a panel composed of Magdalena Gaj, President of Poland's Office of Electronic Communications (UKE) and GSR-13 Chairman; Mohammed Al Amer, also Chairman of Bahrain's Telecommunications Regulatory Authority, and GSR-14 Chairman; Lin Mombo, President of the Regulatory Board, *Autorité de Régulation des Communications Electroniques et des Postes* (ARCEP), Gabon, and GSR-15 Chairman; Gabrielle Gauthey, President, Global Government Sector, Alcatel-Lucent; and Bocar Ba, Chief Executive Officer, Samena Telecommunications Council.

Regulators in the panel recognized that developing a national strategy at governmental level is key. They stressed the

importance of collaboration between industry players, regulators and the various government bodies in implementing national broadband plans, and highlighted the need also to involve scientists and academia. Investors have to perceive regulators as exercising their power autonomously and independently of political influence. In addition, a predictable regulatory environment helps attract investment in the sector.

All panellists recognized that investment in infrastructure is needed and called for cooperation, public-private partnerships and innovative sharing models, including the sharing of spectrum and infrastructure. Industry participants stressed that passive and active sharing should be fostered, as should smart competition in services provided over shared networks. More spectrum is required, because spectrum is the lifeblood of the digital economy. The importance of working together to attract long-term investors was recognized, and participants suggested inviting investors and banking institutions to future meetings of the Global Symposium for Regulators.

Industry participants noted that governments and regulators are aware of consumers' huge appetite for broadband. While broadband is now sometimes considered to be a commodity, it is not always viewed as such by the other sectors. Participants recognized that regulators are working hard to keep pace with the fast-changing technologies. Now the challenge is to upgrade ICT regulations, and address the need for convergence of regulations between different sectors and across borders. Also, cloud computing and machine-to-machine (M2M) communications raise a host of new legal issues because data streams flow through multiple jurisdictions, while regulators can only regulate players in their own jurisdiction. Therefore, as regulation evolves, the challenge of horizontal regulations will have to be addressed through collaboration.

Consumer education was identified as a vital element of modern regulatory frameworks, alongside the principles of transparency, security, privacy and data protection, to capitalize on the benefits of the digital world.

In subsequent sessions, participants discussed the following topics in depth: "Changing ICT consumer behaviours — Consumer empowerment and protection in the digital age"; "Why competition matters"; "Big data — An opportunity or a threat?" "Is it time to rethink spectrum licensing?" "Network debate — Meeting the demand for capacity, are we getting there?" "New business models driven by digital communications and services"; "Regulatory impact assessment — Spurring regulatory efficiency"; "Taking the regulatory model to the next level"; and "Monitoring the implementation of broadband plans and strategies".

Way forward and closing

Smart regulation does not mean more regulation — rather, it means more focused regulation, only when necessary. Sharing his thoughts on the discussions over the three days of GSR-14, Mr Sanou expressed his satisfaction that ITU continues to provide a platform for ICT regulators, enabling them to exchange lessons learned and best practices, and to cooperate for a better world.

Dr Touré traced the history of the Global Symposium for Regulators over the past 15 years, stressing with pride that the event has grown into the world's most influential meeting of the global ICT regulatory community. He singled out the leaders who have served as chairmen of the Global Symposium for Regulators for their skill, expertise and commitment. Dr Touré had earlier paid tribute to all former GSR chairmen at a special awards ceremony, held at a gala event on 3 June 2014 at Bahrain's Al Areen Palace resort.

Dr Hamad Al-Rawahi, 2014 Chairman of AREGNET (Arab Regulator's Network), Executive President of the Telecommunications Regulatory Authority of Oman, and Chairman of the Regulatory Associations meeting which took place back-to-back with GSR-14, presented the outcome of that annual event. He explained that the Regulatory Associations meeting allowed many associations to share successful experiences and have an open discussion on the success factors for making a difference in their countries. The main topics of

ITU/ M. Mouton

Brahima Sanou, Director of the ITU Telecommunication Development Bureau, handing the GSR-14 Best Practice Guidelines to Dr Mohammed Al Amer, Chairman of the Telecommunications Regulatory Authority of Bahrain and GSR-14 Chairman at the Symposium's closing ceremony

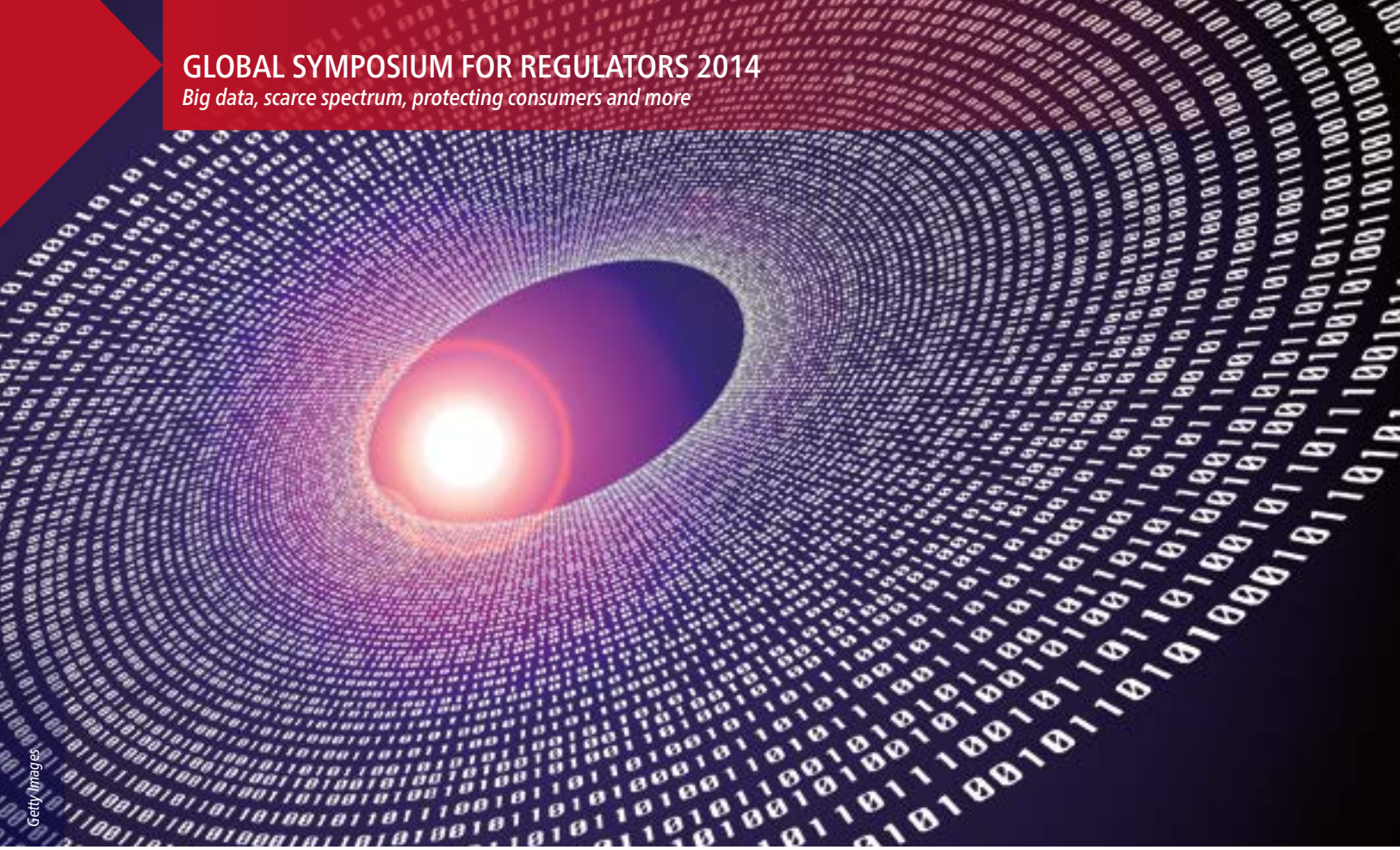
debate were Internet governance, the grey market and the theft of terminals, as well as the need for regional actions in these areas in collaboration with ITU. The meeting recommended the establishment of a working group bringing together regulatory and industry associations to implement the recommendations of the ITU Report on *Mobile Equipment Grey Market, Counterfeit and Theft,* which was produced following a request by the Regulatory Associations meeting held in 2013.

Dr Al Amer, GSR-14 Chairman, presented the GSR-14 Best Practice Guidelines on consumer protection in a digital world. The guidelines — drafted in a spirit of cooperation — were endorsed and are available online*. Dr Al Amer emphasized the importance of building a strong, positive relationship within the global community of regulators to enable the constructive exchange of ideas and solutions on regulation. "GSR-14 has strengthened links among regulators and will certainly contribute to closer and more efficient collaboration in the immediate future", he said.

Lin Mombo, Chairman of the forthcoming Global Symposium for Regulators (GSR-15), invited all participants to attend the next symposium, which would take place in Libreville, Gabon, in 2015. He emphasized the dedication of his administration to organizing this prestigious event and its commitment to make GSR-15 another resounding success.

Mr Sanou thanked the Government of Bahrain and the Telecommunications Regulatory Authority team for hosting the symposium, and congratulated Dr Al Amer on his leadership of the event. Mr Sanou nominated Dr Al Amer Ambassador for the GSR-14 Best Practice Guidelines. In his role of Ambassador, Dr Al Amer will take every opportunity between now and GSR-15 to bring these guidelines to the attention of regulators, at global and regional forums. ■

* *http://www.itu.int/en/ITU-D/Conferences/GSR/Documents/GSR14_BPG_final_en.pdf*



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Big data, scarce spectrum, protecting consumers and more

Highlights of hot topics debated in Bahrain

The Global Symposium for Regulators (GSR) is the largest annual gathering of the global regulatory community concerned with information and communication technologies (ICT). During GSR-14 in Bahrain (Manama, 3–5 June 2014), participants debated a wide range of topics of crucial interest to regulators today. The following highlights give an idea of the challenges that regulators face.

Changing ICT consumer behaviours — Consumer empowerment and protection in the digital age

Regulators need to take a new look at ways to empower and protect consumers, who are increasingly going online for work and play, social life and shopping. A discussion paper on "Consumer protection in the online world" takes stock of current regulatory efforts and suggests ways of improving the consumer experience.

While traditional telecommunications, postal, financial and audiovisual sectors are regulated, many of the operators providing similar services in the online ecosystem are unregulated or more lightly regulated. Changes to the legislative framework may be required in response to some of the following trends.

Growth in the use of mobile devices to make payments, including through the use of near field communication, calls for assurance that new methods are trustworthy. Meanwhile, increasing monetization of personal data has led some operators to massively collect data on individuals. But consumers sometimes do not understand complex privacy terms that allow the tracking and behavioural advertising that often finance "free" services. Children are particularly vulnerable to the marketing of free to download games.

The discussion paper states that "the Snowden revelations on mass surveillance activities by intelligence agencies have put data protection at the centre of the international debate on Internet governance and have considerably increased consumers' awareness regarding privacy issues."

Partnering with industry

Regulators recognize that industry players have a vital role to play in ensuring transparency and accountability in business practices. Industry must be willing to adopt measures geared at protecting the rights of consumers, such as protecting personal data, fighting misleading advertising, reducing spam, enabling data to be deleted and protecting children online. Regulators should encourage the development of codes of practice for service providers, including over-the-top (OTT) players, to ensure that content, promotion and operation of services comply with all necessary consumer protection conditions.

The Best Practice Guidelines on consumer protection in a digital world, adopted by GSR-14, say that "With regard to the storage and transmission of information, regulated telecom and ICT market players and unregulated OTTs should be treated on an equal footing when it comes to the enforcement of consumer protection legal instruments."

Why competition matters

Competition improves consumer choice, delivers lower prices, enhances quality of service, and drives innovation, resulting in new business models, new players and new services. A discussion paper on "Why competition matters and how to foster it in the dynamic ICT sector" outlines the rapidly changing competitive landscape and highlights potential regulatory responses, ranging from licensing reforms, access obligations, and network and spectrum sharing, to protecting consumer choice and promoting interoperability.

Regulators face a vertically integrating, consolidating, converging and expanding market. For example, Microsoft — having acquired Skype and Nokia — offers not only software, but also devices and services. Skype today delivers 39 per cent of all international calls, challenging the voice revenues of traditional telecommunication operators.

Local or regional players are expanding internationally. Bharti of India, for instance, now operates in Africa, while Viettel of Viet Nam has expanded into Africa and the Americas. In the video services market, Netflix — three years ago, a purely domestic company in the United States — today operates in more than 40 countries and 25 per cent of its streaming customers reside overseas. In terms of vertical integration, competition concerns are being expressed — for example, in relation to the Comcast and Time Warner merger announced in February 2014.

Many of the new players in the market (see box) are prompting the traditional players to rethink their business strategies, and become more innovative in their plans, products and services.

Companies developing the technology ecosystem — "Covering all the bases"

Source: TMG.

Big data — An opportunity or a threat?

An estimated 90 per cent of the world's data have been collected over the past two years. With this rapid growth, regulators need to be proactive about putting in place frameworks to harness the social benefits of big data while exercising foresight in protecting legitimate consumer concerns.

A discussion paper on "Big data — Opportunity or threat?" explains how big data can benefit society and signals some of the inherent risks of this powerful new tool. The big data revolution can be compared to the first industrial revolution, and may likewise prove a game-changer for the economy and society as a whole — allowing, for instance, medical research or production processes to be brought to the next level. The dark side of big

data, however, requires regulators to make clear rules for the collection, analysis and use of data.

A series of data breaches have left millions of people exposed, in particular to identity theft. To give just a couple of examples cited in the discussion paper, 77 million PlayStation Network accounts were hacked in April 2011. Of these, 12 million had unencrypted credit card numbers. The hacker or hackers gained access to full names, passwords, e-mails, home addresses, purchase history, credit card numbers, and PSN/Qriocity logins and passwords.

In March 2011, RSA Security was the subject of a cyberattack, and possibly 40 million employee records were stolen. The impact of the theft of information on the company's SecurID authentication tokens is still being debated. The company reports that two separate hacker groups worked in collaboration with a foreign government to launch a series of spear phishing attacks against RSA employees, posing as people the employees trusted, to penetrate the company's network.

Is it time to rethink spectrum licensing?

Among the new approaches to spectrum licensing at the national level are licensed shared access and dynamic frequency selection, which in some ways build upon the success of unlicensed, short-range and low-power devices (Wi-Fi), and "white spaces" systems. These sharing-based approaches may be useful complements to existing options, such as spectrum auctions, tender processes and spectrum re-farming, which have been used to award spectrum in cases where there are multiple applicants for the same spectrum.

In the near future, the debate will focus on using cognitive radio systems to "sense and avoid" other transmitters in a dynamic, real-time way.

For mobile broadband, long-term evolution (LTE) and LTE-Advanced, new spectrum is needed and a major consideration is how to allocate such spectrum in a technology-neutral way

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to allow operators to leverage their scarce resources. The new mobile broadband world calls for data-centric spectrum policies.

A discussion paper on "New frontiers in spectrum licensing" examines new approaches to spectrum licensing, notably through sharing. Mobile broadband is growing rapidly around the world. The forthcoming World Radiocommunication Conference in 2015 (WRC-15) will consider new bands for International Mobile Telecommunications (IMT).

Network debate — Meeting the demand for capacity, are we getting there?

Is the current deployment of high-speed broadband networks sufficient to meet demand? Speakers provided diverse examples of different regulatory, policy and commercial approaches, including mobile, fibre-to-the home, submarine cables and satellites.

In Portugal, 80 per cent of households are covered by either an optical fibre or cable network and 90 per cent of the population has access to a long-term evolution network. Key steps in achieving this were a decision by the national regulatory authority to impose mandatory access to Portugal Telecom's ducts and poles by 2006, and a law passed in 2009 giving communications operators access to ducts owned by other operators, as well as by municipalities, water and waste companies, and so on. The government also subsidizes the construction of fibre-to-the home networks in rural and poor areas, requiring subsidized companies to allow access to others.

In Ghana in the mid-1990s, telephone penetration was just 0.3 per cent. In 2000, the Government took direct measures to introduce access infrastructure. At that time, there were four mobile licensed operators holding licences that had to be renewed annually. In 2004, the Government started to award 15-year licences, with the option to renew for another ten years. Almost immediately, investment and roll-out grew, and by 2006 the penetration rate had grown to about 26 per cent, reaching 73 per cent by 2010 and 110 per cent today — while mobile broadband penetration has today reached 54 per cent.

Peru began to foster private investment in the telecommunication sector in 1994. From a single concession held by the State monopoly, the country progressed to over 600 concession contracts, this being the State's main tool for promoting investment in this market. There are now 30 million mobile lines in Peru. Since 2013, Peru has been working on a fibre-optic backbone network that will enable it to resolve the problem of infrastructure scarcity in its interior provinces. The government is seeking to facilitate access to infrastructure and fixed broadband in the remotest areas through a public-private partnerships project.

Participants agreed that regulatory frameworks must not impede innovation or prevent the exploration of new business models.

New business models driven by digital communications and services

A discussion paper on "The impact of data on ICT business models" explores the trend towards data becoming a new driver of economic growth. The paper traces the evolution of business models built around data, and alerts policy-makers and regulators to the evidence for a sustained structural change leading to a data-driven economy.

