INTERNATIONAL TELECOMMUNICATION UNION

No. 1 January | February 2014

ITU NEWS

itunews.itu.int

Fully exploit your Spectrum with integrated Spectrum Management and Monitoring

Tomorrow´s Communications Designed Today

System Solutions and Expertise for
Spectrum Management & Radio Monitoring
and Network Planning & Engineering.

LS telcom

www.LStelcom.com

Busy times ahead in 2014 — building on the successes of 2013

Dr Hamadoun I. Touré
ITU Secretary-General

The year 2013 was busy and productive and, with so many activities lined up, I have even greater expectations for 2014. At the World Economic Forum in Davos, Switzerland, on 22–25 January, I was delighted to hear world leaders and corporate executives praise the work of ITU and recognize information and communication technologies (ICT) as key enablers of economic and social development.

Broadband Commission for Digital Development

In March, the Broadband Commission for Digital Development will meet in Dublin, Ireland, where its Working Group on Financing and Investment will convene for the first time. The Commission will hold its autumn meeting in September just before the United Nations General Assembly.

You will recall that in September 2013, the Commission held its eighth meeting in New York, releasing its report *The State of Broadband 2013: Universalizing Broadband.* Its Manifesto, released in November 2013, emphasizes broadband's role in driving growth, delivering social services, improving environmental management, and transforming people's lives.

In December, we reached first-stage approval of G.fast, the new ITU broadband standard that will make it possible to achieve access speeds of up to 1 Gbit/s over existing telephone wires. This will give consumers an over-the-counter solution to support bandwidth-intensive services.

Gender is another important area of focus for the Broadband Commission. Its Working Group on Gender also released a report last November warning that if remedial action is not taken, there could be 350 million fewer women than men online within three years, up from 200 million. The report is titled *Doubling Digital Opportunities: Enhancing the Inclusion of Women & Girls in the Information Society.*

At ITU we are looking at how to increase the number of women pursuing careers in ICT, as well as at ways of leveraging ICT to increase the social and economic empowerment of women and girls.

Girls in ICT Day

On 24 April we will again celebrate Girls in ICT Day. I completely agree with the United Nations Secretary-General's statement at Davos that we must erase gender inequality and harness "girl power" to reach development goals. ITU's gender task force has done good work in developing an action plan to implement our gender policy, approved by the Council. Our statutory committees and short lists will include women as well as men, and all staff will be trained on gender mainstreaming.

EDITORIAL

Busy times ahead in 2014 — building on the successes of 2013

Plenipotentiary Conference

The most important ITU event this year will be our Plenipotentiary Conference, to be held in Busan, Republic of Korea, from 20 October to 7 November 2014. ITU Member States will decide on the future role of the Union, determining our ability to influence ICT development worldwide.

As the top policy-making body of ITU, the Plenipotentiary Conference will elect the senior management team of the organization. It will also elect the 12 members of the Radio Regulations Board as well as the Member States that will constitute the next ITU Council for the period 2015–2018.

Given the commitment of the Republic of Korea, we are confident that the event will be a success. Our Member States are preparing for the Plenipotentiary Conference at the regional level and we look forward to their constructive inputs.

World Telecommunication Development Conference

The outcomes of ITU's sixth World Telecommunication Development Conference (WTDC-14), which will take place in Dubai, United Arab Emirates, from 30 March to 10 April 2014, will feed into the work of the Plenipotentiary Conference. The objective of WTDC-14 is to identify priorities for the development of telecommunications and ICT, and to determine the activities of the ITU Telecommunication Development Sector (ITU–D) over the next four-year period.

As part of our work to prepare for WTDC-14, we held regional preparatory meetings around the world last year, from Chisinau, Moldova, for the Commonwealth of Independent States, to Phnom Penh, Cambodia, for Asia-Pacific, then to Montevideo, Uruguay, for the Americas, to Accra, Ghana, for Africa, to Manama, Bahrain, for the Arab States, and to Belgrade, Serbia, for Europe. Along with each regional preparatory meeting, we held a regional development forum to get inputs from key players, especially from industry. We also concluded the series of ITU Connect Summits in all regions with the ITU Connect Asia-Pacific Summit, held in Bangkok, Thailand.

Emergency broadcasting, use of white spaces…

Just before the ITU Connect Asia-Pacific Summit, an ITU workshop on emergency broadcasting held in Geneva last November highlighted the need for international cooperation to enhance the reach of broadcasting in emergency situations. Terrestrial radio and television broadcasting plays an essential role in emergencies, and a report on the subject will be finalized early this year.

Meanwhile, ITU provided satellite terminals for both voice and high-speed data to the World Health Organization to support its humanitarian work in the Philippines following Typhoon Haiyan. ITU also supplied 40 Thuraya satellite phones to facilitate health relief efforts in the worst-affected parts of the country.

The global management of spectrum remains one of the critical functions of ITU. In January, industry players, regulators, operators, manufacturers and research institutions met in an ITU workshop on the use of white spaces by cognitive radio systems. They explored ways forward in dynamic spectrum usage, and considered international and national regulations as well as best practices.

Regulators depend on best practices, and these are currently being studied by ITU's Radiocommunication Sector (ITU–R) Study Groups 1, 5 and 6. ITU supports sharing arrangements to promote more efficient use of spectrum while protecting other services. By mid-2014, ITU–R Study Group 1 (responsible for spectrum management studies) is expected to report on best practices in spectrum management for cognitive radio systems. ITU's global mandate for spectrum management will become even more significant as we experience exponential growth in data and connected devices.

Internet of Things, connected cars, and smart sustainable cities

We are indeed on the cusp of widespread deployment of the Internet of Things technologies. This is clear from the agenda of an interactive workshop in February on *Internet of Things — Trends and Challenges in Standardization.* Its results will inform the drafting of future ITU technical standards that will ensure the smooth operation of networks supporting innumerable interconnected devices.

Shutterstock

Another major highlight is the symposium on the "Future Networked Car" from 5 to 6 March 2014 during the Geneva Motor Show. Leaders from the auto industry, motor sport, international automobile associations and ICT experts will discuss developments in intelligent transport. Specific sessions will examine the potentially game-changing automated driving; connecting road users and roadside infrastructure with a view to increasing safety, reducing emissions and boosting convenience; and will also explore how to integrate connected technologies into vehicles without causing deadly driver distraction. ITU and the United Nations Economic Commission for Europe (UNECE) Inland Transport Committee will jointly organize a session on human factors and regulatory requirements for the introduction of automated driving.

This year will also witness many discussions on the technologies and cross-sector partnerships that aim to build smart sustainable cities. In particular, ITU and the United Nations Educational, Scientific and Cultural Organization (UNESCO) will organize a series of events on this, as well as on other related topics in Montevideo in March, hosted by the Government of Uruguay. The drive towards smart cities represents a convergence of specialized skills around the common goal of responding to the socio-economic and environmental sustainability demands of a rapidly urbanizing global population.

The Council and World Telecommunication and Information Society Day

Each year, ITU celebrates World Telecommunication and Information Society Day on 17 May, to mark its founding in 1865. This year the Council will be meeting on 6–15 May, and we hope that councillors will stay on for our celebration (on 16 May) around the theme of "Broadband for Sustainable Development".

The 2013 theme "ICTs and Improving Road Safety" was in line with the United Nations Decade of Action for Road Safety, which

dedicates the period 2011–2020 to improving global road safety. ITU has been developing standards for safe user interfaces and communication systems in vehicles, designed to optimize driving performance by eliminating unsafe technology-related distractions. I am also pleased that the allocation of harmonized, globally available frequency ranges for automotive radar applications is on the agenda of ITU's World Radiocommunication Conference in 2015 (WRC-15).

As you know, we will be celebrating ITU's 150th anniversary in 2015. We plan to highlight the Union's contribution to creating a connected world, and the work of ITU staff in making this happen. We will also look forward to 150 years of an innovative ITU engaging with the broader ICT ecosystem.

As a start, the Council will consider a draft Strategic Plan and a draft Financial Plan for the period 2016 to 2019, elaborated by its working group established last year. These plans will be submitted to the Plenipotentiary Conference in Busan.

Global Symposium for Regulators

ITU's 14th Global Symposium for Regulators will take place in Manama, Bahrain, on 3–5 June 2014. Under the theme "Capitalizing on the potential of the digital world", participants will seek ways of bringing all the benefits of the digital world to everyone in an informed, responsive and safe manner.

"Fourth-Generation Regulation: Driving Digital Communications Ahead" was the theme of the 13th Global Symposium for Regulators, held in Warsaw on 3–5 July 2013. The symposium examined challenges that regulators face in a networked world and adopted best-practice guidelines.

WSIS+10 High-Level Event and multistakeholderism

The tenth anniversary of the second phase of the World Summit on the Information Society (WSIS) approaches, and a comprehensive preparatory dialogue is already under way. The Second Multistakeholder Preparatory Meeting took place on 16–18 December 2013, constituting a step in the WSIS+10 review process — a United Nations undertaking in which ITU is actively engaged.

The WSIS+10 High-Level Event will be held in 2014 to review progress and propose a new vision beyond 2015. Among the achievements of the WSIS process so far is its multistakeholder character.

The success of multistakeholderism was also demonstrated at the Fifth World Telecommunication and Information and Communication Technology Policy Forum, held in May 2013. The forum showed that we can involve all stakeholders in discussing difficult topics, and emerge united. Internet governance is a critical factor in expanding connectivity and improving broadband access for all. The forum adopted six non-binding Opinions in this area, covering topics such as promoting Internet exchange points, and fostering an enabling environment for broadband connectivity.

ICT indicators

This year, ITU will be holding its 12th World Telecommunication/ICT Indicators Symposium. ITU is widely recognized as the world's most reliable and impartial source of global data on the state of ICT infrastructure and uptake worldwide. With ICT networks now essential for service delivery in every industry, accurate data on ICT penetration, pricing and access are increasingly of interest.

The 11th World Telecommunication and ICT Indicators Symposium, held in Mexico City on 4–6 December 2013, recognized the need for accurate data on indicators to support each country's plans for social development and economic growth.

ITU's annual report, *Measuring the Information Society,* released in October 2013, showed that mobile broadband over smartphones and tablets had become the fastest growing segment of the global ICT market. From a measurement point of view, the challenge now is to identify those who are without access to ICT.


Shutterstock

Youth

Youth from Asia, Europe, the Middle East and North Africa debated climate change on 8–10 January 2014 at ITU, during the FerMUN14 Model UN conference organized by the *Ferney-Voltaire Lycée International.* I will transmit the impressive results of this meeting to United Nations Secretary-General Ban Ki-moon at the United Nations Climate Summit, in New York in September.

Work on defining the post-2015 sustainable development agenda is well under way which includes the launch on 18 February of a crowdsourcing platform developed and facilitated by ITU in support of the Global Partnership for Youth: https://crowdsourcing.itu.int/. This continues the great work of the BYND 2015 Global Youth Summit organized by ITU and the Presidency of Costa Rica which gave young people a voice that can be heard by decision-makers throughout the world. President Chinchilla presented its outcome — the Youth Declaration — to the 68th session of the United Nations General Assembly.