Because of the value of data for successful business models, there are strong incentives for all actors in the data-driven economy to collect as much data as possible. Consumers are often unaware of data being collected about them and what happens to this information. Beyond information and transparency, regulators might consider establishing a standardized procedure to enable consumers to access their data. A recent verdict of the European Court of Justice has given consumers the right to demand deletion of personal data.

Clearly, the data-driven economy is global. Data are often stored in regions with a cold climate, because doing so is cheaper as a result of energy savings. Also, a data item might be routed


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through numerous networks before it reaches its destination. This evidently raises questions of data security and jurisdiction.

The structural change towards a data-driven economy calls for internationally agreed responses by policy-makers and regulators. Consensus needs to be reached regarding governance, and cooperation is needed in implementing a wide range of policy interventions, in order to ensure an overall positive economic effect of this structural change in the marketplace.

Regulatory impact assessment — spurring regulatory efficiency

A discussion paper on "Using regulatory impact analysis to improve decision-making in the ICT sector" throws light on regulatory impact analysis — a powerful but relatively underused regulatory instrument.

In Nigeria, the public can view policy objectives, and comments from stakeholders are fed into the regulatory process through wide consultation. In the European Union, a market analysis is conducted every three years. Croatia has taken this approach one step further with its project "Looking in the Future", which focuses on mapping the future effects of regulatory decisions in cooperation with academia and industry. In India, the challenge usually lies in the enforcement of regulatory decisions. In response, and to ensure transparency and accountability, draft regulations are subject to public consultations with stakeholders before formal approval by the regulatory authority. In Saudi Arabia, the regulator takes a number of measures to ensure that stakeholders benefit from regulation. Periodic market analysis is carried out among individuals, and small- and medium-sized enterprises, as well as public institutions such as hospitals and schools, to quantify the impact of regulation and suggest ways of improving or streamlining regulations. Recommendations from these studies help shape the regulator's strategy for boosting the information and communication technology sector, and passing on the benefits of regulation to all users.

Regulatory impact analysis can significantly contribute to the efficiency, transparency, accountability and coherence of public

policy-making. But there is no one-size-fits-all model. The choice of the methods to be used depends on the types of impacts to be assessed and also on the long-term policy goals set by government.

Taking the regulatory model to the next level

In the current dynamic and heterogeneous digital environment, a number of countries have considered that they are better off establishing a converged regulator to achieve multiple objectives and reap efficiency gains.

Italy, for example, established one of the first converged regulators in 1997. Other countries in the European Union have also adopted convergent regulations, but convergence of the regulator is not a requirement because each country is different. In Bosnia and Herzegovina, a converged regulator was established in 2001 to oversee telecommunications and content regulation. The Bahamas went through this process in 2009 and a complete restructuring of regulatory organizations took place to increase institutional capacity.

The Mexican converged regulator was restructured and granted extended ex post competition powers in 2013, in addition to telecommunication and broadcasting oversight. The converged Spanish regulator, established in 2013, integrates the activities of five previously separate regulators in charge of infrastructure, services and content. In Botswana, the telecommunication and broadcasting authorities were merged in 2013 to integrate postal and Internet services as well.

All speakers stressed the benefits of a converged regulator, citing less duplication, integrated regulation, greater efficiency through staff and cost savings, and the ability to promote local content. A converged regulator is likely to be more efficient in responding to the challenges of the converged information and communication technology sector, and to foster technology neutrality and equal treatment. A converged regulator should also have competition powers.

Monitoring the implementation of broadband plans and strategies

Measurable information about the supply and use of broadband provides a basis for judging whether broadband plans and digital strategies are achieving their objectives.

A discussion paper on "Monitoring the implementation of the broadband plans and strategies" emphasizes the need for monitoring and feedback to be fully integrated into broadband plans. We cannot manage something effectively unless we can measure it. Indicators of adoption and effective use are still being developed by a number of administrations. Within practical limits, monitoring should provide information on all aspects of the broadband market and ecosystem.

When high-speed broadband becomes a core element of advanced services in sectors such as health and education, the savings flowing from the use of broadband-based connectivity may outweigh the costs. When broadband is fully integrated in these sectors, attention turns to outcomes measured not only in terms of costs and savings, but also in terms of overall gains in capability, efficiency, productivity, innovation and public welfare. New measures may need to be developed to monitor changes in people's behaviour and increased dependence on broadband-based services.

ITU/L. Wood

Bahrain, a dynamic ICT market

Enabling innovation

Bahrain, with a population of more than 1.3 million people, boasts state-of-the-art telecommunications and information and communication technologies (ICT). Bahrain's open economy, coupled with its Telecommunications Regulatory Authority's strategy to develop the telecommunications sector, have paved the way for the Kingdom to become an innovative telecommunications hub. In June this year, Bahrain hosted the 14th Global Symposium for Regulators (GSR-14) under the patronage of the Prime Minister, His Royal Highness Prince Khalifa bin Salman Al Khalifa.

Topping the charts

Bahrain is among the Arab region's — and the world's — most vibrant and advanced markets for ICT services, with high penetration of mobile cellular and broadband Internet, low prices, and a top-performing regulator (the Telecommunications Regulatory Authority) that has been repeatedly recognized internationally for its forward-looking approach to ICT development.

For the fourth time running, in 2013, Bahrain's Telecommunications Regulatory Authority received the CommsMEA Best Regulator of the Year Award. "Today's citizens of Bahrain are well-informed and keen users of modern-day

telecoms technologies, setting the bar high for the Authority and local operators", says Dr Mohammed Al Amer, Chairman of the Board of the Telecommunications Regulatory Authority and also Chairman of GSR-14.

In ITU's report "Measuring the Information Society 2013", Bahrain's ICT Development Index was ranked third in the Arab region in 2012 and 39th globally. Regarding the ICT Price Basket, Bahrain ranked 11th out of 110 countries in terms of mobile broadband affordability, with mobile-broadband prices below one per cent of monthly gross national income per capita. Bahrain is one of a handful of countries that have already achieved the Broadband Commission for Digital Development's target to provide an affordable broadband service by 2015.

As Dr Al Amer explains in the Authority's 2013 Annual report, "the outlook of the global telecommunications sector has changed tremendously in the past few years, and Bahrain has been keeping up with the international standards as one of the most progressive markets in the field, with the Authority's efforts playing a key role in achieving this position".

Spectrum allocation

In the Authority's 2013 Annual Report, its General Director, Mohammed Bubashait, talks about "Bringing 21st century telecommunications to Bahrain's citizens and consumers". He explains that, in line with the Third National Telecommunications Plan, the Authority has allocated the necessary spectrum to enable mobile operators to provide or enhance post-3G technologies and services such as long-term evolution (LTE) and LTE-Advanced. This has also helped operators to improve the quality of services and increase capacity.

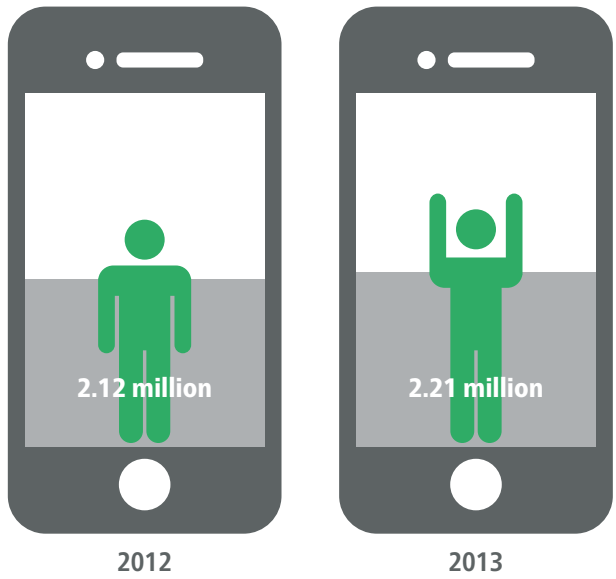
The managed transparent process was used to assign additional spectrum. The three existing mobile operators in Bahrain — Batelco, Zain and Viva — were invited to respond to a consultation document, which set out the Authority's proposals for the award of rights to any or all of the existing individual mobile telecommunication licence holders, to use frequencies available in the 900 MHz, 1800 MHz and 2100 MHz bands to promote current technologies and provide LTE services in the Kingdom. On 9 December 2013, new frequency licences were granted to Batelco, Zain and Viva.

Looking ahead, the Authority has started a national spectrum review to determine the Kingdom's public mobile spectrum needs for 2020 and beyond, and secure the future provision of advanced communication services. The outcome of the review is expected to be announced during 2015.

Market indicators

Mobile and fixed-line subscriptions

At the end of 2013, there were 2.21 million mobile subscriptions, showing a 4 per cent increase over 2012, with the penetration level at 173 per cent. Mobile number portability was



Source: Annual Report 2013, Bahrain's Telecommunications Regulatory Authority.

introduced in July 2011, accompanied by a public awareness campaign with the slogan "I Love My Number". The introduction of mobile number portability contributed to increasing penetration levels and further heightened the competitiveness of the mobile-cellular market.

There were 251 000 fixed-telephone subscriptions by the end of 2013, compared to 261 000 in 2012.

Broadband

The broadband penetration level at the end of 2013 was 128 per cent, while the number of broadband subscriptions reached 1.63 million, up 30.5 per cent since 2012. Much of this growth is in mobile broadband, with subscribers representing 89 per cent of total broadband subscribers at the end of 2013. Fixed broadband (wired and wireless) accounted for the remaining 11 per cent of subscribers.

"Given that the Telecommunications Regulatory Authority has always put the highest priority on consumers' best interest, we were able to achieve high penetration of mobile and broadband services through increased competition and introduction of state-of-the-art technology, including LTE deployment", says Dr Al Amer.

Mr Bubashait adds that "the introduction of state-of-the-art technologies such as LTE into the market will encourage investor confidence in the country's telecommunications infrastructure, which in turn is good for the citizen, good for the consumer, and good for the Kingdom."

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Regulatory snapshot

Bahrain's Telecommunications Regulatory Authority was established in 2002 through the adoption of the Telecommunications Law of 2002 and the first Telecommunication National Plan, as part of a reform process launched by the government to foster competition and protect consumer interests.

In 2004, full competition was introduced in fixed domestic and fixed international services, as well as in international gateways, and satellite and Internet services.

The second National Telecommunication Plan, published in 2008, recognized the need to nurture competition, to create an environment conducive to investment, and to enhance the use of broadband and Internet services. The third National Telecommunication Plan, released in 2012, identifies measures to strengthen Bahrain's ICT competitiveness and readiness to support the fast-growing digital economy.

The duties of the Telecommunications Regulatory Authority include protecting the interests of subscribers and users, and promoting effective and fair competition between established operators and new entrants to the telecommunications market in Bahrain. The Authority's activities are overseen by the Board of Directors. The General Director is responsible for the day-to-day operation of the Authority, and is appointed by His Majesty, King Hamad bin Isa Al Khalifa, based on the recommendation of the Authority's Board of Directors and on the proposal of the Council of Ministers.

Since its establishment, the Authority has constantly encouraged telecommunication operators to find innovative solutions. As Dr Al Amer puts it, "Guided by our Focused Strategy Framework, we work as a team with our stakeholders in order to offer the highest quality and technologically advanced telecommunication services." ■

Meeting the demand for broadband capacity in Portugal

Interview with Professor João Confraria

Member of the Board of ANACOM

Professor João Confraria has been a member of the Board of Portugal's National Regulatory Authority for Communications (ICP — Autoridade Nacional de Comunicações — ANACOM) since May 2012 — a post he also previously held from 1996 to 2002. His tasks include supervising market regulation and legal affairs. With these responsibilities, he has been deeply involved in developing and implementing the European Union (EU) regulatory framework in Portuguese markets. That includes the definition of relevant markets and significant market power, as well as remedies to promote competition and control monopoly power and rules to solve conflicts between operators. Recently, one main focus of these analyses has been broadband markets and next-generation networks. He has also been involved in developing a new framework for universal service provision, as well as in selecting new universal service providers.

Professor Confraria teaches economic regulation and telecommunications at the Catholic University of Portugal. He has worked as a consultant in these areas, and published several books and papers on economic regulation in Portugal.

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How did Portugal succeed in becoming a front runner in Europe in rolling out high-speed broadband infrastructure?

Professor João Confraria: Our success in rolling out high-speed broadband infrastructure is related to investment in optical fibre and cable networks, as well as in long-term evolution (LTE) networks. Fibre and cable networks cover 80 per cent of the households and LTE networks cover more than 90 per cent of the population.

The main regulatory driver for that success has been to impose asymmetric access to the ducts and poles of Portugal Telecom. This measure was taken by ANACOM almost nine years ago and was an important factor in reducing the cost of investing in broadband networks. A second set of measures was enshrined in a law promulgated in 2009. That law clearly anticipates European Union Directive 61 of 2014 in setting out the principles for access to ducts and poles owned by other utilities — electricity companies, water and waste companies, highway operators and railway operators — and other municipalities in the country.

Along with these regulatory steps, the dynamics of competition in the domestic market have also been very important. Portugal Telecom spun off its cable television business and, as a result, had to build up a pay television service from scratch. That was the driver for a huge investment in broadband. The recent launch of quadruple-play bundles showed mobile operators that they need a nationwide broadband business, while fixed operators

understand that they need a nationwide mobile business. Because of this, mobile operators such as Vodafone have been investing in infrastructure and there have been some mergers, for example between the largest cable television operator (Zon) and the smallest mobile operator (Optimus).

What have been the challenges in deploying the infrastructure?

Professor João Confraria: In imposing asymmetric access to ducts, we were of course aware that deep regulatory involvement would be needed in regard not only to pricing but also to service-level agreements, to ensure that they are fair and proportional. One of the main challenges we face is to make sure that pricing and service-level agreements do not create barriers to market entry — at the same time, we have to ensure that appropriate incentives are created for investment. Currently, our main new challenge is how to implement the recommendations of the European Commission on access to next-generation networks and on the cost of access to these networks.

Who are the main players and how was infrastructure funded generally?

Professor João Confraria: The infrastructure was largely funded by the companies concerned, either with equity or through taking on debt. I guess that in most cases the companies took a debt-financing approach.

A small part of the infrastructure was co-financed by the government using public funds, specifically in rural and poor areas. There was a public tender process to select an operator that would build an optical fibre network covering at least 50 per cent of the population in poor municipalities and rural areas. This population represents a relatively small part of the total population of the country — although the area involved represents a substantial part of the land area of the country.

What approach has Portugal taken on net neutrality?

Professor João Confraria: We are following closely the European Union Telecommunications Framework, amended in 2009. This gives national regulatory authorities the right to ask for information e.g. related to quality of service. National operators are obliged to inform consumers about traffic management techniques that they may apply. And regulators have the right to question operators about the application of these traffic management techniques and, if necessary, intervene by imposing additional regulatory measures. We are, however, still engaged in a "learning process" and to date have not yet found a case that seems to merit significant regulatory intervention.

What are your views on market consolidation?

Professor João Confraria: Consolidation seems inevitable. The traditional reasons for market consolidation that we find in other industries — for instance taking advantage of economies of scale, avoiding duplication of costs — of course also apply to the telecommunications and information technology industries. The traditional reasons for mergers apply both to national mergers and to cross-border mergers in these industries.

But there are also other reasons for consolidation that relate particularly to the dynamics of the telecommunications and information technology markets. For example, we see telecommunication operators involved in mergers and acquisitions with content producers or developing IT businesses. In general, there is the perception of companies that by merging they can increase their profits and make better use of their current resources and rationalize their investments.

In what form does infrastructure sharing occur in Portugal?

Professor João Confraria: In my country, mandatory infrastructure sharing concerns ducts and poles, and possibly other elements of civil engineering that can be used to co-locate electronic communications equipment. Of course, there are also voluntary agreements between operators — mainly mobile operators — to share some facilities, including masts to co-locate their antennas.

Another type of facility sharing is related to optical fibre. Two mobile operators, Vodafone and Optimus, voluntarily agreed to build and share fibre to cover half a million homes. Of course, after Optimus merged with a cable television operator, sharing the infrastructure with Vodafone became mandatory. But in the beginning, the sharing process was voluntary between the two companies.

What are the consumer trends in terms of access and speeds in Portugal's broadband market?

Professor João Confraria: We see that, whenever they can, people are increasingly choosing cable or fibre accesses rather than asymmetric digital subscriber lines (ADSL). But in Portugal, the main technology that consumers are choosing for their access to broadband services is still ADSL. Portugal Telecom still uses ADSL to provide Internet protocol television (IPTV) and triple-play (voice, video and data). The same applies to Vodafone, which in most cases uses the local loop rented from Portugal Telecom. So ADSL is still used by a large percentage of Portuguese consumers.

The promised speed with ADSL is up to around 25 Megabits per second, although — depending on location and time of day — that speed is often not reached. Where a home already has an ADSL service, operators sometimes offer customers the possibility of changing to a fibre or cable service without additional charges, generally maintaining the same speed. But in many cases operators offer increased speeds with fibre or cable access services, say up to 100 Megabits per second, often subject to an additional charge. ■


WSIS+10
HIGH-LEVEL EVENT

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WSIS+10 High-Level Event

The importance of ICT in the Post-2015 Development Agenda

With the rapid development of information and communication technologies (ICT) and their mainstreaming into everyday life, the link between these technologies and human development has never been clearer. It has therefore become necessary to consider the development of an inclusive information society in the broader context of the Post-2015 Development Agenda that will succeed the United Nations Millennium Development Goals (MDGs) next year. The way to do this is outlined in two documents endorsed in June 2014: *WSIS+10 Vision for WSIS Beyond 2015* and *WSIS+10 Statement on Implementation of WSIS Outcomes.*

These two documents were developed in an open and inclusive multistakeholder preparatory process comprising six phases that begun in June 2013, culminating in the World Summit on the Information Society + 10 (WSIS+10) High-Level Event, held in Geneva from 10 to 13 June 2014. Pre-events were held on 9 June, where over fifty workshops and interactive sessions brought together global stakeholders from government, the private sector, international organizations and civil society. The pre-event sessions demonstrated the open, collaborative and transparent nature of the WSIS process.

More than 1600 participants took part in the WSIS+10 High-Level Event itself, including around 100 government ministers and deputy ministers, ambassadors, heads of international organizations, chief executive officers from the ICT industry, leaders from business, civil society and academia. They discussed and endorsed these documents.

Participants also reviewed progress made in implementing the outcomes of the two phases of the World Summit on the Information Society. At the first phase in Geneva in 2003, world leaders issued a Declaration of Principles and a Plan of Action (with 11 action lines). These were complemented in 2005 by the

WSIS+10 High-Level Event opening ceremony

Tunis Commitment and the Tunis Agenda for the Information Society. Participants took stock of achievements in the past ten years, based on reports from WSIS stakeholders, including those submitted by countries, by WSIS action line facilitators from United Nations agencies and by UN Regional Commissions.

"Information and communication technologies have long been recognized as key enablers for bridging the digital divide and achieving the three dimensions of sustainable development — economic growth, environmental balance and social inclusion", said Ban Ki-moon, Secretary-General of the United Nations in his video message to participants in the WSIS+10 High-Level Event. "We must do everything in our power to increase access to information and communication technologies and broadband connectivity across the world, including reaching people in remote areas, landlocked countries, small island developing States and the least developed countries. This will empower millions of people and enable us to meet our development goals in the post-2015 era," Mr Ban added.

ITU Secretary-General Hamadoun I. Touré recalled that "World leaders at the World Summit on the Information Society in 2003 agreed to promote the use of information and communication technologies for the achievement of internationally agreed development goals and targets". Dr Touré added that "Today almost everyone on Earth lives within reach of a mobile cellular network and nearly 3 billion people are online; we must now ensure that everyone also has access to broadband connectivity. We are here to pave the way for the future and set the road map for sustainable development in the post-2015 era."

The High-Level Track of the WSIS+10 High-Level Event was particularly successful, welcoming over 100 policy statements. Government ministers and representatives from business and civil society examined key strategic matters — such as measuring and monitoring the information society, building trust in cyberspace, inclusive knowledge societies, securing cyberspace in a borderless world, how youth can shape ICT policies, and WSIS+10 and the Post-2015 Development Agenda.

The Forum Track of the WSIS+10 High-Level Event was conducted in more than 150 sessions in the form of high-level dialogues, thematic and country workshops, showcasing theatres, World Cafés, interactive sessions, including a ministerial round table. A range of topics were discussed, including ICT infrastructure, cybersecurity, enabling environments, accessibility, capacity building, e-learning, m-health, e-agriculture, climate change, empowering women, child online protection and multistakeholder approaches to Internet governance.

Essentially, the *WSIS+10 Vision for WSIS Beyond 2015* and the *WSIS+10 Statement on Implementation of WSIS Outcomes* highlight the importance of the Post-2015 Development Agenda process. The *WSIS+10 Statement on Implementation of WSIS Outcomes* reaffirms the importance of ICT in the further development of the

information society, stimulating innovations, empowering different groups of people in developed and developing countries, providing access to information, and fostering economic and social growth. The statement invites United Nations system organizations and stakeholders to take full advantage of information and communication technologies in addressing the development challenges of the 21st century and to recognize these technologies as cross-cutting enablers for achieving the three pillars of sustainable development (economic growth, environmental balance and social inclusion).

Priorities

Participants discussed crucial issues such as human rights, both online and offline, and emphasized the need to expand access to ICT to all, particularly to vulnerable and marginalized people. In that context, participants stressed the need to develop and make available simplified devices to facilitate digital inclusion.

Capacity building to keep pace with advancing technology, multilingualism in the use of ICT, preserving cultural heritage in the digital age, addressing environmental challenges with green ICT, along with promoting a digital economy and e-commerce are also considered priorities.

Governments are encouraged to implement appropriate national strategies and policies that make information and communication technologies enablers for social and economic development, and to promote enabling regulatory and legal environments that spur investment to facilitate ICT for development.

The importance of building confidence and security in the use of ICT was emphasized, notably to protect personal data and privacy and to strengthen the security and robustness of networks. Participants called for the strengthening of national and regional capacity to address cybersecurity challenges by encouraging a culture of responsibility and joint efforts of all parties involved. They noted that greater cooperation between all stakeholders at the national, regional and international levels is required.

United Nations Group on the Information Society

During the WSIS+10 High-Level Event, the United Nations Group on the Information Society (UNGIS) held its 11th meeting, where it reiterated its commitment to continue promoting policy coherence and programme coordination in the UN system and providing guidance on ICT-related matters in support of internationally agreed development goals. In this context, UNGIS reiterated the importance of the Joint Statement it made at the annual WSIS Forum in 2013 staking a claim for ICT to play a central role in post-2015 development. That statement was addressed to the Secretary-General of the United Nations and to the United Nations System Task Team on the Post-2015 Development Agenda. UNGIS, currently chaired by Dr Touré, has recommended that the two WSIS+10 High-Level Event outcome documents be used as reference and background in the drafting of the Post-2015 Sustainable Development Goals.

Review reveals mixed results in bridging the digital divide

With a special focus on developing countries, ten targets were adopted at WSIS with the aim of encouraging connectivity in villages, schools, libraries, post offices, national archives and governments, as well as adapting school curricula to meet the challenges of the information society, support the development of multilingualism and content on the Internet, and ensure ICT access for more than half of the world's inhabitants.

A report on *Final WSIS Targets Review* was launched on 10 June 2014. The report was prepared by the Partnership on Measuring ICT for Development, of which ITU is a founding member. According to the report, a lot of progress has been made in ICT use, access and infrastructure development, but with mixed results in bridging the digital divide. "This report is a major milestone in tracking the information society worldwide," said ITU Deputy Secretary-General Houlin Zhao. "It shows that while significant achievements have been made in the last decade, the

digital divide remains a major barrier to an inclusive information society. We are determined to continue to plan, develop and implement large-scale ICT projects as we accompany countries on their development journey."

According to the *Final WSIS Targets Review,* remarkable progress has been made in increasing mobile cellular coverage, with all rural communities in the world likely to be covered by 2G mobile cellular signals by 2015. However, Internet connectivity remains a challenge and access to broadband continues to be unequal, with penetration rates around four times higher in developed countries as compared to developing ones. While some countries have successfully integrated computers in schools, less than 10 per cent of schools in many of the world's poorest countries are connected to the Internet. The proportion of teachers trained to use ICT in the classroom is increasing, but fewer than 10 per cent of teachers in low-income countries have been trained to effectively use ICT in their classrooms.

Almost all scientific and research centres have broadband Internet access, and the total number of national research and education networks has grown — with the majority of universities now connected. While libraries, museums and archives are important providers of online content related to culture, a lot remains to be done in terms of digitizing cultural heritage and making it available online.

There is a growing divide in broadband access between enterprises in developed and developing countries and it is clear that, within developing countries themselves, there are wide differences in ICT use between large and small companies, between enterprises in different industries, and between rural and urban enterprises. Unsurprisingly, mobile phones have become the most commonly used ICT tool among micro and small enterprises, and in the informal sector.

The number of websites has grown exponentially between 2003 and 2013, and the number of web pages even more substantially, with developed countries in Europe, the Americas and parts of Asia generating the majority of web content. More than 300 languages are now available on Wikipedia and more than 100 on major social networks, while the proportion of Internet

ITU/C. Montesano Casillas

From left to right: Houlin Zhao, ITU Deputy Secretary-General; Huda Dahroug, Regional Director, Egypt ICT Trust Fund, a WSIS Project Prize 2014 winner; Atef Helmy, Egypt's Minister of Communications and Information Technology and Chairman of the WSIS+10 High-Level Event; and Dr Hamadoun I. Touré, ITU Secretary-General

users whose primary language is English has fallen significantly as access to the Internet has become more widespread.

Results show that information and communication technologies are becoming central to the effective operation of health systems and services although progress is uneven across countries. The WHO Global Observatory reports that the number of countries with e-health strategies is showing a steady rise.

Central governments in all 193 United Nations Member States have an online presence, with online information and services increasing threefold on government portals in the last decade. By 2012, a one-stop portal was provided in 70 per cent of countries, compared to 26 per cent in 2003. By 2014, almost all of the countries in Europe, in the Americas and in Asia provided online information on education, health, finance, social welfare, labour and the environment, but the proportion was lower in other regions, such as Africa.

According to available data, 50 per cent of households in developing countries have access to radio and about 72 per cent have access to television. Most developed countries have completed — or are on track to complete — their transition to digital television, while developing countries have begun that transition or are committed to it.

The *WSIS Stocktaking Report 2014* features key achievements by different stakeholders worldwide.

WSIS Success Stories provides a key reference point to WSIS projects which were awarded the 2014 WSIS Project Prizes.

What next?

The outcomes of the WSIS+10 High-Level Event have set the stage for further discussions on WSIS+10, including at the United Nations General Assembly and at the upcoming ITU Plenipotentiary Conference, to be held in Busan, Republic of Korea, from 20 October to 7 November 2014.

WSIS partners

The WSIS+10 High-Level Event, held as an extended version of the WSIS Forum, was hosted and coordinated by ITU, and co-organized by ITU and the United Nations Educational, Scientific and Cultural Organization (UNESCO); United Nations Conference on Trade and Development (UNCTAD); and United Nations Development Programme (UNDP).

A number of agencies played a facilitating role: the Food and Agriculture Organization (FAO) of the United Nations; International Labour Organization (ILO); International Trade Centre (ITC); United Nations Department of Economic and Social Affairs (UNDESA); United Nations Office on Drugs and Crime (UNODC); Universal Postal Union (UPU); UN Women; World Meteorological Organization (WMO); World Health Organization (WHO); World Food Programme (WFP); World Intellectual Property Organization (WIPO), as well as the United Nations Regional Commissions.

The WSIS High-level Event was supported by governments and the private sector. The United Arab Emirates and Intel were strategic partners. Japan, Kuwait, Mexico, Oman, Poland, Qatar, Rwanda, Saudi Arabia and Switzerland provided support. Côte d'Ivoire, Tunisia, the International Federation for Information Processing (IFIP), the Internet Society (ISOC) and the Internet Corporation for Assigned Names and Numbers (ICANN) also contributed to the event.

Dr Touré said he was "delighted to see this year's High-Level Event culminating with such strong commitment and support for the WSIS review process (WSIS+10) — from governments, from the private sector, from civil society, from academia, and from international organizations". He expressed the hope to see the same spirit next year at the 2015 edition of the WSIS Forum, to be held in Geneva.

Ministry of Information Technology and Communications, Colombia

Role of public governance authorities in promoting ICT for development | Colombia

WSIS prize-winning projects in 2014

Connecting the world

On 10 June 2014, ITU Secretary-General Hamadoun I. Touré announced the 17 winners of a global contest for projects that have contributed most to the connectivity goals of the World Summit on the Information Society (WSIS). More than 140 projects were nominated for the 2014 contest (www.wsis.org/prizes). The WSIS Project Prizes contest identifies successful models that could be replicated to empower communities around the world through information and communication technologies (ICT). The prize categories mainly mirror the 11 Action Lines laid out in the WSIS outcome documents. Reflecting the multistakeholder nature of the WSIS process, entries were submitted by governments, international organizations, civil society, the private sector and individuals. The winners, listed below by category are also highlighted in the 2014 edition of the WSIS Stocktaking Report on Success Stories.

Role of public governance authorities and all stakeholders in the promotion of ICT for development (Action Line C1)

Winner: Ministry of Information Technology and Communications, Colombia

The Redvolución project launched by Colombia's Ministry of Information Technology and Communications is a scheme in which students spread the use of the Internet in their own communities. Favouring the integration of previously isolated populations into the information society, Redvolución has already engaged 1200 schools nationwide, and is expected to work with 6000 schools by the end of 2014. Students show others how the Internet could become a factor for positive change and better quality of life.

Information and communication infrastructure (Action Line C2)

Winner: Ghana Investment Fund for Electronic Communications

The Ghana Investment Fund for Electronic Communications has launched a rural telephony project to provide access to ICT in remote communities and thus open them up for economic development and access to information. The project targets underprivileged and deprived Ghanaian communities with populations of less than two thousand people. It provides 2G/3G base stations with small cellular antennas offering free Internet Wi-Fi services in addition to traditional voice services. So far, 30 rural telephony sites have been deployed across Ghana. The project uses solar energy, reducing pollution and conserving energy.

Access to information and knowledge (Action Line C3)

Winner: GEOSYS, Algeria

GEOSYS's project Aina provides a digital mapping platform on the Internet for the use of all Algerians. The application is based on a satellite-mapping system and covers various points of interest, such as public facilities, administrations, transport infrastructure and leisure activities. Aina is designed to locate almost anything on an interactive map and provide a wide range of practical information. Planned to cover the entire Algerian territory within two years, Aina also allows citizens to contribute information, which is verified before being posted.

Capacity building (Action Line C4)

Winner: Mohammed Bin Rashid Smart Learning Programme, United Arab Emirates

The Mohammed Bin Rashid Smart Learning Programme aims to transform and update the educational system in the United Arab Emirates by creating a unified electronic learning environment in all public schools. In "smart classes", every student will have an electronic device and access to learning resources through high-speed networks. The programme will enable teachers, students, parents and administrators to collaborate to create a student-oriented educational system that identifies students' learning styles, intelligence, strengths and weaknesses. Based on interactive teaching and learning, the programme will enhance students' skills according to their abilities. The programme is the fruit of collaboration between the Ministry of Education and the Telecommunications Regulatory Authority.

Building confidence and security in the use of information and communication technologies (Action Line C5)

Winner: Information Technology Authority, Oman

The Oman National Computer Emergency Readiness Team (OCERT) was established in May 2009 to serve a wide group of ICT users, particularly national infrastructure institutions and major industries, in addition to nationals and residents. It provides a diverse set of information security-related services. In the past few years, it has dealt with cybercrime in Oman and

Polish Agency for Enterprise Development/Poland

Enabling environment | Poland

developed effective tools to detect the different forms of abuse. OCERT also aims to build confidence in the use of e-government services on the Internet, as well as to develop competent Omani experts qualified to respond to security incidents and detect them. Training and awareness is an important part of the OCERT's mandate in reaching out to the public.

Enabling environment (Action Line C6)

Winner: Polish Agency for Enterprise Development, Poland

The Polish Agency for Enterprise Development created the "We support e-business — web.gov.pl" platform in response to the needs of small and medium-sized enterprises in Poland searching for information about running a business on the Internet. The platform encourages all entrepreneurs, including those who have just started to run their own businesses, to begin or expand their activity on the web. The platform collects and provides information free of charge. For instance, it offers innovative ideas for e-services and business-to-business (B2B) technologies, information about European funds for businesses, stories about business successes or failures, and information on Polish laws and constraints on business. With more than 13 000 registered users, the e-platform has created an open and productive business environment, as well as a nationwide business community and network.

E-government (Action Line C7.1)

Winner: Prime Minister's Office, Bangladesh

The Access to Information (A2I) programme, implemented by the Bangladesh Prime Minister's Office, with technical assistance from the United Nations Development Programme (UNDP) and the United States Agency for International Development (USAID), is working to revamp the traditional public service delivery processes, focusing on meeting the needs of underserved communities. Under the theme Services @ Citizens' Doorsteps, the programme focuses on making government services responsive

to the needs of citizens, and taking public and private services to citizens' doorsteps.

A2I is leveraging the flexibility and ubiquity of indigenous ICT by quickly upscaling various small prototypes. This instils an innovation culture in the Bangladeshi civil service. A2I has spearheaded the transformation to Digital Bangladesh. "Since 2007, hundreds of e-services have sprung up throughout the country. Citizens can now pay their electricity, gas and phone bills, download English lessons and consult with a doctor remotely through mobile phones. Over 4500 rural local government institutions have established Union Information and Service Centres where every month, over four million hard-to-reach citizens electronically access diverse critical services such as birth registration, land records, exam results, registration for work permits abroad, telemedicine, and timely information on agriculture. Financial inclusion has been expanded through mobile banking, payment of utility bills, and first-ever introduction of life insurance in rural areas", says Anir Chowdhury, A2I Policy Advisor.

A typical citizen now walks 3 kilometres to the nearby Union Information and Service Centre, instead of going to the district headquarters 30–50 kilometres away. Each centre is managed by a pair of local entrepreneurs — one man and one woman. The gender empowerment aspect of this transformation is undeniable given that most women can go to the centres to access services, whereas it was previously much more difficult for them, if not impossible, to travel to sub-district or district offices. As well as decentralizing the delivery of government services, these ICT-enabled one-stop shops introduce private services through innovative public-private partnership arrangements, and boost self-employment and women's empowerment. Through a grassroots social networking platform, the centres have also played a major role in giving rural citizens a voice and creating further demand for improved service delivery.