ITU Telecom World 2014

ITU Telecom World 2014 in Doha, Qatar, in December, will bring together global ICT leaders for strategic debate, knowledge-sharing, innovation-showcasing and networking.

"Embracing change in a digital world" was the theme at ITU Telecom World 2013, and debates centred on how the dramatic changes in the ICT sector can be harnessed to improve people's lives everywhere. I was pleased to launch the Global Cybersecurity Index, to boost awareness about the importance of securing cyberspace.

Strategically located at the crossroads of three continents, Qatar provides the ideal location to continue the ITU Telecom World conversation on harnessing the power of next generation technology for the benefit of the ICT industry and the people of the world.

Getty Images

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

Editor-in-Chief: Patricia Lusweti
Art Editor: Christine Vanoli
Editorial Assistant: Angela Smith
Circulation Assistant: Albert Sebgarshad

Printed in Geneva by the ITU Printing and Dispatch Division.

Editorial office/Advertising information:
Tel.: +41 22 730 5234/6303
Fax: +41 22 730 5935
E-mail: itunews@itu.int

Mailing address:
International Telecommunication Union
Place des Nations
CH–1211 Geneva 20 (Switzerland)

Subscriptions:
Tel.: +41 22 730 6303
Fax: +41 22 730 5935
E-mail: itunews@itu.int

Big data, big deal, big challenge

CONTENTS

ITU News — *more than a magazine*

From ten issues to six plus more digital content

Thinkstock

Dear reader,

Thank you for your loyalty to *ITU News*. This letter is to inform you of some changes we are making to our print and online editions this year.

Starting with the January-February 2014 issue, the magazine will be published every two months. This means that there will be six issues annually (compared with the previous ten), and each issue will continue to provide full and in-depth coverage of topical themes that are of interest to the telecommunication and information and communication technology world and beyond.

We will introduce premium content and mobile apps for iPad, iPhone, Android and Windows 8 on the *ITU News Online* digital platform during the year. Your subscription to the print edition will also give you full access to each issue via these mobile apps and to the premium content. Current subscription rates for the print edition will remain the same.

There are two reasons for these changes. One is to enhance our online news offer in view of the interest of readers in digital content. The total audience for *ITU News Online* (itunews.itu.int) continues to grow in all six ITU official languages, with more than 961 000 page views of our magazine website during 2013. The other reason is an economy measure to reduce production and postage costs, which continue to increase.

Today, no publication is better placed to give a first-hand account of ITU activities and matters of global concern to people from all areas of our industry. We continue to be committed to presenting our stories with the utmost clarity, simplicity and impartiality.

As always, we welcome your comments and feedback.

The Editor

Getty Images

Big data, big deal, big challenge

The big data phenomenon — emerging technological capabilities for solving huge complex tasks — has been hailed by industry analysts, business strategists and marketing pros as a new frontier for innovation, competition and productivity. The 11th World Telecommunication/ICT Indicators Symposium (WTIS), which took place in Mexico City, from 4 to 6 December 2013, saw big data as having tremendous potential for fostering development by providing real-time information, at low cost, compared with data from other sources.

Practically everything that deals with data or business intelligence can be rebranded as "big data", and the hype looks set to match the stir created by cloud computing, where existing offerings were rebranded as "cloud-enabled" and whole organizations moved overnight to the "cloud".

Beyond the buzz, big data capabilities motivate researchers from fields as diverse as physics, computer science, genomics and economics. The new analytical power is seen as an opportunity to invent and investigate new methods and algorithms capable of detecting useful patterns or correlations present in big chunks of data. Analysing more data in shorter spaces of time can lead to better, faster decisions in areas spanning finance, health and research.

The Technology Watch report *Big Data: Big today, normal tomorrow,* written by Martin Adolph of the ITU Telecommunication Standardization Bureau and released in November 2013, looks at different examples and applications associated with the big data paradigm, describes their characteristics, identifies the commonalities among them, and highlights some of the technologies enabling the upsurge of big data. As with many emerging technologies, several challenges need to be identified and addressed. Global standardization can contribute to addressing these challenges and will help companies enter new markets, reduce costs and increase efficiency.

A food scandal in early 2013, which rocked several European countries, illustrates the power of big data in resolving a crisis. The scandal involved a network of fraud, mislabelling and sub-standard supply chain management. This was not the first food scandal, and will surely not be the last. For restaurant chains with thousands of branches and hundreds of suppliers worldwide, monitoring the origin and quality of each ingredient is nearly impossible. Now, however, data availability and sophisticated real-time analytics offer a way of discovering irregularities early (or, better still, preventing them). Through data analysis, the events leading to the scandal were uncovered and resolved. The incident highlights the promise and challenges of data management for multiparty, multidimensional, international systems.

Billions of individual pieces of data are amassed each day, from sources that include supplier data, delivery slips, restaurant locations, employment records, DNA records, data from Interpol's database of international criminals, and also customer complaints and user-generated content such as location check-ins, as well as messages, photos and videos on social media sites. Gleaning insight and knowledge from this mass of disparate data requires identifying relevant data items and detecting patterns among them in order to draw accurate, comprehensive and actionable conclusions.

This is the big data phenomenon, described in the *Big Data: Big today, normal tomorrow* report, from which the present article is drawn. The report, along with other Technology Watch Reports can be found at http://itu.int/techwatch.

Big data — easier to recognize than define?

While no precise definition exists, four common characteristics help to describe big data — volume, velocity, variety and veracity.

Volume may be the most compelling attraction of big data analytics. In the healthcare field, for example, evaluating the effectiveness of a treatment on a population-wide basis yields a far more reliable result than the same analysis for a dataset of 100 patients. Although the adjective "big" is not quantified, it is estimated that 90 per cent of the data in the world today has been created in the past two years, with machines and humans both contributing to data growth.

The velocity of decision-making — the time taken from data input to decision output — is a critical factor. Emerging technologies are capable of processing vast volumes of data in real time or near real time. This increases the flexibility with which organizations can respond to changes in the market, shifting customer preferences or evidence of fraud. Championed by high-frequency traders in the financial services market, velocity and tight feedback loops are a key part of gaining competitive advantage in a number of industries.

Variety is the messy reality of big data. Text, sensor data, call records, maps, audio, image, video, click streams, log files and more need time and effort to be shaped into a form fit for processing and analysis. The capacity of a system to analyse data from a variety of sources is crucial, as this can yield insights not achievable by consulting one type of data in isolation.

An ability to assess the veracity of data is essential in establishing a basis for important decisions. Big datasets reflect uncertainties attributable to inconsistency, incompleteness, ambiguities and latency in data items. This varying level of uncertainty must be factored into

The Large Hadron Collider (LHC) consists of a 27-kilometre ring of superconducting magnets with a number of accelerating structures to boost the energy of the particles along the way

© CERN

the decision-making process. A system therefore needs capabilities to distinguish, evaluate, weigh or rank different datasets in order to maintain veracity.

Big data in health, science, transport…

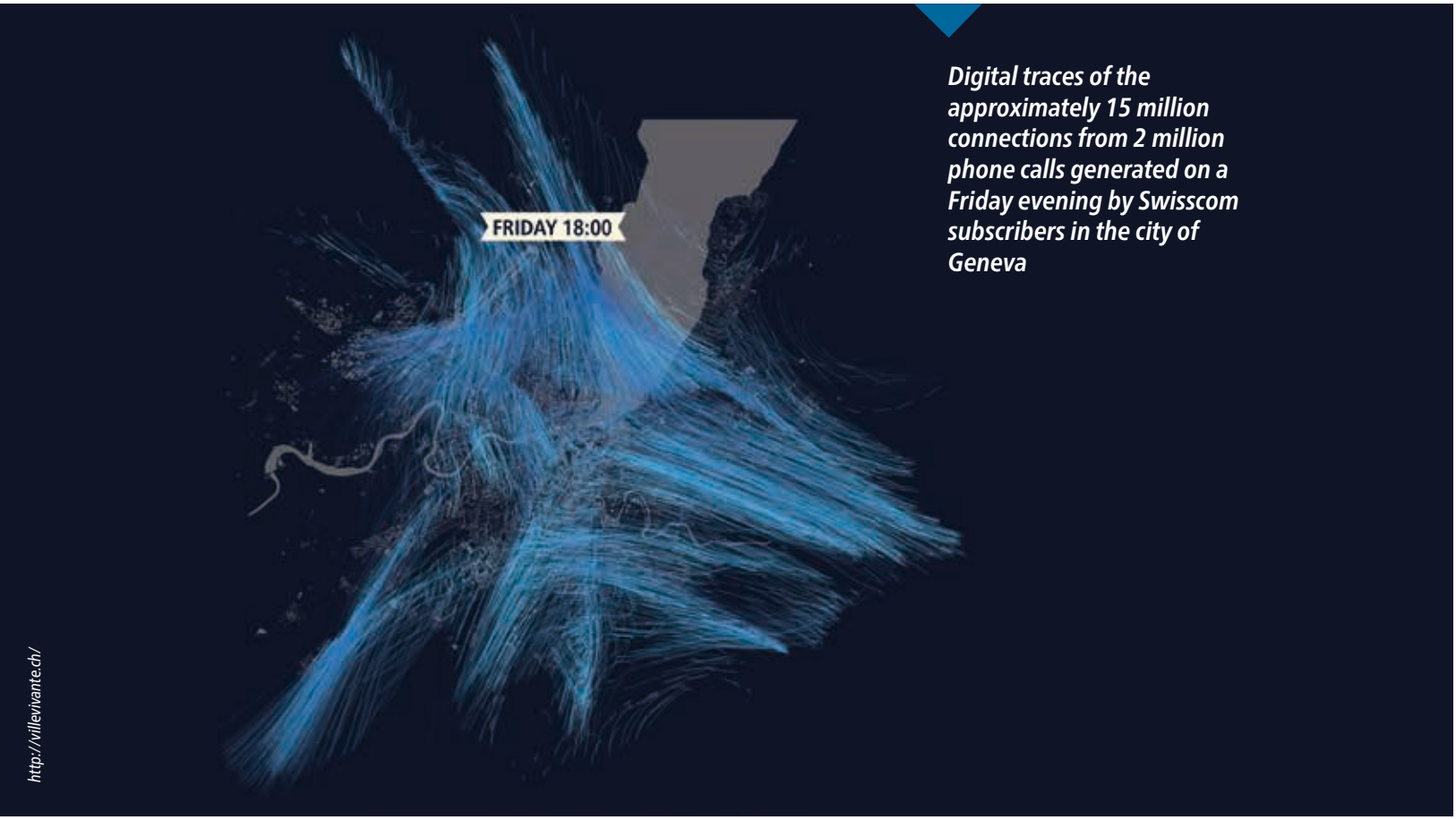
Data are critical in the healthcare industry to document illnesses and treatment given to individual patients. With medical image archives growing by 20 to 40 per cent annually, an average hospital is expected, by 2015, to be generating 665 terabytes of medical data each year. Applications of big data analytics in the healthcare domain are as numerous as they are multifaceted, both in research and practice. For example, remote patient monitoring systems for chronically ill patients can reduce physician appointments, emergency department visits and in-hospital bed days, improve the targeting of care, and prevent some long-term health complications.