E-business (Action Line C7.2)

Winner: Ministry of Education, Saudi Arabia

Saudi Arabia's Ministry of Education has implemented the Financial and Administrative Resources Information System (FARIS) project to handle all its financial, supply chain management and human resources functions. Based on the best standards and practices applied in governmental bodies, FARIS has made it possible to organize work, apply rules and regulations, limit expenses and integrate different functions between subsystems. Reporting information has become faster and more reliable, and the project facilitates the generation of a payroll for more than 700 000 employees.

E-learning (Action Line C7.3)

Winner: Abu Dhabi Systems & Information Centre, United Arab Emirates

The Abu Dhabi Systems & Information Centre's e-Citizen programme aims to bridge the digital divide in society by training people who lack the basic skills to use computers and the Internet to access e-services. The programme aims to train 10 000 citizens over an 8-year period, covering 70 per cent of the outlying areas of the Emirate, including 5000 inhabitants living 160 km off the main island. A large proportion of the population still does not have the appropriate skills to access the Internet to obtain information, products and services, and support e-learning. Besides giving government, businesses and citizens access to services, the programme will improve operational efficiency and boost the use of technology.

E-health (Action Line C7.4)

Winner: Centre for Development of Advanced Computing, Hyderabad, India

The Centre for Development of Advanced Computing's project, MObile based maTernal HEalth awaReness (MOTHER), is a mobile-based application that directly targets pregnant

Mohammed Bin Rashid Smart Learning Programme/United Arab Emirates

E-learning | United Arab Emirates

women. Focusing on women who are illiterate or living in rural communities, MOTHER provides voice calls in regional languages to mothers to raise awareness about pregnancy-related health matters, or to give personalized advice based on their critical health parameters.

Timely availability of critical information to pregnant women contributes significantly to reducing maternal mortality rates and infant mortality rates. In the pilot project, 35 121 voice calls have so far been made to 3505 beneficiaries. Eekala Eeshawaramma, from Andhra Pradesh, has an 11 month old child and has registered her mobile number with MOTHER in order to receive voice alerts related to child health, nutrition and immunization. "I receive calls as per the growth stages of my child. One day, I received a call from MOTHER on how and what to feed my child and about the scheduled immunization. My sister-in-law lifted the phone and listened to the advice about immunization and explained it to me. I then realized that it was time for my child's immunization. We then spoke to our health worker and got the immunization done," she explains.

"Winning the prize for the MOTHER tool is a great recognition for a simple tool that has brought about complex transformation in the lives of its users," says B. Vijayalakshmi, Principal Technical Officer, Centre for Development of Advanced Computing.

E-employment (Action Line C7.5)

Winner: Egypt Information and Communications Technology Trust Fund

The Egypt Information and Communications Technology Trust Fund's Youth Employment Generation programme responds to the urgent need to address prevailing youth unemployment in Egypt. Business leaders say that youth often lack the skills required by different industries operating in Egypt. The programme aims to improve the competitiveness and profitability of local micro, small and medium enterprises. Its social entrepreneurship component inspires youth to be champions leading their businesses. The vocational training and internship component connects private companies with youth joining the job market.

In addition to implementing a web presence, the project has enabled knowledge-sharing mobile services. Through awareness sessions, the programme emphasizes the importance of using ICT services. It provides training sessions (including remote e-training) on such topics as web page creation, networking and e-marketing.

E-environment (Action Line C7.6)

Winner: İSKİ, Turkey

İSKİ's project on Use of Information Technology for Water and Wastewater Analysis aims to monitor and improve the quality of water in Istanbul by facilitating exchanges between field work and laboratory work. Many different information technology tools are used, from mobile phones to specific applications, to collect reliable data on water quality. By combining the use of ICT with environmental research, the project has been able to collect a wide range of data over different time periods, analysing samples from 350 to 400 different locations every day and producing about 50 reports on water quality, essential both for health and protection of the environment.

E-agriculture (Action Line C7.7)

Winner: Ministry of Agriculture, Livestock and Fisheries, Uruguay

The *Sistema Nacional de Información Ganadera* project of Uruguay's Ministry of Agriculture, Livestock and Fisheries traces bovine cattle within the country to make the activities of livestock producers easier. A database has been created, and a geographic information system is used to facilitate the collection of data on location and species. The database has increased confidence in the country's food supply. The project also provides expertise in agricultural maters. It has contributed to integrating rural areas in the country's ICT network and has enhanced agricultural production.

E-science (Action Line C7.8)

Winner: Kuwait University

The Remotely Operable Scanning Electron Microscope is a project launched in 2008 by the Electron Microscopy Unit in the Faculty of Science at Kuwait University. To counteract decreasing interest in scientific studies, the project gives students easy and affordable access to electron microscope technology. The microscope is controllable via the Internet, through a user-friendly IT tool. Students are thus able to remotely observe materials through a microscope, on their screens, at no cost. "When I applied to enter the WSIS contest I was aiming to introduce an idea that will be of a global interest and solve a global problem, namely to encourage youth to study basic sciences such as chemistry, biology, physics, geology, and other related disciplines," says Ali Bumajdad, Kuwait University.

Cultural diversity and identity, linguistic diversity and local content (Action Line C8)

Winner: Cubarte, National Centre of Informatics in Culture, Cuba

Cubarte, the Portal of Cuban Culture, is a project launched by Cuba's National Centre of Informatics in Culture. The aim of Cubarte is to preserve Cuban culture by promoting its most relevant and popular aspects, as well as its most authentic, unknown and identity-related aspects.

The portal is being developed in three languages (Spanish, English and French) and provides information on topics such as fine arts, heritage, community projects and artistic teaching. Cubarte gives access to more than 600 Cuban cultural websites, providing information both on Cuban culture and on future cultural events.

Philmon Press P.L.C./Ethiopia

Media | Ethiopia

Media (Action Line C9)

Winner: Philmon Press PLC, Ethiopia

InfoTech is a 40-minute magazine-style technology television programme created by the company PHILMON PRESS PLC and aired in collaboration with the Ethiopian Radio and Television Agency on the ETV3 channel nationally, and globally via Nilesat satellite.

The show is dedicated to helping Ethiopian audiences use and understand technology to simplify their lives, whether at home or at work. It comprises news, conversations with experts, and programmes about computers, technology and the Internet. It also offers product reviews, tips and tricks, technical support and how-to demonstrations. Most importantly, the show is jargon-free and presented in the Ethiopian national language, Amharic. InfoTech uses education as a prime tool to change state of mind and priorities, working towards future economic growth based on knowledge.

International and regional cooperation (Action Line C11)

Winner: Ministry of Higher Education, Scientific Research and Information and Communication Technologies, Tunisia

The international event, ICT4ALL, is part of the follow-up of the WSIS outcomes and Tunis Agenda recommendations of 2005. Established in 2006 by Tunisia's Ministry of Higher Education, Scientific Research and Information and Communication Technologies, ICT4ALL supports international efforts to increase cooperation in an inclusive approach to reducing the digital divide. ICT4ALL targets African and Arab countries, offering a platform to address fundamental challenges in achieving the United Nations Millennium Development Goals (MDGs) and WSIS action lines.

Poland's journey towards the information society

Poland's *Digital Lighthouse Keepers* project, *Digital School* project and *Women and Girls in ICT* project are just a few of the country's initiatives highlighted in its 10-year country report on the implementation of the World Summit on the Information Society (WSIS) outcomes.

The report was presented to the WSIS+10 High-Level Event held in Geneva in June 2014.

The report is a contribution to the WSIS process and provides an extensive overview of Poland's dedication to implementing the WSIS action lines.

These global action lines were agreed a decade ago, with a view to boosting the development of the information society. Now available to the broad WSIS community, Poland's country report was put together after far-reaching public consultations, which provided cross-cutting input

Poland/UKE

from a variety of stakeholders, including public administration institutions, the telecommunications and postal market regulator, and academia.

Development path

In 2012, *The Economist* described Poland as "one of the world's great development success stories of the past two decades". The country report makes a case for that. A huge part of the economic transformation that Poland underwent as a result of the democratic and pro-competitive transformation process is in fact a history of how information and communication technologies (ICT) have gradually reshaped Poland to become an ICT regional leader.

From being a country with a considerable digital divide and one of Europe's lowest broadband infrastructure roll-out levels, Poland has advanced to become a long-term evolution (LTE) technology leader with a consistent vision of development. In 2013, Poland hosted the Global Symposium for Regulators. The development path has not been easy.

Synergies

Implementing the WSIS action lines represents a challenge for many. But if these actions are taken sustainably, they bring about unique outcomes in the form of synergies between many different areas of activity. In that context, Poland can be considered as a model for how national strategies and programmes all work together to form a platform for a modern Internet-based economy, recognized globally for its achievements.

What are these achievements? Just to give an example, between 2006 and 2013 the number of Poles with access to the Internet doubled, and 3G network coverage went through the roof — reaching 96 per cent by 2012, up from less than 20 per cent in 2008. In addition, Poland achieved swift digital switch-over, and adopted market-friendly regulations, smartly combining the European Union's *acquis* (the body of common rights and obligations which bind all the Member States together within the European Union) with a country-specific perspective. Poland also has a resilient and active national regulatory authority that responds in a timely manner to the market's needs.

With all of that, Poland is now on the verge of getting every citizen ready to go online.

Light a lighthouse

"Do something global locally" is the motto of Poland's digital lighthouse keepers — local volunteers who make their way daily to people aged 50 years or more to assist them in taking their first steps in using the Internet. You could say that giving first-hand advice on basic computer literacy is hardly, in itself, a digital activity. Yet it is in the very spirit of WSIS: activating individuals to network, so that a global change takes place.

Just recently (in May 2014), the vibrant Digital Lighthouse Keepers initiative spawned an interesting follow-up that aims to further activate people aged 50 years or more — the Light a Lighthouse campaign. This started at the Digital Poland Congress, held in Warsaw, a massive social media event designed to reach elderly people to show them that the Internet is a great tool and a friendly environment in which to stay active and connected. This again is an activity that is modest in form, but that is increasingly becoming high-profile because of its smart targeting.

A record of Polish digital history could list many more examples of this kind, to inspire even those who think that their country has nothing more to wish in regard to the information society.

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GEM-TECH Awards 2014

ITU and UN Women have launched a new global annual technology award for individuals or organizations that demonstrate a commitment to advancing gender equality and women's empowerment through information and communication technologies.

ITU Member States, Sector Members, Associates and Academia, including universities and their associated research establishments, are invited to become GEM-TECH award sponsors and hence champion this new initiative.

"This new award will provide much-deserved global recognition for some of the many outstanding gender champions — both female and male — who are driving exciting, innovative and effective information and communication technologies and gender initiatives," says ITU Secretary-General, Dr Hamadoun I. Touré.

"Information and communication technologies can — and should — be a game-changer for girls and women around the world, providing them with avenues for empowerment and for exercising their rights," says UN Women Executive Director, Phumzile Mlambo-Ngcuka. "We must be deliberate in making this happen, and these awards celebrate those that are leading this charge."

Seven award categories

Seven winners will be chosen for the Gender Equality and Mainstreaming — Technology (GEM-TECH) Awards 2014 — one from each of the following categories:

1. Information and communication technology applications, content, production capacities and skills for women's

social and political empowerment, and women's empowerment linkages with sustainable development.

2. Information and communication technology applications, content, production capacities and skills for women's economic empowerment and poverty reduction.
3. Promoting women in the information and communication technology sector — initiatives aimed at attracting, retaining and promoting women within the information and communication technology sector and into decision-making positions (private and public sector).
4. Enabling girls to become information and communication technology creators — initiatives aimed towards providing girls with an opportunity to become not just active users but also creators of information and communication technologies and content.
5. Closing the information and communication technology gender gap — ensuring information and communication technology accessibility for women, such as digital literacy training and ensuring affordable and meaningful access by women to information and communication technologies. Also, initiatives aimed at measuring the information and communication technology gender gap, including research and data on women's engagement with information and communication technologies and their impact.
6. Efforts to reduce threats online, and building women's confidence and security in the use of information and communication technologies.
7. Information and communication technology and broadband strategies, policies and frameworks that promote women's digital empowerment.

These awards will be the first outcome of a new Memorandum of Understanding between ITU and UN Women, providing for increased cooperation between the two agencies in such areas as improving women's access to, and engagement with, information and communication technologies, including policy-making, and promoting the power of these technologies in future United Nations priority action areas, including the post-2015 framework for sustainable development. The 2015 GEM-TECH awards will celebrate the 20-year anniversary of the UN Beijing Platform for Action.

Who can nominate?

GEM-TECH awards are open to individuals and organizations from government, the private sector, civil society, international organizations and academia. ITU Member States, Sector Members, Associates and Academia are invited to nominate candidates for the award. ITU encourages men and women working in the information and communication technology sector to nominate their colleagues — or themselves.

Award ceremony

The awards will be presented by ITU Secretary-General, Dr Touré, and UN Women Executive Director, Ms Mlambo-Ngcuka, as part of a day-long programme of activities around gender issues, during ITU's Plenipotentiary Conference to be held in Busan, Republic of Korea from 20 October to 7 November 2014. Winners will be invited to travel to Busan to accept their award and to join a global celebration.

Why promoting gender matters

GEM-TECH awards will boost implementation of Resolution 70 (Rev. Guadalajara, 2010) on "Gender mainstreaming in ITU and promotion of gender equality and the empowerment of women through information and communication technologies". They will also give visibility to the work being carried out under the United Nations System-wide Action Plan (UN-SWAP) on gender equality and women's empowerment. UN-SWAP is

a UN system-wide accountability framework designed to measure, monitor and drive progress towards a common set of standards to which to aspire and adhere for the achievement of gender equality and the empowerment of women. It applies to all entities, departments and offices of the United Nations system.

Statistics recently disclosed by major tech companies, including Google, Facebook, Yahoo and LinkedIn, show that women occupy less 20 per cent of tech jobs, with the percentage of women in leadership roles not much better — reflecting a global lack of women coming into the ICT field. On the government side, there are still only 16 women ministers out of the 193 ITU Member States, and only 10 of the 160 independent ICT regulatory authorities worldwide are headed by a woman.

Doubling Digital Opportunities: Enhancing the Inclusion of Women & Girls in the Information Society, a report released in September 2013 by the Broadband Commission for Digital Development Working Group on Gender, revealed a significant and pervasive gender divide in broadband access between men and women. Worldwide, there are an estimated 200 million fewer women than men online, and this gap could grow, if remedial action is not taken. Based on extensive research from United Nations agencies, Broadband Commission members and partners from industry, government and civil society, the report provided the first comprehensive global snapshot of broadband access by gender.

UN Women, the lead United Nations agency on gender equality and women's empowerment is pursuing the use of ICT in all areas of its work. Results can already be seen in: combating violence against women through mobile apps that map unsafe spaces; improving access to employment, markets and financing through digital literacy and skills development, information systems and online banking; promoting knowledge and training opportunities through the Knowledge Gateway on Women's Economic Empowerment; and increasing women's political participation and advocacy by mobilizing social media.

Girls in ICT Day

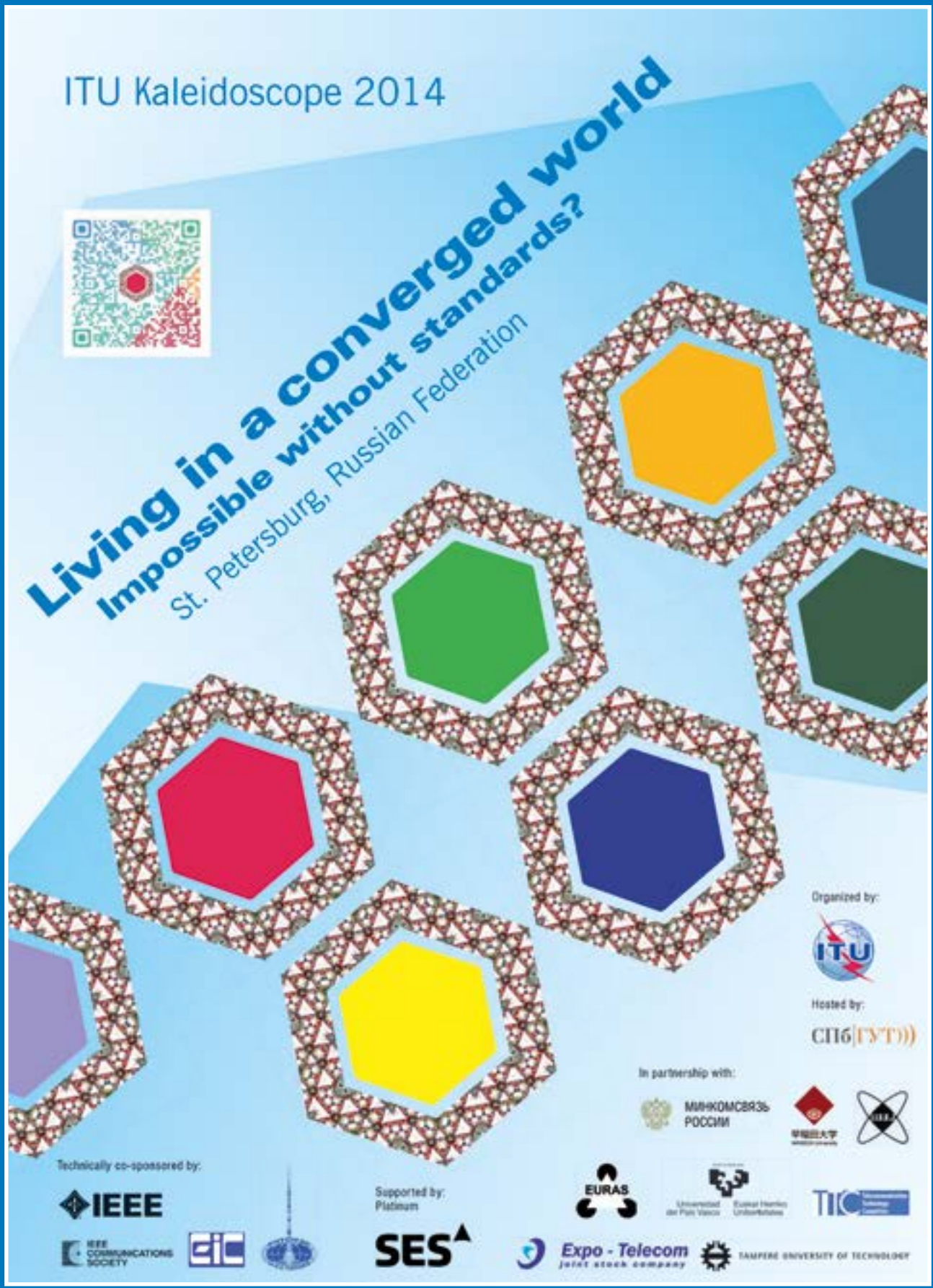
ITU is already active in the field of gender and technology, particularly through its global Girls in ICT Day event, which takes place annually on the fourth Thursday in April, raising awareness of the advantages and opportunities offered by tech careers to a new generation of girls and young women.