Analysing large datasets of patient characteristics, outcomes of treatments and their cost can help identify the most clinically effective and cost-efficient treatments to apply. Furthermore, analysing global disease patterns to identify trends at an early stage is mission critical, not only in managing public health crises, but also in allowing the pharmaceutical and medical sectors to model future demand for their products as a basis for deciding on research and development investment.

An example of big data, par excellence, is an effort being put into solving the mysteries of the universe. Located just a few minutes drive from ITU headquarters, the European Organization for Nuclear Research (CERN) is host to one of the biggest known experiments in the world. For more than 50 years, CERN has been tackling the growing torrents of data produced by its experiments studying fundamental particles and the forces by which they interact. The Large Hadron Collider (LHC) consists of a 27-kilometre ring of superconducting magnets with

a number of accelerating structures to boost the energy of the particles along the way. The detector comprises 150 million sensors and acts as a 3D camera, taking pictures of particle collision events at a speed of 40 million times per second. Responding to the need to store, distribute and analyse the up to 30 petabytes of data produced each year, the Worldwide LHC Computing Grid was established in 2002 to provide a global distributed network of computer centres. A lot of CERN's data are unstructured and only indicate that something has happened. Scientists around the world now collaborate to structure, reconstruct and analyse what has happened and why.

Mobile phones leave traces that can be exploited for transport modelling. This is of particular interest where other transport-related data are scarce. For example, to support transport planning to reduce traffic congestion in Abidjan, Côte d'Ivoire, telecommunication provider Orange offered access to anonymized datasets containing 2.5 billion records of local calls and text messages exchanged between 5 million users over a period of 5 months. Similarly, Korea Telecom helped the City of Seoul determine optimal night bus routes. As a result, seven more night-bus routes have been added to the city's original plan. A similar analysis of Swisscom data in Geneva, Switzerland, is shown in the image below.



Digital traces of the approximately 15 million connections from 2 million phone calls generated on a Friday evening by Swisscom subscribers in the city of Geneva

http://villevivante.ch/

On a larger geographical scale, mobile phone data contribute to the analysis of migration patterns and are invaluable in crisis management. Launched by the Executive Office of the United Nations Secretary-General, the Global Pulse initiative responds to the need for more timely information to track and monitor the impacts of global and local socio-economic crises.

In the telecommunication field, network analytics help providers to optimize their routing network assets and to predict faults and bottlenecks before they cause any harm. Combined real-time network insights and complete customer profiles add value, enabling tailor-made offerings that increase revenue opportunities, while attracting and retaining customers. Network analytics are also an important means to detect and mitigate denial of service attacks.

Data protection, privacy and cybersecurity

The two basic principles of data protection — data avoidance and data minimization — stand in stark contrast to the power of big data to facilitate the tracking of people's movements, behaviours and preferences, predicting an individual's behaviour with unprecedented accuracy, often without the individual's consent. For instance, electronic health records and real-time self-quantification (people wearing sensors to monitor, say, their fitness level or sleep pattern) may be an enormous step forward in streamlining drug prescriptions or diet and fitness plans. But many consumers view such data as very sensitive.

Large sets of mobile call records, even when anonymized and stripped of all personal information, can be used to create fingerprints of users, which when combined with other data such as geo-located tweets or check-ins could reveal the individual's identity.

As the amount of personal data and global digital information grows, so does the number of entities accessing and using this information. Assurances must be given that personal data will be used appropriately, in the context of the intended uses and abiding by the relevant laws.

A closely related concern is cybersecurity. Threats and risks need to be reassessed in view of big data, adapting technical solutions in response. The time is ripe to review information security policies, privacy guidelines, and data protection acts.

Important sources of new data, such as information from mobile-cellular networks and, in particular, social networking services, could complement official statistics. The World Telecommunication/ICT Indicators Symposium (WTIS) nevertheless pointed to a number of confidentiality and privacy concerns related to the use of big data. WTIS encouraged regulatory authorities to explore the development of guidelines on how big data could be produced, exploited and stored. National statistical offices, in cooperation with other relevant agencies, should look into the opportunities offered by big data, while addressing current challenges in terms of big data quality and veracity and privacy within the framework of the fundamental principles of official statistics.

Standards

Achieving the big data goals set out by business and consumers will require the interworking of multiple systems and technologies.

The standards community has launched several initiatives and working groups on big data. In 2012, the Cloud Security Alliance established a big data working group with the aim of identifying scalable techniques for data-centric security and privacy problems. The group's investigation is expected to clarify best practices for security and privacy in big data, and also to guide industry and government in the adoption of those best practices.

The United States National Institute of Standards and Technology (NIST) kicked-off its big data activities with a workshop in June 2012, and in 2013 launched a public working group. The NIST working group intends to support secure and effective adoption of big data by developing consensus on definitions, taxonomies, secure reference architectures and a technology

road map for big data analytic techniques and technology infrastructure. ISO/IEC JTC1's data management and interchange standards committee (SC32) has initiated a study on next-generation analytics and big data. The World Wide Web Consortium (W3C) has created several community groups on different aspects of big data.

ITU's Telecommunication Standardization Sector (ITU–T) is currently addressing individual infrastructure requirements, noting existing work in domains including optical transport and access networks, future network capabilities (such as software-defined networking), multimedia and security.

ITU–T is studying the relationship between cloud computing and big data in view of requirements and capabilities. Recommendation ITU–T X.1600 on "Security framework for cloud computing" matches security threats with mitigation techniques, and the future standardization of the described threat-mitigation techniques is expected to incorporate big data use cases. A previous report in the Technology Watch series advocated the use of privacy-enhancing technologies as a means to implement the "privacy by design" principle, which is of course of great interest to big data applications.

With a worldwide membership comprising governments, telecommunication operators, equipment manufacturers, and academia and research institutes, ITU is ideally positioned to review current practices in the use of aggregated datasets and to develop related technical standards and policies.

ITU has been accelerating its efforts to increase interoperability in electronic health applications in areas such as the exchange of health data and the design of personal health systems. With the boom in personal and wearable "connected health" and fitness products in mind, standardization could enable a smart wristband, say, to exchange data securely with a smartwatch of a different make (uninhibited by vendor or manufacturer boundaries). Big data analytics would then have the ability to integrate the data streams collected from different devices and pinpoint results that could trigger actions beneficial to health.

After doubling the efficiency of its Emmy-winning predecessor, Recommendation ITU–T H.265 is on track to become the web's leading video codec. Considering multimedia's significant share in total Internet traffic, the automatic analysis of digital image, audio and video data is an area to be monitored closely from the big data perspective.

The open data movement is maturing, in emerging economies as well as in highly industrialized countries. With a number of interoperability and policy challenges to be faced, it is opportune for ITU to embrace and advance the cause of open data — in partnership with the many open data champions within and outside its membership. From the standards angle, this might include the development of requirements for data reporting, and mechanisms for the publication, distribution and discovery of datasets.

More work is needed to fully understand the potential of big data, and ITU should further examine the challenges and opportunities related to big data in the ICT sector. ■

Viewpoints from ITU Telecom World 2013

Big data sparked a lively debate during the Big Conversation session at ITU Telecom World 2013, in Bangkok, Thailand, last November.

Chairing the conversation was TM Forum's Tony Poulos, aiming to go beyond the buzz word to find out more about the opportunities and challenges that surround big data.

Deflating the hype, Digital Intelligence consultant Paul Papadimitriou suggested that data — an inert body of information — can only be turned into meaningful knowledge (or, indeed, monetized) through human intervention. The sheer volume generated each day by public and private authorities, institutions and individuals, leads us to search out how to find "the needle inside the huge haystack of data out there."

But it is not just about size. Andy Haire, former Deputy Director General for telecommunications and post of the Singapore regulator, Infocomm, described how the combination of low-cost computing and storing facilities is "a potent cocktail" enabling information on individuals, their habits and behaviours to be exposed — and in some cases, misappropriated or used to draw wrong, and potentially damaging, conclusions.

With big data, the emphasis moves from causation to correlation, the panellists agreed. Associating data and predicting behaviour are already driving business models in the real world — such as credit

analysis based on whether or not a person uses capital letters in an SMS (those who did not were considered a bad risk), or insurance firms tracking average driving speeds to re-evaluate policy costs.

This might work, but is it fair and should it be allowed? Mr Papadimitriou called for a more scientific angle, rather than assuming that because a thing happens 90 per cent of the time, it will always happen. He recognized the value of big data, saying that "we should be happy to have these tools to make better and more informed decisions", while warning that we have to avoid equating assumption with fact.

Data security and personal privacy are key, according to Charles Brookson of Azenby — even if definitions of privacy and whom we trust are subjective, varying between countries and cultures. He urged a mature, sensible and balanced approach to formulating a data trust framework, because "government regulations can't catch up with what people are actually doing, as they are still based on clockwork exchanges and formal designs of data protection which have nothing to do with privacy."

All agreed with Mr Papadimitriou that "you don't know what privacy is until its loss hits you." Finding a balance between surveillance and personal privacy is difficult, given what Mr Brookson called "the openness of these structures and whether you think — as a citizen — that everything is available to public scrutiny but subject to checks and controls under law."

Recent revelations as to the extent of government surveillance in the world of big data are, for this panel at least, hardly surprising. Establishing a balanced framework or even self-regulation may not be a straightforward task.

Opportunities and challenges

A session on "Big Data: Opportunities and Challenges" provided contrasting perspectives from expert thinker Viktor Mayer-Schönberger of the Oxford Internet Institute, policy guru Daniel Cooper of Covington & Burling, and Head of Identity and Privacy services (EMEA), Harm Jan Arendshorst, Verizon Enterprise Solutions.

"True value of data is only reaped if data are being reused over and over and over again for multiple purposes", said Mr Mayer-Schönberger, giving the example of Google using search terms to predict seasonal flu outbreaks. He foresees telecommunication companies fully entering the big data arena, where those who have the platforms to collect the data would have the ability to extract more value from datasets not only by using them themselves, but also by licensing them to others. But he warned that operators might be caught between a need to boost revenue streams from their subscriber base, while at the same time trying to assuage privacy worries and hold onto the business of customers who might choose at any moment to switch to a more privacy-conscious operator.

"Existing legal frameworks are quite inadequate to address the big data phenomenon," according to Mr Cooper. Current data protection laws are weak in regard to data retention and transparency. The world of big data often involves a secondary use of data for different purposes, many of which may not be known at the time the data are collected. There is a desire, particularly within the information technology and pharmaceutical sectors, to be able to use personal data for research purposes. Nevertheless, cautioned Mr Cooper, "There are a lot of dangers in the world of big data we must be mindful of", and regulation is essential to make sure that organizations play by the rules and use their data correctly.

Building trust is critical for players operating in this environment. "The relation with big data and trust and privacy is evident in every initiative", noted Mr Arendshorst. Customers want and need to trust their provider. "Trust is a valuable currency in the marketplace. Expect more trust-related services", said Mr Mayer-Schönberger. Individuals may not understand the complexities of the big data ecosystem, but they need to be able to trust societal institutions to use data correctly, according to Mr Cooper.

Moderator Andy Haire posed the question of data breaches and whether regulators should be able to force companies to undertake costly data protection activities. The law needs to be guided by common sense, argued Mr Cooper.

Summing up, Mr Arendshorst voiced hopes for building future communication networks that can be trusted and used for fun. Now that we have instant Internet access, we need to protect ourselves. "We want to stimulate use of connectivity and hope to build a secure, trustworthy collaborative environment." He noted that "the opportunities are great, but laws must change. The challenge is balancing privacy rules whilst not damaging initiatives." Optimistic that we will solve the 1984-like surveillance threat that big data conjures up, Mr Mayer-Schönberger is, however, less optimistic of human society's ability to constrain big data analysis — fearing that we might fall prey to a dystopian scenario.

Privacy for citizens

Who owns the data items that leave our devices? And what privacy expectations are reasonable? These were some of the questions debated during a panel session on how world citizens can ensure their privacy in a digital world.

AllTheContent's Clement Charles was clear that data belong to us, the citizens, and we should control what is done with our data. According to Mr Charles, "It is wrong to think that there is a will for citizens to be tracked." In privacy terms, he noted that the current balance between

Shutterstock

privacy and lack of privacy was more heavily weighted towards lack of privacy. This balance needs to be constantly adapted. Consumers, governments and stakeholders need to be educated about privacy, and where necessary there should be a change in mindset. "The current NSA (the United States National Security Agency/ Central Security Service) issue is the first in a long series showing how the pain of not having privacy is associated with the gain of having great digital services", he said, emphasizing that there is a huge opportunity in guaranteeing privacy to citizens.

Panellists echoed the need for a broader understanding of the balance between privacy and digital services. According to Pat Walshe of GSMA, "Devices and users have become broadcasters of data. But with this technology shift, we have not had a cultural shift. People are not aware of the data intent; how data will be used. The challenge now is to provide people with simple clear choices, clear information."

With so many new technologies and services appearing on the market, regulation is not keeping pace with development. "With this revolution and upheaval, some areas are a bit of a wild west. We need to see how we can best balance and enable all these new services", said Adriana Nugter, an Independent Advisor. The panel unanimously agreed that the current privacy status is unsustainable — after all, how many of us actually read the lengthy privacy policies when we sign up for something new? Simplification is key. "Principles need to be set out in a simple document [for users] to sign off on", said McCarthy Tétrault's Timothy Ellam.

So what is the solution? A top-down approach is required, argued Mr Charles, even on an international level, to safeguard privacy concerns. Trust frameworks, if overseen by governments, could enable consumers to accept certain conditions for usage of their data. What is important now is to create a basis for conduct that will be of greater benefit than cost to world citizens. Current privacy regulation needs to be changed to enable business and innovation to flourish. After all, "Mobile-derived data have the possibility to meet very pressing public policy objectives", Mr Walshe reminded the panel.

Creating the right regulation may be key but there needs to be a careful balance, juggling the needs of consumers, the industry and government. The onus for ensuring consumer privacy cannot just be the responsibility of operators when there are now so many other players in the ecosystem. Stakeholders must come together to foster trust and create an environment where innovation can flourish for the benefit of all. ■

E-waste and the Internet of Things

The problem is part of the solution

By Alain Louchez and Valerie Thomas

The Internet of Things (IoT) was all the rage at the 2014 International CES, staged by the Consumer Electronics Association, in Las Vegas, United States, from 7 to 10 January. Essentially, IoT describes the integration of any object, whatever its size or nature, into the communications space.

Thanks to the timely convergence of many technologies, anything can now be reached and interfaced with, anytime, anywhere. This is fertile ground for application developers. But as electronics are increasingly embedded in the economic and personal fabric of society, we will need to manage these devices beyond their useful life, both to protect the environment and to maintain our supply of materials.

Internet of Things fuels e-waste

The National Strategy for Electronics Stewardship, a report by the United States Interagency Task Force on Electronics Stewardship, acknowledges that "these technologies have become critical to our way of life and to our growing economy". It also warns that "with these technologies, however, comes the increasing challenge of protecting human health and the environment from the harmful effects associated with the unsafe handling and disposal of these products."

Mercy Wanjau, Principal Legal Officer at the Communications Commission of Kenya, already noted in 2011 (see *ITU News*, No. 9, 2011) that "e-waste is one of the fastest growing waste streams." Today, according to United Nations University estimates reported by ITU, 67 million metric tons of electrical and electronic equipment were put on the market in 2013. In the same year, 53 million metric tons of e-waste (waste electrical and electronic equipment) were disposed of worldwide. With the pervasiveness of IoT, the production of e-waste is bound to accelerate.

As a result, e-waste is receiving a lot of attention not only at the national level (for example, the United States Congress introduced on 24 July 2013 a bill on toxic e-waste, the Responsible Electronics Recycling Act), but also at the international level. For instance, ITU is working with the Secretariat of the Basel Convention on controlling transboundary movements of hazardous wastes and their disposal, and with the United Nations University, in collaboration with the Solving the E-waste Problem (StEP) Initiative and the Centre for Environment and Development for the Arab Region and Europe (CEDARE), to raise awareness of the dangers of e-waste and to encourage the inclusion of e-waste management in the design of national policies for information and communication technologies (ICT).

ITU maintains a comprehensive reference site on e-waste, and has published a toolkit on end-of-life management of ICT equipment. This toolkit was developed in partnership with more than 50 ICT companies and environmental organizations, and generated new technical standards, such as Recommendation ITU–T L.1000 "Universal power adapter and charger solution for mobile terminals and other hand-held ICT devices". This standard sets out technical specifications for a universal charger compatible with a variety of consumer electronic devices, reducing waste and improving user convenience. When fully implemented around the world, the new standard will eliminate an estimated 82 000 tons of redundant chargers and at least 13.6 million tons of CO_2 emissions annually.

While governments are looking closely at the impact of IoT on society, notably on security and privacy, the consequences of IoT on environmental sustainability are not being treated with the same degree of urgency.

Electronic equipment used throughout the IoT value chain will eventually end up as e-waste. A TreeHugger article by Elizabeth Chamberlain and Kyle Wiens of iFixi, published on 9 January 2014, comments on a recent study by Huabo Dunn and colleagues at the Massachusetts Institute of Technology on "Quantitative characterization of domestic and transboundary flows of used electronics — Analysis of generation, collection, and export in the United States", released on 15 December 2013. That article sees the rise of computerized basic IoT elements as an emerging culprit in losing the war against e-waste: "and as more and more objects — fridges, toys, household appliances, and accessories, for example — become computerized, less obvious forms of e-waste will be hitting the market. It's easy to make the connection between a giant CRT monitor and e-waste; it's less easy to make that connection with singing birthday cards. Nobody thinks twice about trashing them, but they're e-waste."

"Internet of Things — Trends and Challenges in Standardization" was the theme of an ITU workshop in February 2014. More information is available at: http://www.itu.int/en/ITU-T/Workshops-and-Seminars/iot/201402/Pages/default.aspx

Shutterstock

Building environmentally friendly IoT devices should become a top priority. Researchers at *Université Catholique de Louvain* in Belgium (June 2013) made the argument for this clearly: "The vision of the Internet-of-Things (IoT) calls for the deployment of trillions of wireless sensor nodes (WSNs) in our environment. A sustainable deployment of such a large number of electronic systems needs to be addressed with a Design-for-the-Environment approach. This requires minimizing 1) the embodied energy and carbon footprint of the WSN production, 2) the ecotoxicity of the WSN e-waste, and 3) the Internet traffic associated to the generated data."

Environmental management through the Internet of Things

IoT technologies, such as machine-to-machine (M2M) communications are already being used to improve the environment, for example rubbish collection, oil recycling, light bulb recycling, reduction of CO_2 emissions, control of noise pollution, wastewater management, and even removal of cooking grease in restaurants.

At an IoT Workshop in Beijing, China, in August 2013, Li Haihua, Senior Engineer of the China Academy of Telecommunication Research, Ministry of Industry and Information Technology, and Deputy Director of the Department of Internet of Things and Service & Resources, reported that in China "IoT has been applied in the automatic monitoring of more than 15 000 key pollution sources".

In a paper on "Adopting the Internet of Things technologies in environmental management in South Africa", presented in April 2012 at the 2nd International Conference on Environment Science and Engineering, Nomusa Dlodlo, a Senior Researcher at the Council for Scientific and Industrial Research's Meraka Institute in Pretoria, shows the linkage between IoT and environmental management across many domains.

Internet of Things and e-waste management

Considering that discarded electronics components within IoT-enabled objects are a significant source of e-waste, providers of IoT equipment must increasingly take account of dangers arising from the use of hazardous material in the production of devices.

Products should be designed and manufactured to reduce their lifecycle environmental impact. Environmental concerns should also be an integral component of smart manufacturing, which has a symbiotic relationship with the Internet of Things. As an example, the Georgia Institute of Technology's Manufacturing Institute, which is closely associated with the United States Advanced Manufacturing Partnership, considers the environment as a central concern of modern manufacturing.

There are benefits in tracking e-waste. In 2011, the Massachusetts Institute of Technology's Senseable City Lab project BackTalk clarified the "convoluted path of e-waste", highlighting glaring economic inefficiencies. Better remote tracking would improve the accuracy of e-waste data; for example, the United States Environment Protection Agency "has recognized the need for a scientific-based approach to getting better information on e-waste flows from the United States."

The emphasis of current work on defining standards, protocols and specifications in the IoT space is on interoperability, because there is no common language for machines and objects across a wide range of markets. No specific consideration has yet been given to integrating environmental concerns into IoT standards.

What now?

If IoT-enabled objects were to have not only a standardized Global Positioning System (GPS) tracking capability but also some sort of universal e-identification, it would facilitate recycling, reuse and end-of-life management. This could help to overcome the cost challenges of collection and recycling, and open up new opportunities for the private sector, such as the recovery of rare-earth metals. It would also facilitate the enforcement of regulations restricting the use of certain hazardous substances. Identification systems such as the Universal Product Code (UPC) and the International Standard Book Number (ISBN) are widely used; a similar system could surely be developed for electronics products.

Some tools are already available. An environmental procurement tool known as EPEAT helps buyers identify, compare and select environmentally preferable products, and provides manufacturers with environmental criteria for the design and development of products. Also, the e-Stewards Initiative has created an e-Stewards Certification for electronics recyclers, integrating the requirements of the ISO 14001 standard on environmental management. And there are a wide range of services to support effective electronics use and management.

We are on the cusp of widespread deployment of IoT technologies. The attractive possibilities are masking unintended consequences, including e-waste. Policy-makers need to consider the environmental component. The time to act is now.