ITU estimates a global skills shortfall of over two million ICT jobs in the coming ten years. With digital technologies now pervading every business sector, girls and young women who learn coding, apps development and computer science will have a significant advantage over their non-tech-trained peers, regardless of the field they eventually choose to work in. "Empowering girls and young women to fulfil their potential through information and communication technologies will benefit not only young women and girls themselves, but entire societies and their economies", says Dr Touré.

Basic computer skills empower more than one million women

In March 2014, the ITU Women's Digital Literacy Campaign reached its initial goal of training one million women in basic computer skills and modern ICT applications to improve their livelihoods. The campaign, launched in April 2011 by ITU in partnership with the Philippine-based non-governmental organization Telecentre.org Foundation, benefits from the combined reach of the Foundation's global network of 100 000 telecentres and ITU's 193 Member States and 700 Sector Members.

To reach the one-million mark, some 20 000 Telecentre.org Foundation outlets in countries around the world each provided training to at least 50 women. ITU contributed curricula developed by its Telecommunication Development Bureau (BDT).


ITU Kaleidoscope 2014
Living in a converged world
Impossible without standards?
St. Petersburg, Russian Federation
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Kaleidoscope 2014 participants at Bonch-Bruevich *Saint-Petersburg State University of Telecommunications, Russian Federation, with Malcolm Johnson (centre, left), Director of the ITU Telecommunication Standardization Bureau*

ITU Kaleidoscope Academic Conference 2014

Living in a converged world — impossible without standards?

The all-encompassing nature of technological and industrial convergence calls for a multidisciplinary approach to standards. The ITU Kaleidoscope Academic Conference 2014, held in Saint Petersburg, Russian Federation, from 3 to 5 June 2014, therefore approached the topic "Living in a converged world — impossible without standards?" from a variety of perspectives. The conference was held at the invitation of the Ministry of Communications and Mass Media, and hosted by the *Bonch-Bruevich* Saint-Petersburg State University of Telecommunications.

Information and communication technologies (ICT) are increasingly converging with different industries and social sectors. This is evidenced daily by innovations such as e-health, intelligent transport systems, smart grid, mobile money and smart water management.

The need for standards to enable interoperability and compatibility has never been more apparent. In future

it will be difficult to find an industry or socio-economic activity that does not rely on the common backbone provided by ICT. This places huge demands on ICT standardization.

Keynotes

Keynote speeches shared insight into the potential of nanoscale communications, and developments in cloud computing and sensor networks. Professor Ian F. Akyildiz (Broadband Wireless Networking Lab at the School of Electrical and Computer Engineering, Georgia Institute of Technology, United States) talked about the Internet of Nanothings. Y. Koucheryavy (Tampere University of Technology, Finland) expanded on experimental biology and molecular communications, while Antonio Puliafito and Maria Fazio (University of Messina, Italy) presented the pros and cons of data-centric versus device-centric cloud services for resource monitoring.

Nanonetwork communication

"Nanotechnology is providing a new set of tools to the engineering community to design nanoscale components with unprecedented functionalities," observes Professor Ian F. Akyildiz. He explains that networks of nanomachines (nanonetworks) will enable a plethora of applications in the biomedical, environmental and industrial fields, among others, once a way is found to enable these machines to communicate.

A new wireless technology is needed to respond to this challenge, because simply miniaturizing classical antenna would impose the use of very high radiation frequencies, compromising the feasibility of electromagnetic nanonetworks. Professor Akyildiz is therefore working on graphene-enabled electromagnetic communication.

The results of modelling and analysis point to the terahertz band (0.1–10 THz) as the frequency range of operation of novel graphene-based plasmonic nanoantennas. Further work has led to the development of a novel channel model for terahertz band communication, taking account of the channel capacity of this unregulated frequency band. New communication mechanisms are also being developed for electromagnetic nanonetworks, including modulation based on the transmission of femtosecond-long pulses, low-weight codes for channel error prevention, a symbol detection scheme at the nanoreceiver, an energy model for self-powered nanomachines with piezoelectric nanogenerators, and a medium access control protocol tailored to the terahertz band. Finally, a one-to-one nanolink is emulated to validate the proposed solutions.

In the imaginary world of Kaleidoscope's Jules Verne's corner, pheromones act as carrier substances in nanonetworks, enabling electromagnetic or molecular communications between human beings.

Invited papers

Three invited papers covered the role of software-defined networking and network virtualization in the transition to Internet protocol version 6 (IPv6), the accessibility of broadcasting and broadband technologies to the elderly and persons with disabilities, and the workings of the world of ICT standardization.

"A Software Defined Approach to Unified IPv6 Transition" was presented by Kevin Hu (Huawei Technologies, China). Christoph Dosch (ITU–R Study Group 6 Chairman; IRT GmbH, Germany) spoke about creating more inclusive communications, presenting "Conversion of Broadcasting and Broadband Internet — A benefit for people with disabilities (and for us all)". In "Standardization: A primer", Ken Krechmer (University of Colorado, United States) offered an insider's view into ICT standardization processes.

State of the art

A technical programme committee composed of more than 100 ICT experts from academia, research institutes and the private sector evaluated 98 papers submitted by authors from 39 countries. Of these, 34 papers were selected for publication and presentation.

The research results relate to various ITU activities, such as quality of service, cybersecurity, digital identity, future networks, cloud computing, radio-frequency identification (RFID) technology, optical wireless networks, accessibility, sensor networks, multimedia applications, open data, e-health, emergency communication networks, and standards education. A number of papers address specifically radio-related matters, in particular third-generation (3G), fourth-generation (4G) and fifth-generation (5G) mobile communications and their impact on spectrum.

Prize-winners

The authors of the three winning papers shared a prize of USD 10 000 offered by SES (Luxembourg):

- 1st prize (USD 5000): "Towards converged 5G mobile networks — Challenges and current trends" by Anna Wielgoszewska (Zakrzewska), Sarah Ruepp and Michael S. Berger (Technical University of Denmark). Anna Wielgoszewska (Zakrzewska) is now with Bell Labs Ireland.

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Authors of the three winning papers of Kaleidoscope 2014 (from left to right): Ved P. Kafle; Anna Wielgoszewska (Zakrzewska); and B. Spyropoulos

- 2nd prize (USD 3000): "Dynamic mobile sensor network platform for ID-based communication" by Ved P. Kafle, Yusuke Fukushima and Hiroaki Harai (NICT, Japan).
- 3rd prize (USD 2000): "Combining ICT-standards essential-patents and medical-managerial guidelines towards sustainable assisted-living and home-care" by B. Spyropoulos (Technological Educational Institute of Athens, Greece).

Young Author Recognition Certificates were awarded to: Anna Wielgoszewska (Zakrzewska); José Vinícius de Miranda Cardoso (Federal University of Campina Grande — UFCG, Brazil); Veronica Rojas Mendizabal (CICESE Research Center, Mexico); Megi Medzmariashvili (Lund University, Sweden); Beny Nugraha (Mercu Buana University, Indonesia); Eduardo Saiz (University of the Basque Country, Spain); Fan Bai (Waseda University, Japan); and Nikolay Suschenko and Alexander Lutokhin (Federal State Unitary Enterprise Radio Research and Development Institute, Russian Federation).

ITU academia members

Representatives of ten ITU academia members presented their research work as part of the conference programme, and some of them have expressed an interest in contributing to the work of ITU–T study groups. For example, the University of Rome Tor Vergata, Italy, intends to submit a contribution to the next ITU–T Study Group 17 meeting, based on "Global convergence in digital identity and attribute management: Emerging needs for standardization", a paper presented by Maurizio Talamo and Daniela Merella. The University of the Basque Country, Spain, has already made a contribution to ITU–T Study Group 11, based on "Global standards, the key enablers for deploying next-generation emergency communications networks", a paper presented by Fidel Liberal. This paper proposes an emergency inter-networking system capable of connecting existing first responder communication systems and enabling the integration of next-generation mobile networks. Work has also been carried out on a *"Unified methodology of Internet speed quality measurement usable by end-users on the fixed and mobile networks"*, thanks to a contribution from the University of the Basque Country. Takuro Sato, from Waseda University, Japan, one of the authors of a poster on "Content distribution in information-centric networks: Economic incentive analysis in game theoretic approach", hopes that his research results will be reflected in international standards within the scope of ITU–T Question 15/13.

Read more about it

All papers presented at the conference are included in the Conference Proceedings and are freely available for download on the Kaleidoscope 2014 web page (http://www.itu.int/en/ITU-T/academia/kaleidoscope/2014/Pages/default.aspx).

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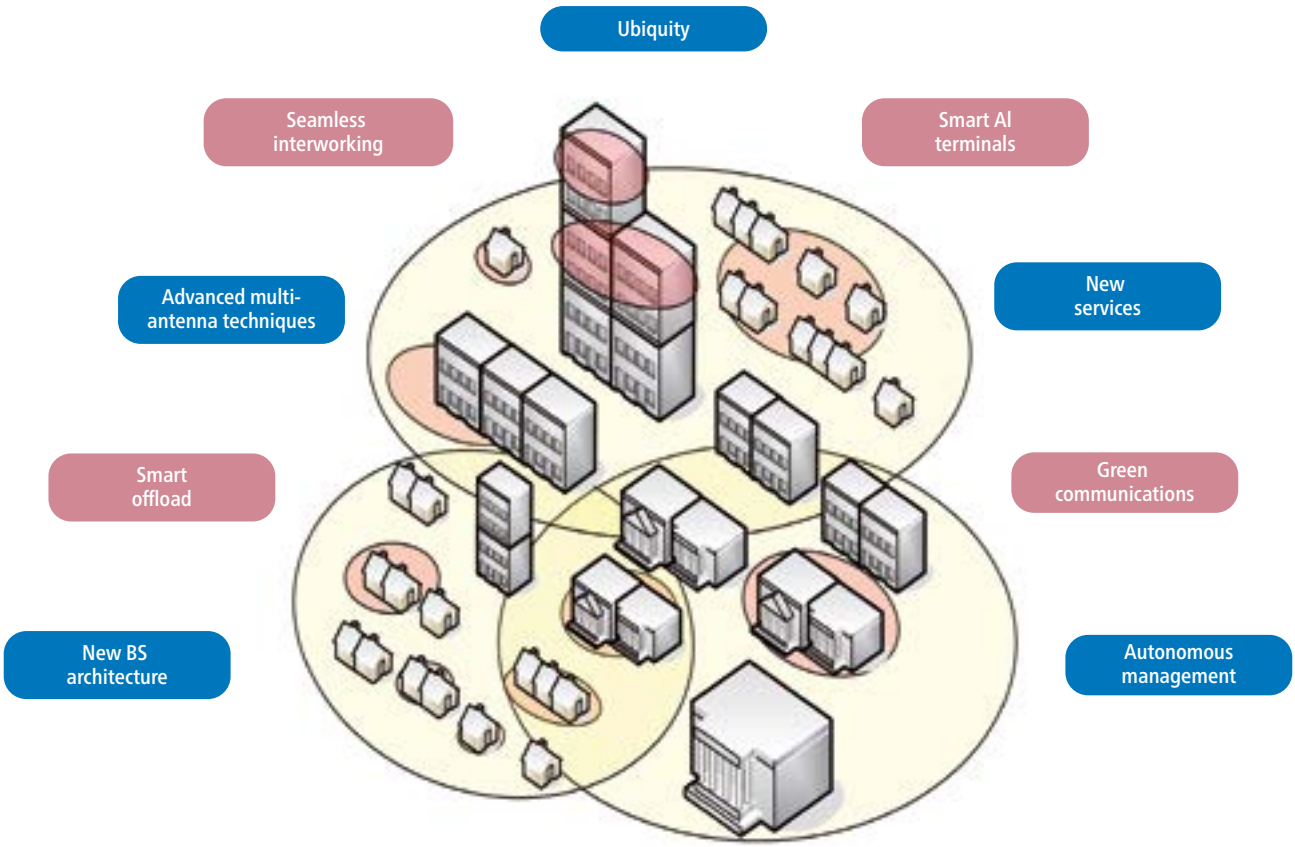
Towards converged 5G mobile networks — Challenges and current trends

"Towards converged 5G mobile networks — Challenges and current trends", a paper by Anna Zakrzewska, Sarah Ruepp and Michael S. Berger of the Technical University of Denmark, won First Prize at the ITU Kaleidoscope Academic Conference 2014, held in Saint Petersburg, Russian Federation, on 3–5 June. This article presents some highlights adapted from the paper.*

Rapid development of wireless technologies coupled with standards convergence herald the emergence of fifth-generation (5G) wireless communication. Broadly speaking, 5G is expected to provide much greater capacity to meet growing user demand resulting from a number of new services compared to fourth generation (4G). The 5G system will however face new technical challenges, such as machine-to-machine communication, energy efficiency, complete ubiquity and autonomous management (see Figure).

* *Anna Wielgoszewska (Zakrzewska) is now with Bell Labs Ireland.*

Scenario characteristics of 5G



In their paper, the authors analyse new technologies that could enable 5G networking, discuss potential standardization and development directions, and present recent research efforts in the area of future mobile networks.

From here to there

Current technologies go far beyond the traditional telephony and basic data services that were offered by second-generation (2G) standards. Key features of future mobile networks include increased capacity, lower capital and operational expenditure, complete ubiquity provided by full multi-standard interworking, as well as spectrum and infrastructure sharing.

There has been continuous development of wireless communications since the early 1980s, when the first analogue mobile telephony systems emerged. Widely deployed 2G mobile networks introduced short message service (SMS) and data enhancement. The third-generation (3G) family of standards offers much higher data rates than its predecessors, enabling such services as video streaming or podcasting, and making data services more common.

Finally, Long Term Evolution-Advanced (LTE-A), based on orthogonal frequency division multiple access, and Institute of Electrical and Electronics Engineers (IEEE) 802.16m, better known as WiMax 2.0, are considered to be 4G technologies because they meet the requirements of ITU's Radiocommunication Sector (ITU–R) for International Mobile Telecommunications Advanced (IMT-Advanced) systems. They offer high data rates (peak throughput 100 Mbit/s and 1 Gbit/s in high and low mobility scenarios, respectively) and support a wide variety of dedicated applications from a rapidly growing market.
Day by day, wireless communications are becoming an integral part of society and, as a consequence, technological expectations are growing continuously.

One global unified standard for 5G mobile networks will allow seamless connectivity between existing standards, such as High Speed Packet Access (HSPA), LTE and Wireless Fidelity (Wi-Fi), and future wireless systems offering a wide variety of new multimedia services. Examples of emerging future applications include augmented reality and tactile Internet to provide a rich multimedia experience. Other examples are smart cities, driverless cars or advanced healthcare systems where patients can be instantly monitored at their homes.

5G requirements

The official requirements for 5G have not yet been defined but operators, vendors and academic institutions are already imagining possible scenarios. And the expectations are that 5G will provide uniform throughput of at least 1 Gbit/s, peaking at around 10 Gbit/s, with a couple of milliseconds of latency, offering highly reliable service. In Europe, the Mobile and wireless communications Enablers for the Twenty-twenty Information Society (METIS) consortium focuses on setting the foundation of 5G systems. It forecasts that 5G will provide a truly ubiquitous unlimited mobile experience through terminals enhanced with artificial intelligence capabilities. New applications are foreseen that will facilitate such domains as e-health and machine-to-machine communication.

From a network perspective, 5G requires tight and seamless interworking among existing and future standards. Rising demand for mobile traffic will enforce new ways of enhancing capacity, such as dense deployment of small cells, as well as intelligent traffic steering and offload schemes. Ever-growing energy consumption in wireless networks imposes new mechanisms of energy control and reduction. Finally, there is a need for autonomous network management because of network complexity and heterogeneity.