About the authors

Alain Louchez is the Managing Director of the Center for the Development and Application of Internet of Things Technologies (CDAIT) at the Georgia Institute of Technology.
Valerie Thomas is the Anderson Interface Associate Professor of Natural Systems in the H. Milton Stewart School of Industrial and Systems Engineering, with a joint appointment in the School of Public Policy at the Georgia Institute of Technology.

Shutterstock

Smart water management

Access to basic water services, including clean drinking water and sanitation, is still unavailable to much of the world's population. According to United Nations estimates, 783 million people do not have access to clean water. Almost 2.5 billion people do not have access to adequate sanitation, while six to eight million people die annually from the consequences of water-related disasters and diseases. Safe, adequate and efficiently managed freshwater resources are essential to the sustenance of basic livelihoods, and to the economic and political stability of countries.

Growing pressures on freshwater resources are rising by the minute owing to ever-increasing populations, the growing needs of agriculture and other industries, as well as increases in energy consumption and pollution. Climate change is becoming a real and global threat; without smart management, hundreds of millions of people worldwide will face severe water and energy shortages, ultimately leading to hunger and disease outbreaks.

Information and communication technologies (ICT) have the potential to enhance water sustainability, efficiency and accessibility — for example ICT can also be incorporated to increase efficiency in irrigation, saving up to 70 per cent of water in some networks. But standardization and governance are needed to ensure that these technologies are properly

managed to protect water resources, and to ensure sustainable development and the equitable distribution of water-derived benefits.

ITU's Focus Group on Smart Water Management provides a peer forum to tackle the existing global water challenges so that countries can use ICT to overcome them. Standards are required particularly in water information transfer, storage, access and updating, to allow geographic and time-dependent characteristics (such as smart metering) to be linked.

The following article is based on an ITU/UNESCO (United Nations Educational, Scientific and Cultural Organization) report on *Partnering for Solutions: ICTs & Smart Water Management,* researched and written by Amanda McIntosh and Solomon Hailu Gebrechorkos, under the auspices of the Carlo Schmid Programme. The authors gratefully acknowledge the support of Ramy Ahmed Fathy, Chairman of ITU's Focus Group on Smart Water Management, and Cristina Bueti of ITU.

Water crisis

Water scarcity, pollution, flooding, and other forms of water stress pose extreme threats to the global community. According to the United Nations, around 1.2 billion people (almost one-fifth of the world's population) live in areas of physical water scarcity, while 500 million people are approaching this situation. Another 1.6 billion people (almost one quarter of the world's population) face economic water shortage because countries lack the necessary infrastructure to take water from rivers and aquifers.

In many countries, the management of freshwater resources is less than optimal. This is extremely serious when water is scarce. Over-exploitation of water resources is another cause of water scarcity, as countries push for economic development.

Water leakage is also a high concern. This is a clear indication that there is need for smarter infrastructure, as well as for investment to replace ageing infrastructure.

Though sustainable water management policies have been high on the agenda of most governments, the potential of ICT to improve water management has not been exploited fully. Harnessing the capabilities of ICT within the water sector is a smart means to manage and protect the planet's water resources.

Smart water management seeks to resolve problems in the water sector by promoting the coordinated development and management of water. The aim is to maximize economic and social welfare without compromising the sustainability of water.

Smart water management technologies

Smart technologies play a crucial role in effectively and efficiently managing water resources, distribution and consumption. With ICT, the work of measuring, monitoring, metering and control of water resources can be done at lower cost and with greater precision. Satellite remote sensing, cloud computing, semantic sensor web and geographical information systems (GIS) — to name but a few — are common examples of the well-established technologies that provide information today on real-time water use.

ICT tools have made it possible to collect high-resolution digital geographical data through remote sensing. Digital geographical data can be used to create topographical models, while digital photography and videography have made it possible to store and retrieve large volumes of ground information. Such information is obviously useful to policy-makers.

Advanced ICT techniques using laser technologies are even able to capture stream flow data from one end of a river without the use of a gauge. Smart metering technologies can provide individuals, businesses and water companies with information about water use and demand, as a basis for decision-making.

Smart water metering systems can measure water consumption in real time, as well as abstraction for irrigation, and can automatically communicate this information for monitoring and billing purposes.

By combining smart water metering and mobile banking, a reliable transparent and secure flow of funds and information between the consumer and the water service provider can be achieved. This leads to the reduction of water payment transaction costs as well as administrative costs, which consequently increases revenues for water utilities.

The ICT industry has developed a range of devices and technologies tailored to key activities within the water sector. Use of these tools has led to the improvement of water allocation, consumption and usage. It has also led to the mitigation of natural hazards and to environmental protection. The table below illustrates the products and technologies provided by the ICT industry to serve the needs of the water sector.

Areas where the ICT industry is developing products and technologies for use in smart water management

Area	Products/technologies	Outcomes
Weather forecasting	Remote sensing from satellites Wireless sensor networks Geographical information systems Sensor networks and Internet	Improvement in weather forecasting
Mapping of water resources, water supply and distribution	Geographical information systems Buried asset identification and electronic tagging Smart pipes, smart hand pump, smart river meters and smart metering Smart water grid Real-time risk assessment Supervisory control and data acquisition	Improving the management of water distribution networks Reducing losses of water by active leakage control Reducing network damage and deterioration Reducing the risk of infection in the water system Increase in revenue Improvements in customer relations
Water demand forecasting	Geographical information systems Ground penetrating radars Optical and pressure sensors Clouding computing Supervisory control and data acquisition	Rain/storm water harvesting Managed aquifer recharge Process knowledge systems Improvements in water resource management
Early-warning systems	Geographical information systems Sensor networks Early-warning websites Mobile and mobile network Digital Delta	Reservoir flood management and mapping Quick data acquisition and data processing and analysing Quick and easy data dissemination for warning the public
Irrigation in agriculture	Sensor networks Geographical information systems Mobile and mobile network Subsidiary communications authorization and radio data systems	Reduction of water consumption Improvements in enterprise and resource planning

Smart cities and regions

Smart water management is an obvious fit for smart cities and regions seeking increased efficiency and more active involvement of citizens in enhancing sustainability. For example, in Canada, the government of British Columbia has initiated a Living Water Smart programme for sustainable water stewardship. This provincial plan involves eleven ministries and a range of stakeholders, and envisages investment in smart infrastructure.

The use of smart water metering has opened up possibilities for citizens to report leaks, faulty water pipes and general conditions of water canals and other infrastructure. Complaints can now include a simple photo; and details of a faulty water canal or pipe can be uploaded in real time to a central database. An example of this technology is CreekWatch, one component of IBM's Smarter Cities Water Management Solution. Social media and interactive tools offer water agencies and utilities powerful means to communicate and engage citizens on local water management challenges and drive conservation programmes.

Technologies such as water point mapping can help in improving access to a water supply, by allocating resources to deliver basic services where they are needed the most. Such technologies can also be used to measure progress and performance. In Liberia, for example, 150 data collectors equipped with phones map more than 7500 water points.

Smart technology has also been incorporated into standpipe management models to improve performance monitoring and regulation. This ensures that low-income communities that are not connected to a piped water supply to the home are able to enjoy reliable access to a fresh clean supply of water.

Incorporation of sensors and analytics in the agricultural sector ensures that crops are watered when needed, reducing the large volumes of water lost due to inefficient irrigation.

Role of ITU

ITU's Focus Group on Smart Water Management was established by ITU's Telecommunication Standardization Advisory Group (TSAG) in June 2013. The focus group brings together academia and research institutes, municipalities, non-governmental organizations, ICT organizations, industries and other stakeholders to address standardization gaps and identify new standardization work items to be taken up by its parent group, ITU Telecommunication Standardization Sector (ITU–T) Study Group 5 (Environment and climate change).

ITU has already developed ICT standards for ubiquitous sensor networks and for the Internet of Things. These standards are relevant to smart water management. ITU is now working on further specific standards to ensure that water is managed in an efficient, equitable and ecologically sustainable manner.

ITU standardization will pave the way for the use of ICT in smart water management. The first step is to identify best practices, through targeted, integrated and coordinated research on the use of ICT in smart water management. Implementation of best practices is the next step.

ITU can provide assistance, within countries, to facilitate the development and implementation of ICT infrastructure for smart water management. As part of this, ITU should offer information and training sessions to develop capacity within countries for the implementation of ICT methods for smart water management. On a broader scale, ITU should use social networks to raise awareness of the benefits of using ICT in smart water management. ITU's Focus Group on Smart Water Management is working along these lines in order to come closer to the overarching goal of ensuring sustainable water for all.

Shutterstock

Success stories in smart water management

Information and communication technologies (ICT) are central to the success of smart water management. The following highlights focus on some initiatives being taken in different parts of the world by different stakeholders where the power of ICT is harnessed to effectively achieve smart water management. The highlights are adapted from an ITU/UNESCO report on *Partnering for Solutions: ICTs & Smart Water Management* (see related article on pages 23–26).

United States

IBM provides software for smart water management to help utilities control pressure, identify leaks, decrease water use, prevent sewer overflow, and enhance the management of water infrastructure, resources and activities. These tools combine huge amounts of data received from various devices, systems and stakeholders to provide actionable reports to support the management and operational decision-making process.

This is just the sort of support that the City of Dubuque, United States, wanted for its sustainable Dubuque project (see figure). Part of the project involved

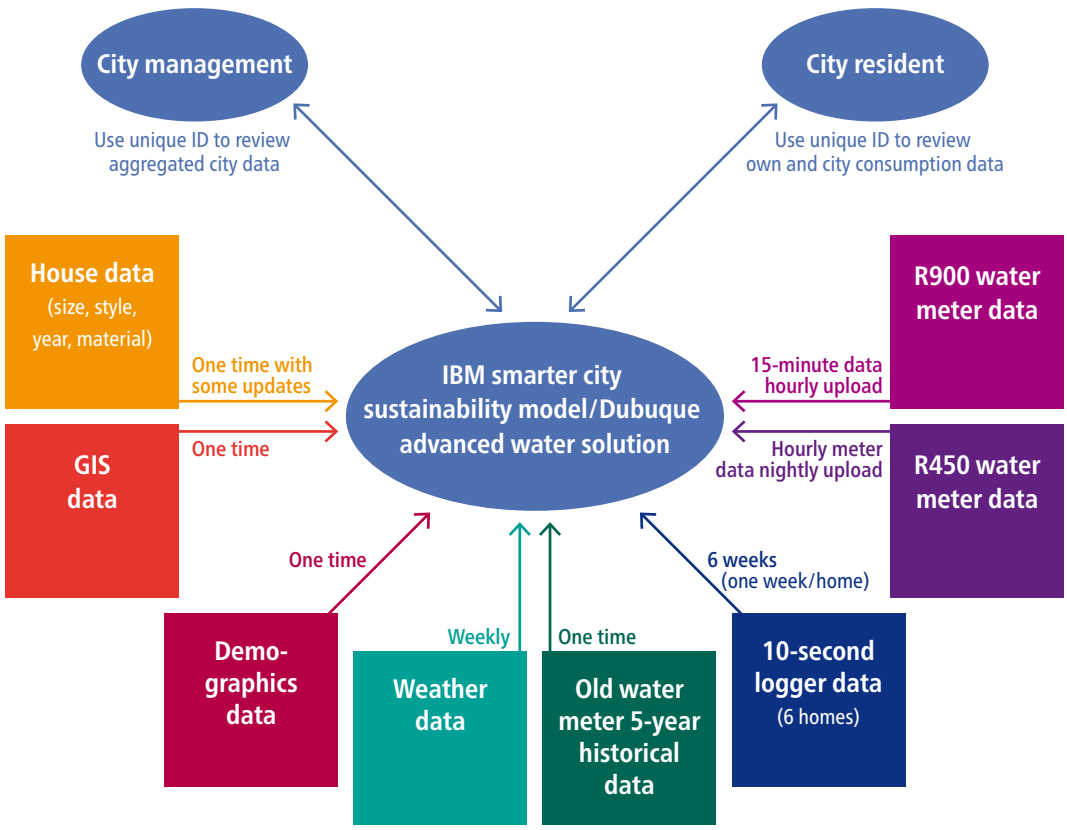
replacing community water meters, and the city enhanced its infrastructure with technology to help inhabitants make more informed decisions about their water use, by tracking consumption, costs and environmental impact.