Machine-to-machine communication

Devices are becoming more powerful and more numerous. Beyond such devices as smartphones, tablets or game consoles, the future wireless landscape will have to serve cars, smart grid terminals, health monitoring devices, household appliances

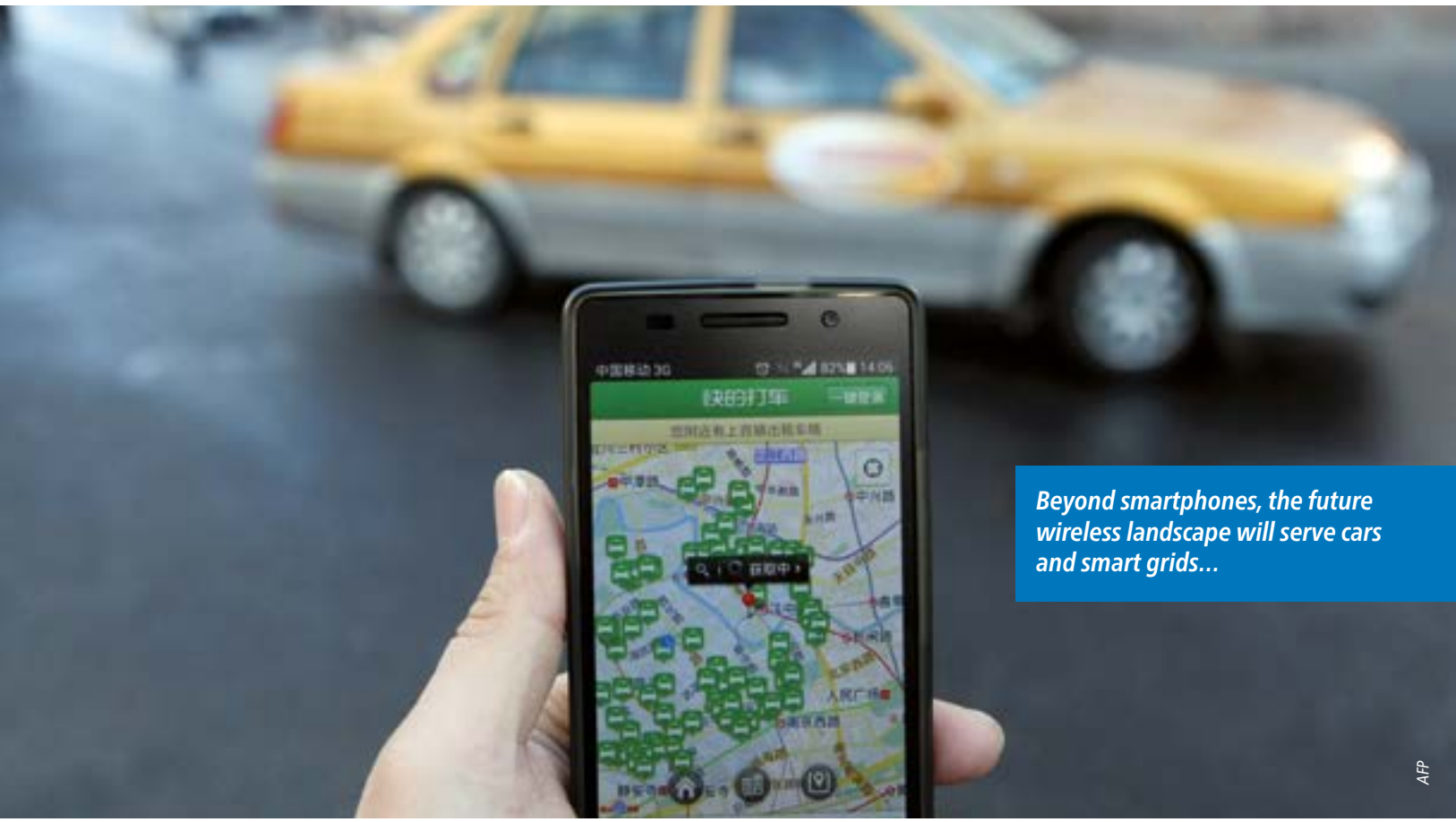
and so on. It is estimated that machine-to-machine traffic will increase 24-fold between 2012 and 2017.

Taking e-health as an example, remote patient monitoring using a body area network — where a number of wireless sensors, both on-skin and implanted, record the patient's health parameters and send reports to a doctor — will soon become a reality. Therefore, in order to offer e-health services, 5G will need to provide high bandwidth, meet stringent requirements for quality of service (such as ultra-low latency and lossless video compression) and implement enhanced security mechanisms. Work will be needed to manage radio resources efficiently, because of the diversity of traffic types, ranging from the reports sent periodically by the meters, to high-quality medical video transmission.

Capacity crunch

With the new broadband services and high demand for mobile data, future wireless systems will require much higher capacity than can be provided today. There are three main ways of enhancing capacity, namely dense deployment, additional spectrum bands and higher spectral efficiency.

The spectrum used by mobile communication systems today is becoming congested. One novel idea is to use visible light bands, where light-emitting diodes (LEDs) can be both a source of illumination and a hot spot. Because of its local character, this technology would improve indoor data coverage in general, and offer greater security and privacy than radio



Beyond smartphones, the future wireless landscape will serve cars and smart grids...

AFP

communication. But the technology is not yet mature.

The very high spectrum bands (such as 28 or 60 GHz) have enormous potential because they can provide wider bandwidth and support higher data rates. Also, the use of unlicensed spectrum around 2.4 and 5 GHz, as well as refarming the 900 and 1800 MHz bands, could also increase the spectrum available for broadband data. Furthermore, it is expected that new bands will become available after the World Radiocommunication Conference in 2015. But new spectrum bands alone will not be sufficient to satisfy future traffic demands, so spectrum efficiency will have to be increased. Multiple access schemes exploiting non-orthognality and multi-antenna techniques, together with spectrum sharing, are the key enablers to achieving higher spectral efficiency.

Finally, further network densification is a means to address the challenge of the traffic growth in mobile networks. Introducing small cells, such as metrocells, picocells, and femtocells, is a cost-effective solution to further increase network capacity. This solution has demonstrated its great potential — the number of small cell sites deployed worldwide has already surpassed the number of macrocells.

Core network virtualization

Moving towards 5G will impose changes not only in the radio access network but also in the core network, where new approaches to network design are needed to provide connectivity to a growing number of users and devices.

The trend is to decouple hardware from software and move network functions towards software. Software-defined networking, which is being standardized by the Open Networking Foundation, assumes separation between control and data. Consequently, thanks to centralization and programmability, configuration of forwarding can be greatly automated.

Standardization efforts aiming at defining network function virtualization are being conducted by multiple industrial partners, including network operators and equipment vendors within the European Telecommunications Standards Institute (ETSI). Introducing a new software-based solution is much faster than installing an additional specialized device with a particular functionality.

Both solutions would improve network adaptability and make it easily scalable. With simpler operation, new network features are likely to be deployed more quickly.

Summary

Various technologies will complement each other to reach the common goal of providing ubiquitous service through 5G mobile networks. Clearly, there is an enormous potential in exploiting higher frequency spectrum bands, multi-antenna techniques and small-cell development, followed by schemes that support machine-type communication and reduce power consumption in mobile networks. Wi-Fi has great potential as a supportive access technology — and software-based solutions will play a major role in core networks.

Most of the concepts that the authors present in their paper are in the early stages of development. In the next decade, significant research and standardization efforts will be needed to meet the new network requirements and challenges of 5G. As a result, one can expect a converged network to offer a wide variety of new services in an energy-efficient manner. And convergence of standards will provide truly ubiquitous access, creating a fully integrated wireless future.

Healthcare sensors can read blood pressure, insulin level, and heart or lung conditions and transmit data via wireless communications

AFP

Dynamic mobile sensor network platform for ID-based communication

"Dynamic mobile sensor network platform for ID-based communication", a paper by Ved P. Kafle, Yusuke Fukushima and Hiroaki Harai of the National Institute of Information and Communications Technology, Tokyo, Japan, won Second Prize at the ITU Kaleidoscope Academic Conference 2014, held in Saint Petersburg, Russian Federation, on 3–5 June.
This article presents some highlights adapted from the paper.

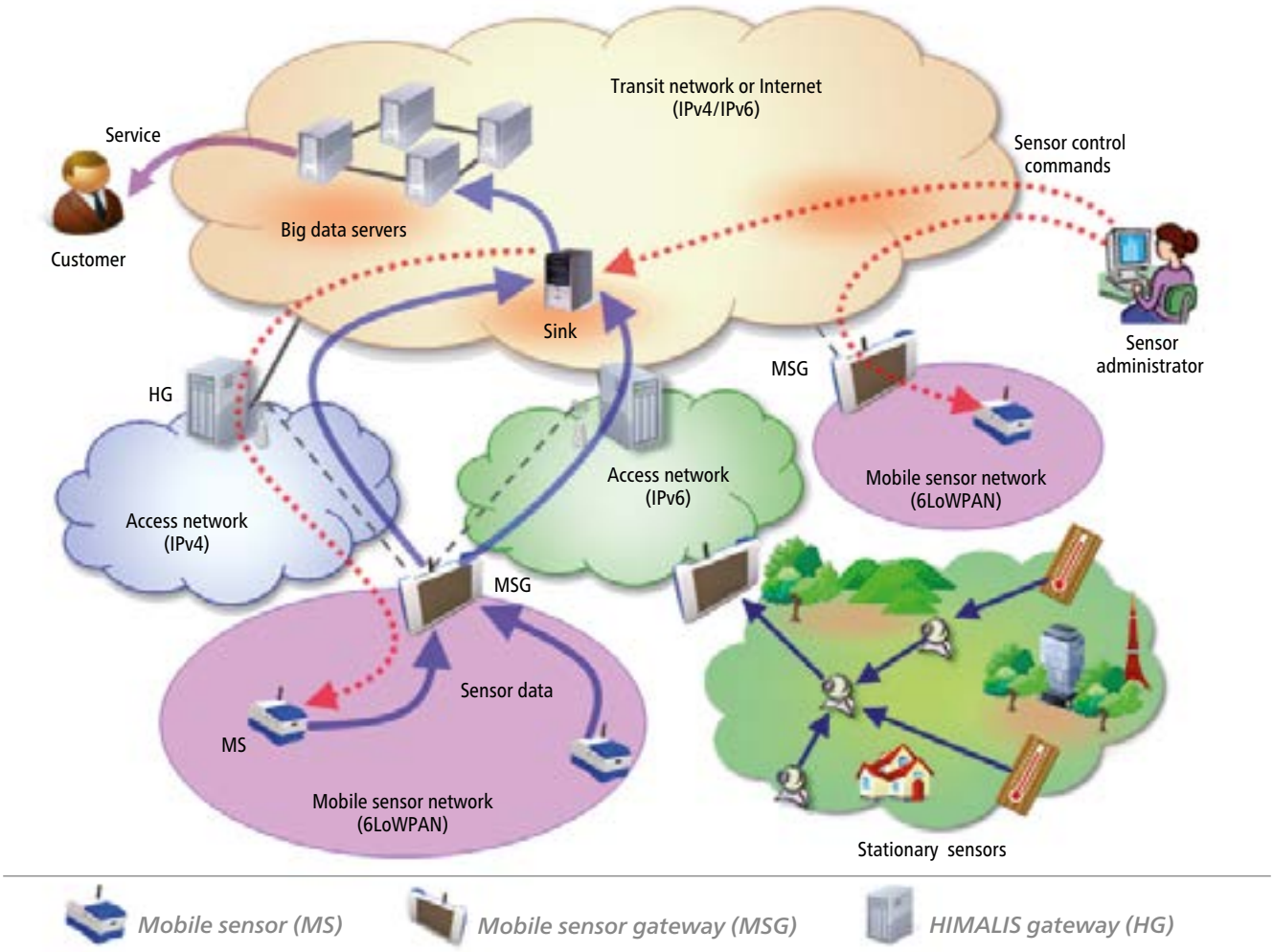
Examples of possible applications of the proposed dynamic mobile sensor network include health care and the automatic monitoring and registration of patients when they visit hospital. Because the proposed platform easily supports the addition of new sensor modules, healthcare sensors can be added to read human body parameters such as blood pressure, insulin level, and heart or lung conditions.

Mobile sensors and mobile sensor gateways

Different types of sensors are available for sensing physical events and transmitting sensor data through wireless communications. But most of the current sensor networks are application-specific and static. They cannot easily be adapted to different networking environments or applications because their networking protocols and applications (for example, ZigBee) are pre-installed as a package.

In their paper, the authors present a design for a dynamic mobile sensor network platform, consisting of mobile sensors, mobile sensor gateways, and sink servers. Figure 1 shows the components of the dynamic mobile sensor network platform. The mobile sensor network is connected to one or more access networks via the mobile sensor gateways. Mobile sensors and mobile sensor gateways can support different network-layer protocols, for example, IPv4, IPv6, or 6LoWPAN — whatever is available in their surrounding access networks. The mobile sensor network is monitored and controlled remotely by a sensor administrator using control commands.

Figure 1 — Components of the proposed dynamic mobile sensor network platform



To reliably provide sensor data irrespective of location, the mobile sensors and mobile sensor gateways carry out authentication for network access and ensure the security of data transport. Users can freely install new applications and configure the sensor network to operate in light-weight or full-function modes depending on the application requirements or available networking environments.

Some components of the proposed sensor network platform are already in the standardization process in ITU, notably in Study Group 13 of the Telecommunication Standardization Sector (ITU–T) while others could be submitted for standardization in the near future.

ID-based communication

The proposed dynamic mobile sensor network platform uses newly assigned, location-independent, static IDs, rather than Internet protocol (IP) addresses or locators. The authors call this "ID-based communication". The platform design applies the ID/locator split protocol stack developed for Heterogeneity Inclusion and Mobility Adaptation through Locator ID Separation (HIMALIS).

Because ID-based communication does not use locators that depend on the network layer protocol, it can take place between different network-layer protocols. ID-based communication allows locators present in packets to be changed as the packets traverse different network segments. It also survives even when the communicating endpoints change their locators. Thus, the proposed dynamic mobile sensor network platform natively supports mobility of not only mobile sensors, but also of mobile sensor gateways or the sensor network as a whole.

The mobile sensor network platform includes inbuilt authentication and security mechanisms for identification of sensor nodes, their access control, registration and updating of ID/locator mappings in the name registry servers, name resolution, and mobility and multihoming management.

ID-based communication has already been accepted as an important approach to the design of future networks being standardized in ITU–T Study Group 13 — Recommendation ITU–T Y.3001 (2011), "Future networks: Objectives and design goals". The basic concepts of ID-based communication and ubiquitous sensor networks have been standardized through Recommendation ITU–T Y.3031 (2012), "Identification framework for future networks" and Recommendation ITU–T Y.2221 (2010), "Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment".

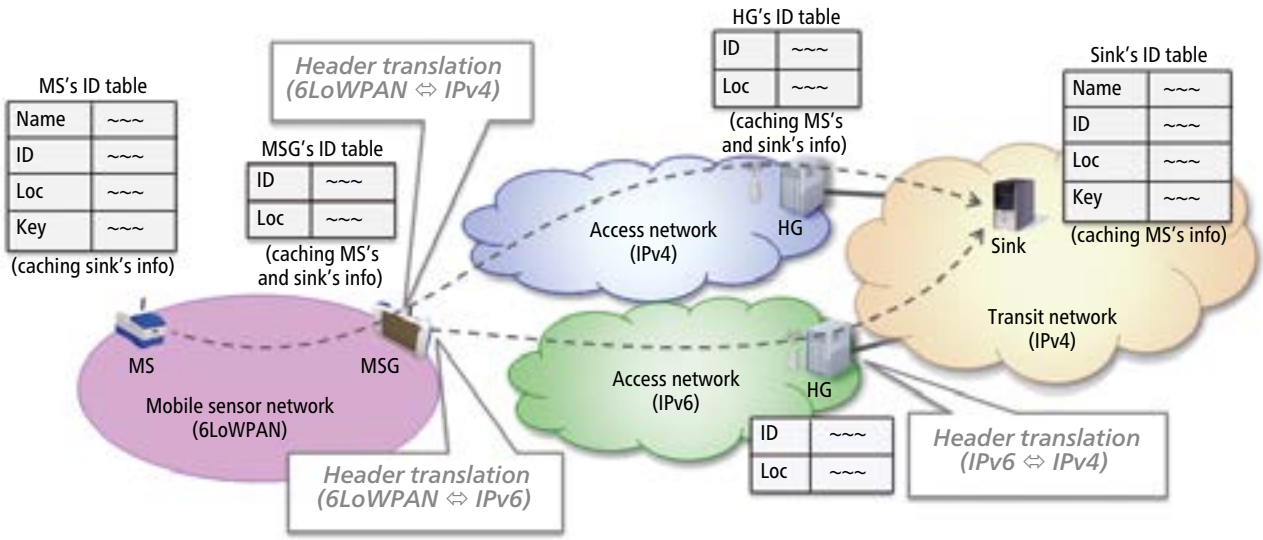
The authors of the paper suggest that other component technologies can be gradually brought to ITU for standardization. These include, for example, methods for supporting heterogeneous network protocols, detecting and managing mobility across heterogeneous networks, authentication and network access control, and interfaces between sensing and communication units.

Network functions

Network functions can be classified as either control plane or data plane. Control plane functions are used for network access control, mobility and multihoming management, and registering, retrieving and updating ID/locator mapping in name registries. The data plane uses information such as ID/locator mapping and security keys provided by the control plane to establish ID-based communication between the mobile sensor and the sink in order to transfer sensor data via the mobile sensor gateway.

To establish an ID-based communication session, the mobile sensor or the sink starts a communication initialization procedure, exchanging their IDs and locators, verifying each other's identity, and negotiating a shared secret key through handshake signalling. As shown in Figure 2, both the mobile sensor and the sink store each other's ID and locator, and the security key, in their ID tables. The sink's ID and locator are also stored in the ID tables of the mobile sensor gateway and the HIMALIS gateway so that they can translate the network protocol header of the sensor data packets traversing from the mobile sensor to the sink.

Figure 2 — ID-based communication across heterogeneous protocols



Mobile sensor (MS) | Mobile sensor gateway (MSG) | HIMALIS gateway (HG) | Locator (Loc)

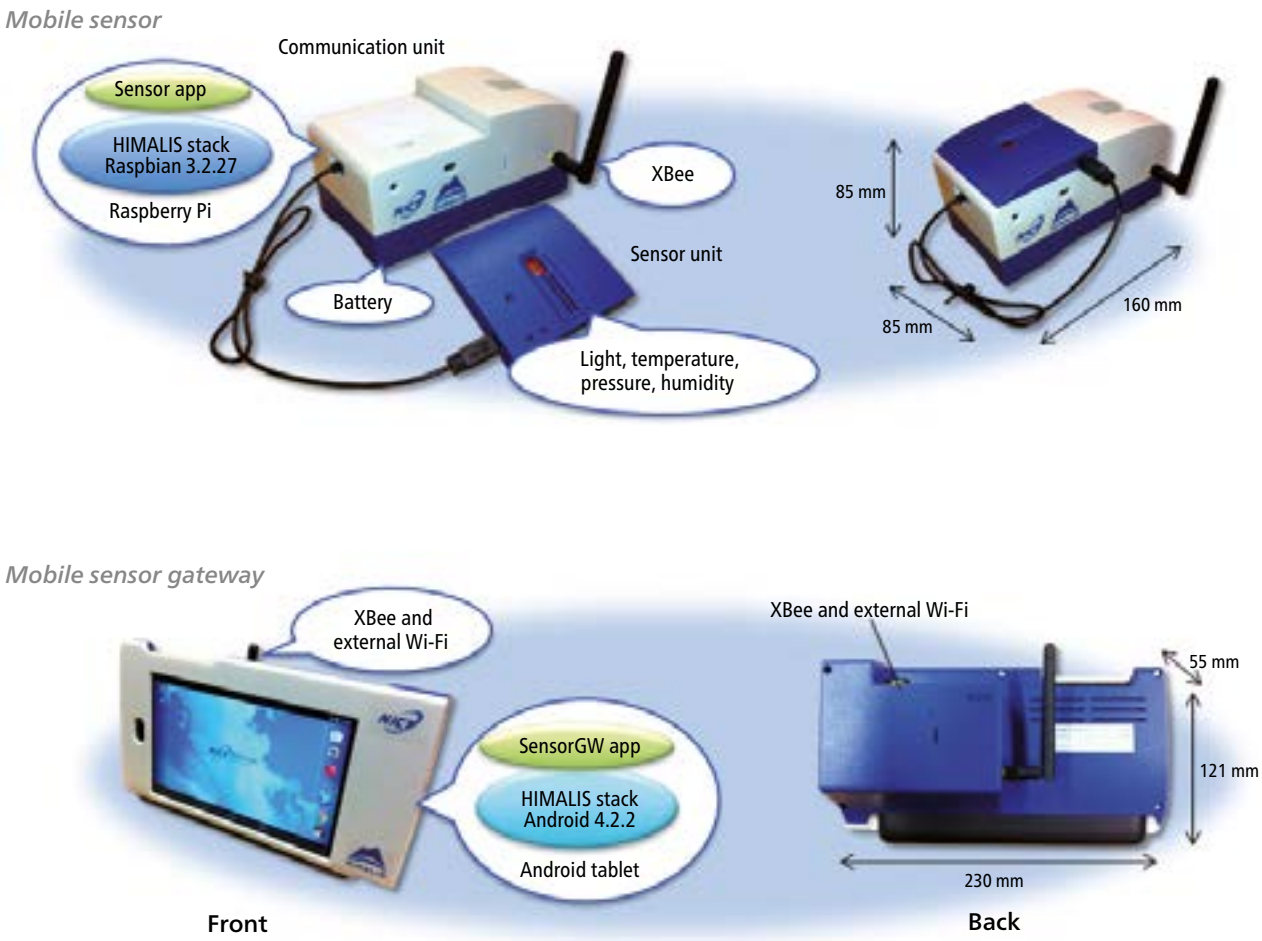
How the platform works

The components of the proposed dynamic mobile sensor network platform are implemented as illustrated in Figure 3, where the small oval shapes represent the software components. The mobile sensor, consisting of the sensor unit and the communication unit, currently has four sensors — for light, temperature, pressure and humidity. Other sensors can be added as required. The sensor unit is connected to the communication unit through a USB cable. The communication unit is composed of Raspberry Pi (Model B) and XBee S1 RF module. Raspberry Pi includes an ARM 1176JZF–S 700 MHz processor, 512 MB memory, 8 GB SD card storage, and Raspbian OS. The HIMALIS stack and the sensor application are installed on it.

The mobile sensor gateway has been implemented on a Nexus 7 Android tablet with specifications: NVIDIA Tegra 3 Quad-core 1.3 GHz processor, 1 GB memory, 16 GB storage, and Android 4.2.2 OS. An XBee RF module and an extra Wi-Fi interface are also attached to it externally. The HIMALIS stack and the sensor gateway application are installed on it.

The mobile sensor can generate sensor data at a preset sampling rate and transmit them to the sink. The mobile sensor gateway can add location information to the sensor data. A mobile sensor can transmit sensor data to one or more sinks through a mobile sensor gateway. Similarly, a sink can get sensor data from many mobile sensors. The relationship between the mobile sensor, the mobile sensor gateway and the sink can be controlled by the sensor administrator. The sensor administrator distributes mobile sensor identities and security keys

Figure 3 — Implementation overview



to the sinks. The ID-based communication sessions persist even when the mobile sensor, the mobile sensor gateway or the sensor network as a whole moves from one access network to another.

To enhance reliability and ensure seamless handover, the mobile sensor gateway can have two or more upstream links simultaneously connected to different access networks. To access sensor services, a user establishes an ID-based communication session with the sink. Alternatively, the sink can distribute the sensor data to storage servers that offer sensor application services.

Health care and automatic registration of patients when they visit hospital

Examples of possible applications of the proposed dynamic mobile sensor network include health care and the automatic monitoring and registration of patients when they visit hospital. Because the proposed platform easily supports the addition of new sensor modules, healthcare sensors can be added to read human body parameters such as blood pressure, insulin level, and heart or lung conditions. A patient carries the mobile sensor along with the mobile sensor gateway to continuously send the sensor data — irrespective of his or her location and mobility — to the sink where a self-healthcare application uses these data to evaluate the patient's health condition. In an alternative approach, the patient carries only the mobile sensor and uses the mobile sensor gateways carried by others or installed in homes or public places. In this case, the mobile sensor and the mobile sensor gateway will authenticate each other using the HIMALIS access control mechanism before enabling the mobile sensor to send data to the sink.

For the automatic monitoring and registration of patients when they visit hospital, patients carry mobile sensors and the hospital installs mobile sensor gateways at the entrance gates and in waiting rooms. When the patient enters the hospital premises, the mobile sensor accesses the sensor network through the mobile sensor gateway and sends the patient's body parameters to the sink server located in the hospital. The healthcare application running in the sink server evaluates the patient's condition based on previous and current sensor data, and distributes the result to the devices carried by the nurses and doctors so that they know in advance about the patient's arrival as well as current health condition.

The proposed dynamic mobile sensor network platform can also be applied to tracking mobile objects such as people, animals and vehicles. It can dynamically establish ID-based communications between sensors and sinks, which can be one-to-one or one-to-many or many-to-one. ID-based communications remain intact even when sensors or sinks move from one network to another.

The proposed dynamic mobile sensor network platform has been validated using a testbed network composed of Raspberry Pi, Android and Linux. ■

Longer life expectancy calls for the creation of a global homecare technology platform

AFP

ICT patents and home care

"Combining ICT-standards essential-patents and medical-managerial guidelines towards sustainable assisted-living and home-care", a paper by B. Spyropoulos of the Biomedical Engineering Department, Technological Educational Institute of Athens, Greece, won Third Prize at the ITU Kaleidoscope Academic Conference 2014, held in Saint Petersburg, Russian Federation, on 3–5 June. This article presents some highlights adapted from the paper.

Longer life expectancy and the increasing demand for accessibility for people with disabilities call for the creation of a global homecare technology platform. Such a platform should be based on common standards for information and communication technologies (ICT) so as to enable interoperability in home care and assisted living. Homecare technology should respect guidelines for medical management, taking account of local economic, social and medico-technical conditions.

Standard-essential patents

Standards for biomedical devices reduce production costs and increase usability for both patients and healthcare professionals, contributing to an affordable and accessible healthcare system. However, the adoption of a standard may decrease or even eliminate competition between related technologies and methods. This is particularly a risk when the standard is based on one or more standard-essential patents.

A standard-essential patent is a patent for an invention that has to be employed in order for a product, software or service to comply with a technical standard. Including "essential" patents in standards could lead to monopolies in biomedical technology, potentially harming patients' immediate or long-term interests in the field of home care.

Standards-developing organizations exist in many industrial branches, but those concerned with ICT are of special importance in home care because they set the strategic interoperability and interconnection standards that facilitate global communication in our networked society.

Industrial property

Standards-developing organizations often require participating stakeholders to disclose their patents (or patent applications) that are relevant to a standard under development. Intentionally or not, patentees often fail to disclose all patents required for compliance with a standard. The standards-developing organization concerned then fails to obtain licences for all the related standard-essential patents, allowing patentees to sue for ex post royalties from companies adopting the standard. In other words, standards-developing organizations cannot ensure fair, reasonable and non-discriminatory access to all inventions covered by standard-essential patents.

In the paper, the author argues that although identifying standard-essential patents can be complex, close cooperation between standards-developing organizations and industrial property organizations can efficiently mitigate the risk of missing some. The early disclosure of documents relating to industrial property would reduce the unintentional or even intentional obscuring of industrial property portfolios.

Standards are often developed by scientists — either from public or private institutions — who are involved in research and development related to the subject matter of the proposed standard and who may already have filed one or more patent applications in that technological field.

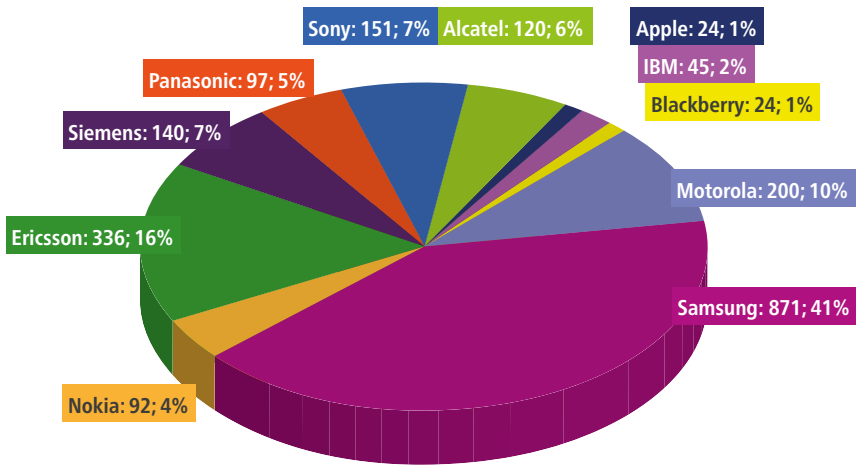
The other view is that excluding the possibility of such an injunction changes the dynamics of negotiating the details of a fair, reasonable and non-discriminatory licence, diminishing the commercial value of standard-essential patents.

ICT-related patents

ICT standard-essential patents have become important for home health care over the past 10–15 years. The spread of mobile and wireless phones has gradually metamorphosed into the spread of powerful pocket-computers — miniaturized, low-cost and extremely reliable devices.

As illustrated in the chart the distribution of industrial property documents related to wireless equipment, filed during

Industrial property documents related to mobile wireless, filed during the period 1993–2013 by selected leading manufacturers



the period 1993–2013 by some leading manufacturers. Patent owners tend to push for their own technology when standards are being developed, seeking royalty payments and licensing revenues.

Standards-developing organizations prefer to avoid conflicts over industrial property rights, which create barriers to the implementation of their standards. But they have to evaluate proposals by patent holders in order to determine the trade-off between technical quality and openness.

When industrial property rights are involved, the standard-setting organization seeks assurance from patent holders that they will license the technology to any interested standards implementer on fair, reasonable and non-discriminatory terms. The catch is that the standard-setting organization is not yet obliged to carry out (possibly in cooperation with a patent organization) a relevance search in advance, to avoid intentional obscuring of industrial property portfolios. This results in legal conflict.

The courts in the United States, Europe and elsewhere have repeatedly ruled on important cases among leading ICT corporations. For example, in a case in 2013 between Microsoft and Google-owned Motorola, the court ruled that Motorola's demands related to its standard-essential patents in the 802.11 Wi-Fi and H.264 video standards violated the fair, reasonable and non-discriminatory rules by demanding 2.25 per cent of the price of each product using the patents.

Home care and ICT standard setting

Homecare technologies offer an affordable alternative to expensive hospitalization for general health care, and are especially useful for developing countries. But in the globalizing economy, industrial property assets are virtually synonymous with competitiveness, so reaching agreements about intellectual property will play an increasingly important role in the standard-setting procedure.

Home care depends on ICT. Consequently, fair, reasonable and non-discriminatory access to inventions covered by ICT standard-essential patents is a worthwhile goal calling for efforts from all stakeholders worldwide. ■

Intellectual property rights in an interconnected world

Contributed by Antoine Dore, ITU Senior Legal Officer; and Keith Mainwaring, Editor, Technical Report on Counterfeited and Substandard ICT Equipment

Standard-essential patents

Tension concerning standard-essential patents (commonly referred to as "SEPs") has increased in recent years, particularly among parties involved in the wireless, smartphone and tablet computer industries. This has prompted ITU to step up the frequency of meetings it holds with industry, competition authorities, standards-development organizations and governments to examine the effectiveness of patent policies and to discuss high-level principles clarifying the meaning of "reasonable and non-discriminatory" (often referred to as "RAND").

"Standardization plays a fundamental role in connecting businesses and society and in promoting innovation and new technologies. Balancing the rights of standard-essential patent holders and standards implementers is critical to the health of the patent system, market competition and the standardization process," says Malcolm Johnson, Director of ITU's Telecommunication Standardization Bureau (TSB).

The main tool ITU employs to safeguard a fair balance between stakeholder interests is the ITU–T/ITU–R/ISO/IEC Common Patent Policy and related Guidelines agreed in 2007. Central to the Common Patent Policy is the principle of standard-essential patent holders committing themselves to licensing their standard-essential patents to standards implementers on a reasonable and non-discriminatory basis.

Because most of the intellectual property rights policies of standards-development organizations do not explicitly define specific parameters or requirements for reasonable and non-discriminatory licensing, debates regarding the meaning of "reasonable and non-discriminatory" commitment can arise in private licensing negotiations as well as in litigation between parties that cannot agree on reasonable and non-discriminatory licensing terms for their standard-essential patents.

Many of the positions of stakeholders arise from concerns relating to patent "hold-up" — abuse by the patent holder of its position after a standard has been completed.

The patent hold-up concern arises because many practitioners of the standard (that is, potential licensees in standard-essential patent licensing negotiations) have invested substantial resources in developing and marketing products that comply with a given standard, to the point where it would not be economically feasible, and not good for promulgation of the standard, for that company to shift to non-compliant products or to withdraw from the market altogether. Because a standard-essential patent by definition cannot be worked around, it can obtain market power if there is a marketplace demand for products to conform to the standard in question.

On one hand, once companies have made substantial investments, they can become "locked into" a standard for all practical purposes, and can be vulnerable to efforts by a given standard-essential patent holder to extract exorbitant royalties far in excess of the value of the underlying patented technology. Thus, without some constraint on the standard-essential patent holder's ability to maximize royalties for standard-essential patent licensing, a locked-in manufacturer may become compelled to pay grossly excessive, unreasonable and

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discriminatory royalties rather than risk an injunction that would render it unable to market standard-compliant products. The locked-in manufacturer will then pass these extra costs onto consumers. In fact, many commentators argue that these hold-up situations raise competition law concerns, that preventing hold-up is a primary purpose of the reasonable and non-discriminatory commitment, and that the scope of the reasonable and non-discriminatory commitment should be interpreted accordingly.

On the other hand, many standard-essential patent holders have invested significantly in research and development for standardized technology, and the reasonable and non-discriminatory commitment allows for "reasonable" compensation for the standard-essential patent holder. Some standard-essential patent holders have raised concerns that policies limiting their rights when enforcing standard-essential patents (such as limitations on the right to seek injunctions for infringement), or policies limiting the royalties that standard-essential patents may earn, can incentivize potential licensees to become unreasonably aggressive in licensing negotiations and to hold out for royalties lower than what the patent holder should be entitled to on a reasonable and non-discriminatory basis.

ITU convened a high-level patent round table in October 2012 to examine the effectiveness of reasonable and non-discriminatory patent policies and to consider whether these policies are in need of reform. Since then, the TSB Director's Ad hoc Group on Intellectual Property Rights and experts from a number of companies as well as government officials and regulators have expended time and resources in attempting to reach consensus on what constitutes reasonableness and non-discrimination, and on the use of injunctive relief.