IBM researchers developed a portal that allows households to know their water consumption in near real time, be notified about potential irregularities and leaks, get a better understanding of their consumption patterns, and compare their water use with that of others in the community. Data are transmitted from smart meters in people's homes over a 450 MHz or 900 MHz wireless communication band, then processed and uploaded to the database.

Smart water metering projects have mainly been initiated in Europe and North America — representing 89 per cent of the global smart water market in terms of module shipments. Smart water metering measures the amount of water consumed or abstracted, and automatically transmits the information to the service provider for billing and monitoring purposes, making manual readings redundant.

Automated meter reading allows for the automated collection of meter

The City of Dubuque, United States, uses IBM software for smart water management



Source: http://www.cityofdubuque.org/index.aspx?nid=1543.

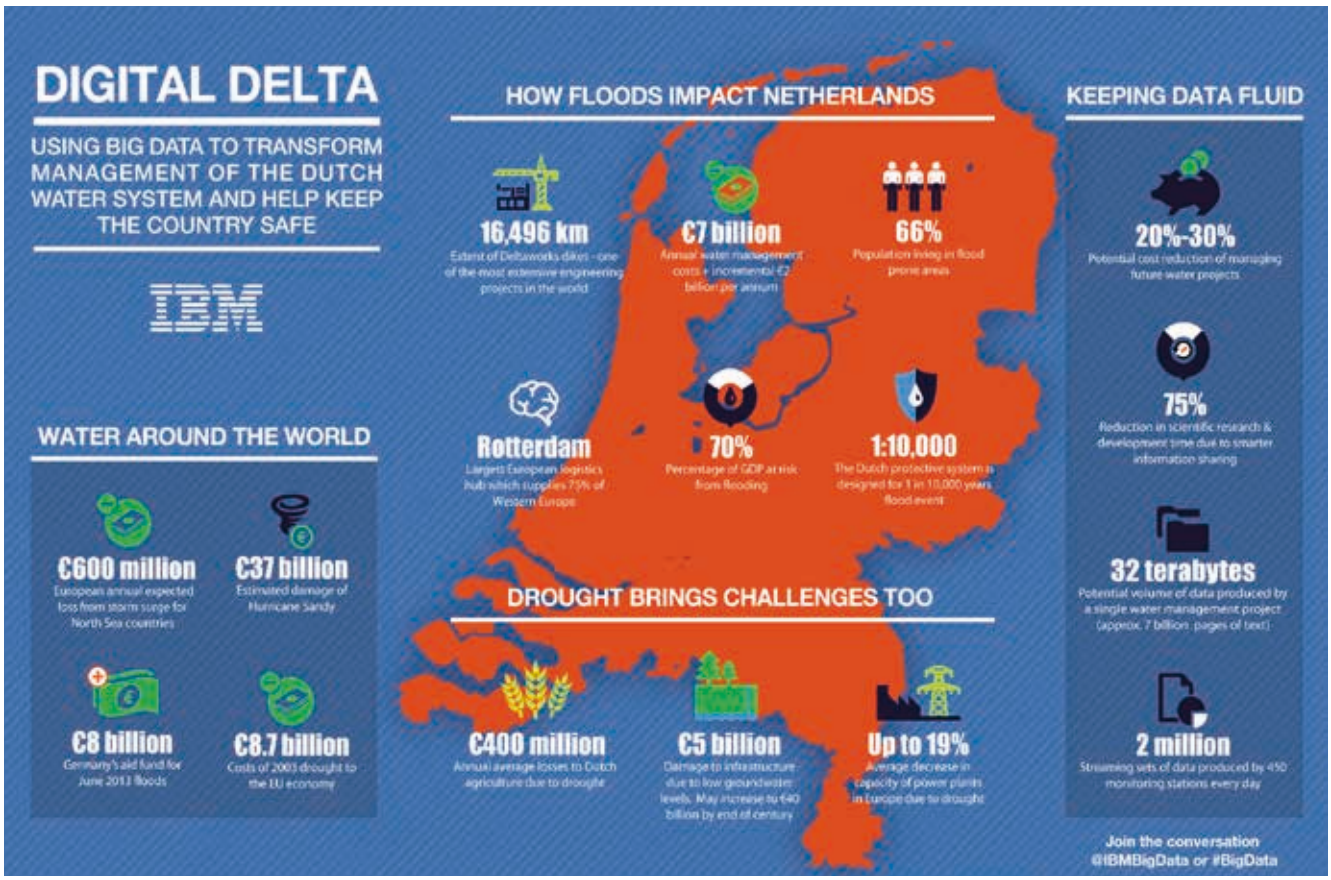
readings, usually by radio transmission, without the need for any physical assessment, whereas advanced metering infrastructure involves a two-way communication with the water meter. In particular, smart water metering systems make it possible to remotely detect illegal connections and leaks.

According to a case study report from the Water and Sewer Authority District of Columbia, United States, the fixed-network automated meter reading system reduces non-revenue water from 36 per cent to 22 per cent and increases revenue by 7 per cent through debt reduction. It also makes other savings, reducing meter reading costs from USD 4.15 per meter to less than USD 1, reducing complaint handling costs by 50 per cent and customer call centre services by 36 per cent, and — with 20 fewer field vehicles required — saving 106 000 litres of fuel annually.

Netherlands

More than half the Dutch population lives in flood-prone areas, making flood management a core task in the Netherlands. The high cost of water management has led the government of

Digital Delta uses big-data transformation for water management in the Netherlands



Source: http://www-03.ibm.com/press/us/en/pressrelease/41385.wss.

the Netherlands to embark on the Digital Delta initiative (see chart on previous page). The Ministry of Water, the local water authority of Delfland, the University of Delft and the Deltares Science Institute worked with IBM to create a system that would use insight from big data to transform flood control and management of the water system.

The Digital Delta system is an intelligent cloud-based system which has consulting capability. This management system is expected to address concerns ranging from the quality of drinking water to the impact of extreme weather events. It is also expected to reduce water management costs by 15 per cent.

The Netherlands also benefits from the smart grid and smart water metering components of the European Innovation Partnership on Water programme, established by the European Commission. The smart grid uses sensors, digital communications, and embedded digital processing to make the grid automated, observable and controllable.

The smart water meters improve administrative processes, including billing. They also make it easier to detect fraud or leaks, and to handle errors such as backflow. They can monitor water temperature and pressure, provide data to assist in distribution network planning, and reduce costs.

France

Veolia Environment is a French transnational company with operations all over the world. It provides solutions to meet the needs of municipal and industrial customers in three complementary segments: water management; waste management; and energy management.

ENDETEC, a division of Veolia Water Solutions and Technologies, has developed KAPTA, a technology for the surveillance of water supply networks. This technology has been successfully implemented in Nice, a Cote d'Azur metropolitan area of France, as well as in other European countries.

The device comprises smart, energy autonomous sensors, installed on the supply network at critical points. The sensors continuously measure water quality parameters, such as pressure, active chlorine, temperature and conductivity.

The system allows for round-the-clock surveillance in real time by Veolia experts, who analyse the data via a secure web service. In case of an alert, the experts investigate the cause of any unusual change in water quality and decide whether the water contamination was accidental or intentional. If necessary, they set in motion precautionary measures, such as closing off an area and evacuating people.

Italy

The water resources management programme for the Tiber River Basin in central Italy uses the web processing service (WPS) and the geographical information system (GIS) to improve the remote management of water resources. WPS offers computation models that operate on geographically referenced data. Image data formats or data exchange standards, such as Geography Markup Language (GML), can be used as inputs for analysis.

The purpose of WPS is to enable water resource managers to acquire the required information about the condition of the water resource in each section of the river. WPS helps operators to balance water use and water availability, taking flow conditions into account.

Kenya

Across rural Africa, millions of people are dependent on hand-pumps for their water supplies, but one-third of these pumps are estimated to be broken at any given moment and repairs may take up to a month. Access to mobile networks, however, is the norm. These circumstances gave researchers at Oxford University the idea of using mobile networks to indicate when hand-pumps are no longer working.

Hand-pump with monitoring device

Kyuso district in Kenya was chosen as the site for a pilot study on smart hand-pumps. In Kyuso, 95 per cent of the population lives in rural areas, and 60 per cent fall below the 1 USD per day poverty threshold. More than one-sixth of hand-pumps were not functional over a period of weeks or even months. Households generally take more than 30 minutes to fetch water, and the supply is irregular.

The researchers developed a technology in which a mobile data transmitter is attached to the handle of the pump. The device measures the movement of the handle to estimate the water flow. The device (see photo "Hand-pump with monitoring device") periodically sends information via text message back to a central office, allowing for maintenance to be done quickly when a pump is broken.

There is one water point data transmitter per pump, while a database processes and presents the data from all the hand-pumps. The processed information is then displayed in a graphical format together with the location of the pump. The fitted device measures usage in hourly time steps, giving the amount of water used in real time, as well as providing alerts if the hand-pump is broken or not functioning.

Another interesting project is the MajiData online database service developed by Kenya's Ministry of Water and Irrigation and Water Services Trust Fund in cooperation with UN-Habitat, the German Development Bank (KfW), Google and GIZ.

The MajiData website provides information on all the urban low-income areas of the country and is linked to satellite imagery. This service assists water service providers and water boards in organizing appropriate water supply and sanitation for urban slums and low-income areas.

Smart irrigation for sustainable agriculture in Abu Dhabi

Water conservation is crucial in the United Arab Emirates in the face of increasing demands from a growing population. Because the agriculture sector accounts for up to 75 per cent of the country's annual water consumption, improving water management in that area offers great potential for reducing the overall amount of water consumed. Introducing smart irrigation technology that improves the efficiency of water use will not only help farmers to make their activities more profitable, but also increase the sustainability of agriculture in general.