In May 2014, the Ad hoc Group reached unanimous agreement on a proposed amendment to the current Patent Guidelines, as well as on the addition of related text to the declaration form, to make it clear that reasonable and non-discriminatory licensing commitments made to ITU are intended to bind both the current patent holder and subsequent purchasers of the patents. The Telecommunication Standardization Advisory Group (TSAG) endorsed these proposals at its meeting held in Geneva in June 2014.

But while consensus has been reached on the transfer of licensing commitments, there are still significant differences of opinion among industry on injunctions, reasonableness and non-discrimination.

Meanwhile, to provide government officials, private-sector executives and industry analysts of all disciplines with an overview of the current state of play in the interrelationship of intellectual property and standardization in the ICT sphere, ITU has released a new publication, "Understanding patents, competition and standardization in an interconnected world" (see http://www.itu.int/en/ITU-T/Documents/Manual_Patents_Final_E.pdf). This publication provides a basic understanding of the relationship between patent law, competition law and the standardization ecosystem. Building on these fundamental concepts, the publication explores the sharp increase in recent years in litigation involving standard-essential patents and provides readers with the basis necessary to engage with ITU's ongoing evaluation of possible reform to the ITU–T/ITU–R/ISO/IEC Patent Policy and related Guidelines.

Counterfeit ICT products

Another important matter concerning intellectual property rights, currently being discussed at ITU is that of counterfeit ICT products. Such fake products pose a serious problem that adversely affects developed and developing economies, the ICT industry, as well as consumers around the world. The costs and negative effects of these fake products on all stakeholders are broad and numerous: lost taxes, royalties and other revenues; decreased sales, prices and operations; erosion of brand value, goodwill and reputation; reduced incentive to innovate and invest; lower employment and economic growth rates; network disruptions and interoperability challenges resulting in poor quality of service delivery and reception; and risks to health, to safety and to the environment.

These problems have been recognized by the ITU Plenipotentiary Conference (Guadalajara, 2010) in Resolution 177 and by the World Telecommunication Development Conference (Dubai, 2014) in its Resolution 79 on "The role of telecommunications/information and communication technologies in combating and dealing with counterfeit telecommunication/information and communication devices.

In the context of WTDC-14 Resolution 79, Brahima Sanou, Director of ITU's Telecommunication Development Bureau (BDT) says: "We will continue to increase and develop ITU activities and our work with stakeholders, to combat counterfeit ICT devices and to limit the spread of these devices, in response to the concerns of Member States. In particular, we will organize seminars and workshops to raise awareness of the potential health and environmental risks of using counterfeit ICT devices, and we will explore ways of limiting their spread, particularly in developing countries, which are the most at risk from the dangers of counterfeit ICT devices".

Under the same WTDC-14 resolution, Study Group 1 of the ITU Telecommunication Development Sector (ITU–D) will prepare guidelines to assist Member States in identifying counterfeit ICT devices and in increasing public awareness to restrict trade in these devices. More particularly, it will examine the impact of counterfeit ICT devices being transported to developing countries, and continue to study safe ways of disposing of harmful e-waste from counterfeit ICT devices currently in circulation in the world.

Study Group 11 of ITU's Telecommunication Standardization Sector (ITU–T) is also currently working on the matter from a standards perspective, and will soon be releasing a technical report on the counterfeiting of ICT equipment. The report will provide background information on the extent and nature of the problem, as well as technological and other measures that may be used to address it. The highlights of this report will be presented to the ITU event to be held on 17–18 November 2014 on combating counterfeit and substandard devices (see http://www.itu.int/en/ITU-T/C-I/Pages/WSHP_counterfeit.aspx). At this event, the common concerns, challenges and initiatives of the various stakeholders in their fight against counterfeiting and substandard products will be reviewed, and potential solutions and strategies to curtail these problems will be examined. ■

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Two routes for future telecommunications

Evgeny Vasilyev, General Director
OJSC "Multiregional TransitTelecom" (MTT)

Evgeny Vasilyev

Telecommunications have for many decades been a crucial means of communication for humanity and one that is constantly changing as technology evolves. In recent years we have seen the emergence of two independent and parallel routes of development in telecommunications. Bringing these routes together, or at least understanding the likely future course of their development, is a major task facing regulators throughout the world.

The operator's point of view

The first and more traditional route is that of telephone communications, which increasingly means mobile communications. This preserves all the attributes of conventional telephony: numbering; interconnectivity; legal and regulatory provisions regarding voice calls and data transmission on networks run by international or regional/area operators; and call termination in local operators' networks. Most activities in this area are regulated by established national legislation and international agreements between operators.

The second and more rapidly developing route is that of network-based Internet/cloud communications. This covers communications on Internet protocol (IP) networks, including the more or less standard voice over IP (VoIP) implemented by traditional operators, as well as the most widespread and rapidly growing area of communications today — communications within network communities (social networks) that do not terminate in a public switched telephone network (PSTN), in the context of over-the-top (OTT) services.

Organizing traditional operators' communications using VoIP raises the question of the interface between traditional and IP networks. Some aspects of this question are familiar to the operators themselves and to the regulators, because VoIP telephony provided by traditional operators is similar to conventional telephony, despite using the IP network as the transmission medium. This telephony aspect is already partially covered by current legislation. However, in many countries the functioning of VoIP networks is not fully covered by normal national legislation on PSTNs, since in the IP backbone networks there is no division into local, area and international components. VoIP communications in many countries exist in a grey area of incomplete legislation.

As for communications within network communities, they constitute a niche area, do not terminate in PSTNs and are virtually unregulated. Every network community applies its own principles of identification and organization.

In our view the most interesting area of development concerns the conventional/network telephony interface which effects the transfer of calls between networks and establishes voice and data connections between users of network telephony and PSTNs.

The regulator's point of view

Traditional telephony is tied to territory and geography. From the very beginning, the subscriber's basic identification resource in the telephone network was his or her number. Numbering resources were allotted to each country, each country had its own code, and the telephone number included the regional/area code, so that subscribers were tied to national administrative areas. The emergence of mobile networks modified one of those principles by eliminating the mandatory geographical link with administrative divisions within a country, although the country code is retained even in mobile operators' numbers.

The new and developing network communication paradigm (social networks) presupposes extraterritorial use without regard to the geographical location of users (subscribers). Network communities that form around any of the services available on IP networks exist in a virtual sphere with "transparent" boundaries, where regulatory requirements along the lines of PSTN regulation hardly exist. There are no binding quality requirements, no requirements regarding signal routing between subscribers, no problems of call termination in a local operator's network, and so on.

The link between traditional and OTT services

We can thus see that both from the technical and regulatory viewpoint, the new OTT services differ from traditional telephony. What is more, they are actually cut off from "classical" telephone communications; while this spurs rapid progress, it also creates a multitude of problems that limit the potential of OTT telephony in

various ways, the most important of which is to ensure fully functional and legitimate communications with traditional telephony subscribers.

In order to link these two types of telephony, we need either common rules governing subscriber identification, or harmonized rules for translating subscriber identifiers between networks and services. The latter approach has been under development for some time. One possible solution to the problem of selecting identifiers and formulating rules for translation between networks is the Internet Engineering Task Force (IETF) standard based on electronic number mapping system (ENUM) technology. That solution, however, for all its advantages, has a number of drawbacks, including the requirement to acquire and manage additional data, as well as the difficulty of establishing voice connections between traditional telephony subscribers and social network users owing to the different user identifier formats, which in turn depend on factors such as the rules of the networks themselves, both operational and future.

To date a number of social networks have learned how to connect their subscribers with PSTN subscribers, but that often entails infringing national laws (sometimes in non-obvious ways), including those regarding caller identification (vagueness as regards translation of social network names/subscriber identifiers when transferring a call signal to a PSTN), and requirements regarding termination of national or international calls in a local network (there is no simple mechanism for linking social network users to specific national territory).

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The situation could change fundamentally if all social network users had telephone numbers and were willing to use them as identifiers for any connection. There are a number of non-obvious problems with this. The first, the personal one, is that, for various reasons, by no means all users indicate their usual telephone numbers. The second, the legislative one, is that regulators issue national numbers only for specific types of use, which often do not include network communities.

Is there a solution?

It has been many years since administrations, through the ITU Telecommunication Standardization Sector (ITU–T) Series E Recommendations, defined number ranges for use in global networks and for global services, as well as procedures for allotting numbers, using them and monitoring their use. These are the number ranges beginning with the code +883.

In our view, this offers a simple and obvious way of bridging the gap between traditional telephony and network communities. All that is needed is to ensure that social network subscribers can acquire these global numbers, and to allow their recognition in traditional operators' networks. This would simplify the technical aspects of interconnection between networks (traditional PSTNs operate very well with telephone numbering but are reluctant to recognize any of the other identifiers used by many social networks), as well as the regulatory aspects (defining global services and global networks comes under the definition of network communities and services available to subscribers in those communities; the number ranges used do not overlap with national number ranges, and using them should not infringe current national regulations). Current problems in this area have arisen from the fact that, as a result of the rather modest progress made in the use of such numbering for global networks and services, their use is hardly reflected at all in national legislation and occupies a grey area, despite the fact that all Recommendations on this matter have been through the traditional approval procedure involving the administrations of all ITU Member States.

We believe that once a topic such as global numbering has emerged, it needs to be dealt with at the higher level of regulation and legislation.

Some time ago, our company "Multiregional TransitTelecom" (MTT), one of the largest Russian multiservice communication operators, correctly assessed the huge potential of the global networks/global services paradigm. We joined ITU–T as a Sector Member and began to work actively, first studying the paradigm and later laying the foundations of our GlobeCEN global network for collaboration and education, once the necessary global numbering resources had been obtained. MTT network subscribers now number in the tens of millions, all using their own global number from the range of numbers allotted to our network by the Telecommunication Standardization Bureau in accordance with the procedures set out in the Series E Recommendations. Having such a number enables the user, in a technically simple and totally legal way, to connect from a social network to a traditional telephone network, place calls, have voice conversations, transmit various types of data, and use the associated services, not only within a social network but also in outgoing communications to a traditional public network or in the other direction. The subscriber's global number is used as a social network subscriber identifier; when the subscriber makes a call from the social network to a number in a traditional telephone network, that global number — in a way that is totally legal and technically very easy — serves as the caller identifier.

MTT, which this year celebrates its 20th anniversary, is actively involved in standards-setting, particularly in ITU–T Study Group 2, whose mandate includes issues relating to the use of global numbering for global networks and services.

MTT believes that use of +883 series numbers is being held up by operators for reasons that include inadequate publicity and uncertainty regarding the legality of using and allowing transit of calls from and to these numbers. MTT today has the world's largest database of users of such numbers. But there are still problems: there is no broad two-directional coverage and calls are generally made in one direction only; even if a caller identifier is legal, with legal numbers, operators are reluctant to allow return calls from traditional networks to social networks, and in fact generally do not allow them, with a few isolated exceptions.

Looking ahead

It is necessary to popularize global services and networks and the use of the already well-established numbering ranges available for such services and networks.

Owners of the various global social networks and global services should consider using global numbering for their subscribers, and should be more active in seeking ways of allowing their subscribers to connect to traditional telephone operators' networks.

Traditional telephone network operators should not be afraid of unknown +883 series numbers. Instead, they should register those numbers in their networks, and acquire the multimillion-entry database of subscribers from global networks including social networks.

National regulators should assess the utility of these global numbers and expressly authorize their use in communication networks. ■

Official Visits

During June and July 2014 courtesy visits were made to ITU Secretary-General Dr Hamadoun I. Touré by the following ministers, ambassadors to the United Nations Office and other international organizations in Geneva, and other important guests.

June

Zhang Feng, General Engineer, China's Ministry of Industry and Information Technology and Dr Hamadoun I. Touré, ITU Secretary-General

From left to right: Thomas Nyak, Director, Ministry of Telecommunications and Postal Services, South Sudan; Dr Hamadoun I. Touré, Secretary-General; and Virginio Lomena, Deputy Director, Ministry of Telecommunications and Postal Services, South Sudan

Joseph Bangurambona, Director General, Burundi's Telecommunications Regulatory Authority

Dr Vijayalakshmy K. Gupta, Member of the Telecom Regulatory Authority of India (TRAI)

Mohamed Yahya Ould Horma, *Président du Conseil National de Régulation,* Mauritania

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Sacha Polverini,
Senior Program Officer, Financial Services for the Poor, Bill & Melinda Gates Foundation

Abdulwahed Fakhroo,
Managing Director, Zone Technology, Qatar

André Neypatraiky Rakotomamonjy,
Madagascar's Minister of Post, Telecommunications and New Technologies

From left to right: Christoph Legutko, Global Public Policy CEE Director, Intel; Dr Hamadoun I. Touré, ITU Secretary-General; and John E. Davies, Vice President of the World Ahead Program, Intel

From left to right: Shariffa Mohammed Al Meskary, Manager of Oman's International Relations and Information; Dr Salim bin Sultan Al Ruzaiqi, Chief Executive Officer, Oman's Information Technology Authority; and Dr Hamadoun I. Touré, ITU Secretary-General

Dr François-Xavier Ngarambe,
Ambassador of Rwanda

Bruno Nabagné Koné,
Côte d'Ivoire's Minister of Post and Information and Communication Technologies

Fadi Chehadé,
Chief Executive Officer and President of the Internet Corporation for Assigned Names and Numbers (ICANN)

Marshal Thares Punsri,
Chairman of Thailand's National Broadcasting and Telecommunications Commission

Kathryn C. Brown,
Chief Executive Officer, The Internet Society

Ali Hassan Bahdon,
Djibouti's Minister of Communication, in charge of Posts and Telecommunications

Abdul Latif Siddique,
Bangladesh's Minister of Posts, Telecommunications and Information Technology

Komi Koutche,
Benin's Minister of Communication and Information and Communication Technologies

Yang Xueshan,
China's Vice Minister of Industry and Information Technology

Tryphon Kin-Kiey Mulumba,
Minister for Posts, Telecommunications and New Information and Communication Technologies, Democratic Republic of the Congo

Deborah Taylor Tate,
ITU Special Envoy for Child Online Protection

Dr Debretsion Gebremichael Measho,
Ethiopia's Minister of Communication and Information Technology

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Dr Rupert T. Griffith,
Minister of Science and Technology,
Republic of Trinidad and Tobago

Pierre Claver Ndayiragije,
Ambassador of Burundi

Houlin Zhao, ITU Deputy Secretary-General and Tariq A. Al Awadi, Executive Director, Spectrum Affairs, Telecommunications Regulatory Authority, United Arab Emirates

From left to right: Rahma Salih Elobied, Ambassador of Sudan; Dr Hamadoun I. Touré, ITU Secretary-General; and Dr Tahana Abdalla Attia, Sudan's Minister of Science and Technology

Anayansi Rodríquez Camejo,
Ambassador of Cuba

From left to right: Houlin Zhao, ITU Deputy Secretary-General; Yousuf Al-Balushi, Vice-Chairman of the ITU Radiocommunication Advisory Group; and Mohamed Al Badi, Senior Specialist, Oman Telecommunications Regulatory Authority

Doan Quang Hoan,
Director General, Viet Nam's Ministry of Information and Communications, Authority of Radio Frequency Management

July

From left to right: Axel Leblois, Founder and Executive Director, G3ICT; Houlin Zhao, ITU Deputy Secretary-General; and Francesca Cesa Bianchi, Vice President, G3ICT

From left to right: John Otachi Kakonge, Ambassador of Kenya; Houlin Zhao, ITU Deputy Secretary-General; and Fred Matiangi, Kenya's Minister of Information, Communication and Technology

Thongphone Savanphet, Ambassador of Lao People's Democratic Republic

Pamela K. Hamamoto, Ambassador of the United States

Professor Shao Zhiqing, Vice Chairman, Shanghai Municipal Commission of Economy and Informatization

Yang Zhen, President, Nanjing University of Posts and Telecommunications

Amadeo Pérez, Ambassador of Switzerland

Luis Gallegos Chiriboga, Ambassador of Ecuador

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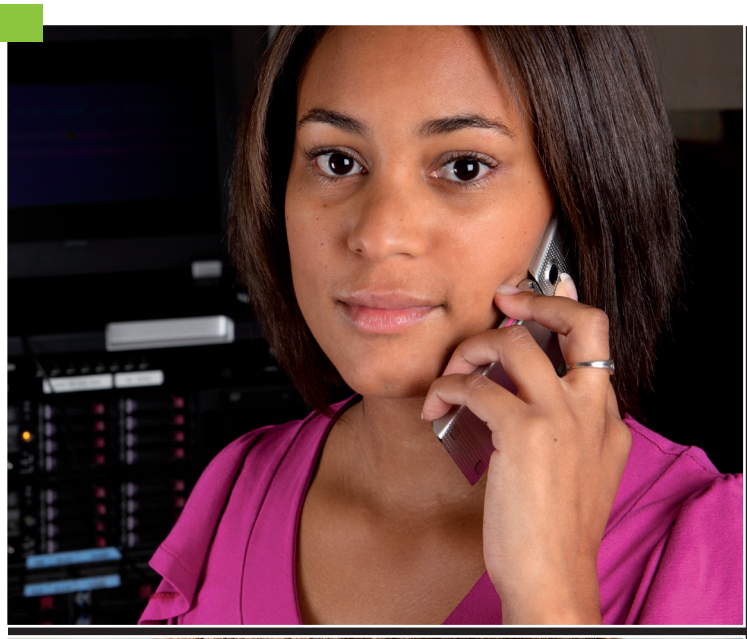

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ITU TELECOM WORLD '14

Doha, December