The information in this article was provided by the Abu Dhabi Food Control Authority of the United Arab Emirates.

Smart irrigation technology

Greenhouse vegetables require water to grow and ripen, so irrigation is essential. But an automatic irrigation system that is triggered by a timer may provide water that is not needed. Soil moisture sensors can reduce the number of unnecessary irrigation events. Automation of irrigation systems based on soil moisture sensors has the potential to maximize the efficiency of water use by maintaining soil moisture at optimum levels.

Farmers in the United Arab Emirates have to cope with sporadic low rainfall coupled with harsh climatic conditions. An added difficulty is that the country's sandy soil has low water-holding capacity. If the amount of water present is insufficient for plant needs, then stress occurs. The quality of plants may be reduced or — in cases of severe water shortage — the plants may die. Irrigation is therefore common.

Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant reflects the soil's ability to transmit electricity — the constant increases as the water content of the soil increases. Benchmarking the dielectric constant according to this concept, water content at field capacity (the upper limit of the regime) is considered to represent 100 per cent availability of water for crop growth, while water content at the level where plants wilt (the lower limit of the regime) is considered to represent 0 per cent availability of water.

Comparative study — tomatoes and cucumbers

A project is being carried out in Abu Dhabi to compare the water requirements of traditional irrigation with those of smart irrigation technology. The overall goal is to improve the sustainability of the agricultural sector.

For each crop, the safe limit of soil water depletion (the lower limit of the regime) is determined experimentally and is taken as the criterion for triggering smart irrigation. The project uses a wireless soil moisture sensing system to measure the water content of the soil. This type of information is necessary to make good irrigation scheduling decisions — especially if a variable rate irrigation system is used.

The smart irrigation system consists of smart sensor probes installed at multiple depths. These probe arrays are linked to a solar-driven monitoring station and a radio-frequency transmitter. A sample of 200 farms has been selected from around the emirate. Water consumption is measured by fixing meters at each of the farms. The farms are classified into three categories depending on their crops: farms that cultivate vegetables, date palms and fodder; farms that cultivate date palms and fodder; and farms that cultivate only date palms.

As a proof of concept, the research arm of the Abu Dhabi Food Control Authority has implemented a pilot study on smart irrigation technology. The study, which took place from 2011 to 2013, considered two different crops (tomatoes and cucumber).

The smart irrigation system is based on soil-water balance and crop-water balance, as measured at one or more points in the field. Continuous measurement of the water content of soil indicates when irrigation water needs to be applied to prevent crop stress. The computerized

Abu Dhabi Food Control Authority

scheduling of irrigation allows for the storage and transfer of data, easy access to data, and calculations to predict crop evapotranspiration.

The pilot study evaluated the efficiency of water use in the irrigation of tomatoes and cucumbers grown in greenhouses. Four different irrigation regimes were evaluated: treatment according to the Dacom intelligent irrigation system; and three levels of irrigation equivalent to 75 per cent, 100 per cent and 125 per cent of the reference evapotranspiration calculated according to the United Nations Food and Agriculture Organization (FAO) Penman-Monteith method.

The Dacom intelligent irrigation system significantly reduced the water requirements for irrigation and achieved a higher crop yield as compared with the other irrigation levels (see table).

Scaling up smart irrigation

The pilot study on tomatoes and cucumbers is part of a research and demonstration project being undertaken by the Abu Dhabi Food Control Authority to quantify the potential of precision irrigation. The project's aim is to evaluate a wireless soil moisture sensing array for the purpose of scheduling irrigation. The goal is to maximize water productivity by optimizing crop yield and minimizing the amount of water used in irrigation.

Water use efficiency is an important agronomic factor, especially in agricultural irrigation systems and in climatic zones where a limited amount of water from the rainy season has to last for the whole growth period, as no further rainfall can be expected. The project's purpose is therefore to evaluate tools that will enable farmers in the United Arab Emirates to make better use of their water resources.

The project uses smart wireless soil moisture sensing systems to increase irrigation efficiency. The idea is to assess the actual water requirements of crops through the use of wireless soil sensors placed in the root zones of plants at depths of up to 1.2 metres, depending on the type of plant. The sensors are used to determine soil moisture content at 10 centimetre intervals.

These data are then sent to a central computer wirelessly via satellite. The computer software displays the data graphically, which helps researchers to observe moisture levels near the plant roots. The software processes these data to determine, depending on the type of soil, when irrigation should take place and how much water should be used. The software also runs the irrigation device wirelessly.

The project timeframe is 2012–2015 and comprises three phases. During the first phase, information will be collected on the production and smart irrigation of cucumber and tomato crops (2–3 years), forage crops (2–3 years) and date palm

Crop water use efficiency (kilograms of crop per square metre) for the Dacom intelligent irrigation system as compared to three FAO irrigation levels

Crop	FAO 125%	FAO 100%	FAO 75%	Dacom
Tomato	12.44	14.13	12.7	16.85
Cucumber (winter)	38.43	37.46	44.99	48.53
Cucumber (spring)	14.44	16.46	19.30	23.43

Shutterstock

trees (3–5 years). In the second phase (2 years), the smart irrigation system will be rolled out to mass production on farms to test its economic viability at full scale. Activities will also be expanded to evaluate the use of these technologies on the other main crops in the country, such as potato, lettuce and citrus. In the third phase, the most effective technology will be disseminated to farmers throughout the country, and the plan is to assist farmers in adopting the technology.

The benefits of smart irrigation

As a scarce resource in the United Arab Emirates, water affects all sectors of the economy. The findings from research on smart irrigation systems showed that smart irrigation is superior to traditional irrigation in terms of controlling water use and in producing agricultural outputs. Smart irrigation therefore has a beneficial effect on revenue. It increases water productivity in vegetable agriculture, increasing the return per square metre of vegetable production. It also dramatically decreases irrigation losses, which will save millions of cubic metres of water annually on a national scale. The next stage is to develop an irrigation scheduling programme for the vegetables greenhouses in the Al Ain area.

In terms of raising awareness, the results of the project will lead to a realistic appreciation of the actual consumption of water by farms for irrigation purposes. "The findings of the initiative will help us direct the farmers to use only the required amount of water so as to conserve water. The specific water needs of each crop can be identified and irrigation regulated accordingly". This is the view of the Abu Dhabi Food Control Authority, in pursuing — among its strategic priorities — the improvement of agricultural practices and progress in the farming sector.

Overcoming challenges

One of the main challenges is to get farmers to adopt smart irrigation. The response in the United Arab Emirates is twofold, involving awareness-raising by disseminating the results of research on smart irrigation, and providing education and practical support in cooperation with the Farmer Services Centre.

Once the farmers agree to adopt the smart irrigation system, they will need to be provided with specific information on the daily irrigation requirements of their crops. This will be achieved through the development of a computer or web application which will make the information available to the farmers at any time.

Another obstacle concerns how to deal with areas where soil salinity is high and water quality is low. Such areas have so far been excluded from the research, and outcomes are likely to be less good, but farmers in these areas need support. One possibility would be to use the Abu Dhabi soil mapping information and feed the web application with the most recent salinity levels in each region. These salinity levels could then be taken into account in calculating the water requirements for irrigation.

Agricultural policy

The Abu Dhabi Food Control Authority project is in line with the policy of the Government of Abu Dhabi and in particular its Agenda 2030. The policy aims to achieve the environmentally sustainable development of the farming sector, in order to guarantee food safety and food supply in the United Arab Emirates. This is in line with the national vision for sustainable agriculture, which states that "The agricultural sector is one of the country's largest consumers of water, and this is a reflection of the management of agricultural lands and soil treatment. The increasing population, and the need to secure food for them, requires special efforts to guide the agricultural sector towards environmentally sustainable consumption of water, the correct use of chemicals and safe waste management of farms".

Sustainable agricultural development is based on a balanced framework for developing and implementing suitable farming systems and good agricultural practices. Increasing production efficiency through modern techniques, and combining high value crops and animal wealth are essential.

The project promises to develop irrigation management guidelines based on best practices. The guidelines will provide practical information and advice that farmers can use to make, document and revise decisions relating to the design and operation of irrigation systems, to achieve sustainable irrigation.

According to the findings so far, the Dacom method shows an increase in irrigation efficiency of more than 10 per cent as compared to other scientific estimation methods, which in turn means saving millions of cubic metres of water in Abu Dhabi.

Multimode broadcasting receiver

P.V. Giudici, Vice-Chairman of the Radiocommunication Advisory Group; and Alfredo Magenta, member of the Radio Regulations Board

Alfredo Magenta

The convergence of different digital services, coupled with the feasibility of an intelligent unique receiver — available at an accessible price — covering all radio bands and all different systems, offers a new way of thinking about telecommunications. This article envisages the advantages that a multimode broadcasting receiver would bring worldwide, and looks at some of the steps to be taken to make such a device universally available.

Selling a huge number of multimode devices would drastically reduce their unit cost, increase the services available to users, and open the door to a universal mobile telecommunications system integrated with all other services. This could create a new generation of systems and a new generation of services.

The key to progress along these lines is coordination between the different actors involved. If users are ready to buy the new equipment and industries are producing such equipment, then governments need to have the relevant frequency plans in place. Also, to promote change, it is important for there to be enough broadcast programmes with interesting content to attract users' attention.

In an era of technological convergence, a low-cost receiver is a keystone in bridging the digital divide. Once the millions of old receivers are replaced, convergence of services will become a tangible reality. This will set the stage for the development of a universal mobile telecommunications system and hence of a global information society.

Digitization

The increasing introduction of digital methods in different systems in the 1990s led ITU to undertake an in-depth analysis of the convergence of telecommunication services.

Digitization of services results from the development of technological systems. It involves both the development of new standards and the production of equipment capable of complying with them.

One of the first digital achievements was the digitization of signal distribution links, in order to reduce occupied bandwidth and make the received signal more resistant to noise. This enabled the producers of broadcast programmes to improve audio and video quality. Another step was the digitization of television broadcasting by satellite and, more recently, terrestrial transmissions. At the same time, the spread of personal computers and the Internet made possible the realization and transport of digital audio systems, video and multiplexed data.

This boosted the search for compatible alternative systems, leading to a convergence of services that will probably require a revision of frequency allocations and, as

a consequence, new planning as well as redefinition of "service". It will be the task of smart systems to package programmes, and of smart receiving equipment to select the requested programme and present it to the user in the desired form.

In some bands, the digitization of broadcast terrestrial radio programming has been left out of this process. A further step needs to be taken to digitalize radio broadcasts in amplitude modulation and frequency modulation, in order to harmonize broadcast and reception systems and complete the convergence of services.

Technological advances

New technologies can change society. In our time, we have seen information being spread incredibly quickly and cultural changes taking place even faster. Thanks to technologies such as shortwave and satellite, telecommunications now almost instantly reach more than 80 per cent of the world population.

This favourable situation calls for the enhancement of radio and television programmes by means of a global language translation system that enables users to receive these programmes in their own languages. The same applies, of course, to the transmission of text via the Internet. Here, however, the creation of language translation programmes has already made it possible to use e-mail worldwide, across language barriers.

For radio and television programmes, a comparable system would require the creation of a receiver capable of coping with the technical, economic and sociological implications of converged systems. To meet these needs, the ITU Radiocommunication Sector (ITU–R) Study Group 6 (Broadcasting) has adopted Question 136/6 on world broadcasting roaming, as defined in Recommendation ITU–R M.1224. One solution would be the reception via a single receiver of all the radio and television programmes and multimedia available in different areas of the world.

We already have the latest generation of small mobile devices that serve as telephones, cameras, FM radio receivers, SMS transmitters and receivers, and so on. In addition, iPads and similar devices operate primarily on the Internet, while also serving as audio communication devices and television viewing platforms, among other functions.

From this level of technological development, the next step is to create a flexible, all-inclusive and universal reception system, which enables the use of different programmes and services. In other words, there is a need for a multimode receiver (a multimedia, multi-software, multi-standard, multi-band device) capable of satisfying a global audience.

Equipment characteristics

A first step towards a multimode receiver is surely to make a multimode radio receiver, as recently proposed to Study Group 6. This might stimulate the production of specific chips for radio receiving functions. In the not too distant future, this in turn might facilitate the creation of an omni-purpose chip with the functions necessary for receiving global multimedia telecommunications.

A multimode radio receiver should satisfy the following user requirements. It should be compact, lightweight, and powered from the mains or by rechargeable battery with several hours autonomy. It should have all the manual controls of a radio receiver, enabling users to tune in to radio and television programmes in all the frequency bands allocated to broadcasting. The device should be capable of receiving all the emission standards currently being used for broadcasting around the world, and be able to download from the Internet any other specific emission standards being used for broadcasting in particular countries.

The device should offer a menu presenting, for each station, the quality level of the received signal. It should update, either automatically or on command, the list of programmes being received at the time, and it should read the metadata with information about the contents of the programme — language, genre (sports, news, music, and so on) and

sub-genre (for example, classical music or light music). The menu should display a clickable list of stations that meet the selection criteria entered by the user and provide the user with a choice of languages. The receiver should provide translation into one main language chosen by the user.

Multimode radio receivers should also be designed with the capability of making information and communication technologies accessible to the more than 650 million people with sensory disabilities.

Meeting all these requirements obviously demands worldwide standardization, both of the receiver and of the multiplexed metadata in the programme stream.

Standardization of the receiver will perhaps initially require the production of different types of chips — one with the software needed to manage the different functions of the receiver, another to selecting the frequency bands and antenna. Given the high potential market demand for the devices, the cost of these chips should be sufficiently low to be commercially viable.

Potential market

Of the eight billion people in the world today, some 30 per cent are probably ready for technological innovations in telecommunications. This would mean that there are at least two billion users ready to adopt technologically advanced devices. However, given that China, India and Brazil are beginning to use new technologies, and that these countries along with the developed nations in Europe, Asia and North America account for more than half of the world's population, the number of users interested in purchasing new telecommunications equipment is likely to be nearer five billion. A market of this size would drastically reduce the unit

cost of receivers, because production costs could be spread over a high number of saleable units.

The globalization of markets, the rise of multinational corporations and the availability of transport are among the factors that have made the world's population increasingly mobile. Millions of people move far away from their homelands. Their desire to stay in touch with their countries of origin, coupled with a need to know about the place they are in, drives these users to seek a device that allows them rapid information updates.

Economic and legal aspects

Mobility in a global industrialized world requires the respect of both local and international regulations.

People can buy equipment capable of accessing local proprietary standards, in order to receive programmes that are available locally. It follows, from the standpoint of an intelligent unique receiver, that different standards can no longer be discriminated against because they must be recognized by the receiving device. This implies that the relevant software can be acquired.

Alongside the technical requirements, the development of a unique receiver would call for international economic standards to govern the acquisition of software. Such software must be not only downloadable, but at the same time non-transferable to other users. This further requires the development of international law to allow the uses of such intellectual property and to set penalties for abuses.

Advantages for manufacturers

The creation of a single multimode receiving apparatus would allow each holder of proprietary emission standards to retain possession of its intellectual property and to build different transmission apparatus for local services, thus conserving its domestic market.

At the same time, the intelligent unique receiver would reduce production costs because the same components could be used worldwide. Universal marketing would also decrease advertising costs.

A universal multimode broadcasting receiver would not only give the telecommunication market a boost, but would also break down barriers to the information society.

Shutterstock

Direct-to-home television platforms

Revenues going up, entry costs coming down

More than 150 platforms with television revenues primarily derived from direct-to-home (DTH) satellite broadcasting are now offering services. The 202 million subscribers in more than 100 countries (early in 2013) are expected to generate an annual revenue exceeding USD 100 billion, according to Euroconsult's Executive Report *DTH Platforms: Key Economics & Prospects,* released in November 2013.

Market profiles

The report highlights wide differences between countries. It identifies three distinct market profiles on the basis of different growth patterns and service availability. First, advanced markets such as the United States, the United Kingdom, France and Japan have high maturity in terms of pay-TV, and are seeing fierce

competition resulting from telecommunication and media convergence and online entertainment. Second, in transitional markets, pay-TV penetration is increasing beyond 50 per cent, and consolidation is taking place among pay-TV providers in order to reach critical mass and achieve solid operating margins. Finally, emerging and fast-growing direct-to-home markets had 126 million subscribers and 20 per cent growth in 2012. Strong competition exists among platforms, with up to six or seven services in countries such as India and Indonesia.

Commercial strategies

The report benchmarks the commercial strategies and economic performance of direct-to-home platforms, and provides a number of findings to support future development priorities. "In a highly competitive environment, content stays at the heart of the development model", says Pacôme Revillon, CEO of Euroconsult. "Excluding new platforms, the standard offering now stands at 100–150 channels, with around 25 per cent of platforms offering more than 150 channels." Emphasis is being given to proprietary content and channels, and to securing premium television rights. This results in higher programming costs, usually representing more than 40 per cent of operating costs and 30–40 per cent of revenues.

High definition (HD) is becoming a must-have for direct-to-home platforms worldwide. Two-thirds of platforms now offer HD content. And the number of platforms with more than 20 HD channels more than doubled in the past two years. SKY Perfect JSAT in Japan is set to become the first HD-only platform by 2015. Although HD penetration already reaches 40 to 60 per cent of subscribers for certain players, it still remains a niche service in many fast-growing economies.

While platforms in advanced markets aim for an average revenue per user of more than USD 40 to 50, subscriptions and strategies are now targeting low-cost services, particularly in emerging digital markets. Entry prices of no more than a few dollars per month result — for many platforms — in an average revenue per month of around USD 10 or less. However, low-cost strategies allowed Tricolor TV in the Russian Federation and Multichoice in South Africa to sign up a total of 12 million subscribers in five years.

Besides high definition and low costs, the third major trend for direct-to-home platforms comprises vertical integration and converging service ecosystems. This is based on three pillars. The first is the roll-out of new generation digital video recorders with up to 1 terabyte storage capability and more flexibility in home networking. The second is the roll-out of non-linear services — with video-on-demand (online and push) already being provided by more than two-thirds of direct-to-home platforms, television everywhere and on the move, and over-the-top (OTT) services. The need to offer triple-play services leads to different strategies, ranging from the ownership of direct-to-home services by telecommunication operators (more than 60 per cent of platforms in Latin America), to direct investments in telecommunication operations (Sky Digital in the United Kingdom or Bulsatcom in Bulgaria) and partnership-oriented strategies (DirecTV in the United States and Canal+ in France).

Service strategies have allowed platforms to maintain churn rates between 10 and 20 per cent, with best performing platforms — such as Astro in Malaysia, Cyfrowy Polsat in Poland and Sky Deutschland in Germany — reducing their churn rates in recent years.

Direct-to-home subscriptions should reach close to 350 million people worldwide by 2022, including around 270 million in fast-growing economies. Asia (led by India and Indonesia) and Latin America (led by Brazil and Mexico) are expected to be the fastest-growing markets. In these markets, subscriptions should continue to be supported by low-cost offerings and the roll-out of new services.

Welcome address by ITS Japan Chairman Hiroyuki Watanabe

MIC/Japan

Intelligent transport systems

World congresses seek transport safety, security and efficiency

Contributed by Japan's Ministry of Internal Affairs and Communications

Highlights from the 20th ITS World Congress

Intelligent transport systems (ITS) will create a new vehicle industry, according to Hiroyuki Watanabe, Chairman of ITS Japan, who shared his vision for the future after declaring open the 20th ITS World Congress. In a video message to the congress, held in Tokyo on 14–18 October 2013, Japan's Prime Minister Shinzo Abe identified intelligent transport systems as a strategic growth factor for Japan and declared that he would build more infrastructure to support such systems.

Under the theme "Open ITS to the Next", the 20th ITS World Congress Tokyo 2013 sought ways to open up the potential of intelligent transport systems on the basis of open platforms, open connectivity, open opportunities and open collaboration. The event attracted

The Ministry of Internal Affairs and Communications booth

MIC/Japan

20 961 people from 65 countries. Along with the opening and closing ceremonies, there were 232 sessions. These included executive sessions, in which high-level industry executives, public officials and academics from around the world shared global and strategic views on intelligent transport systems. There were also special interest sessions, organized at the request of organizations or individuals involved in developing and deploying intelligent transport systems. These sessions took the form of open workshops for experts from government, industry and academia.

An exhibition of intelligent transport system technologies, products, and services provided opportunities for interdisciplinary networking among national and regional organizations, industry associations, the corporate sector and researchers. A total of 137 companies and ministries exhibited their products, services or policies.

The exhibition was open not only to congress participants, but also to interested parties from companies and industry groups. Various field trips and tours were conducted to give participants a closer look at the deployment of the latest technologies.

In the area of safety, there was an exhibit on new driving support systems that lay the foundation for automated driving, from conventional technologies such as forward-collision prevention braking systems and lane-departure prevention systems, to collision prevention systems and parking support systems that use vehicle-to-vehicle communication. A disaster-response system that uses communication from vehicles to an intelligent transport system control centre was unveiled.

Opening up to society

Starting from basic concerns regarding safety and traffic management, the field of intelligent transport systems is now extending into three new domains: energy management; personalized mobility

services navigated by big data; and resilient transport systems. The first two stem from the emergence of electric vehicles and continuously advancing information and communication technologies (ICT).

The concept of resilient transport has become prominent since the earthquake that devastated east Japan in 2011. More generally, mobility in mega cities or regions is a major challenge that needs to be addressed in emerging economies, especially in Asia.

20 years of achievement

In the early 1990s, the three main world organizations responsible for advancing intelligent transport systems, ITS Japan (Asia-Pacific), ITS America (the Americas) and the European Road Transport Telematics Implementation Coordination Organization (ERTICO), agreed that there should be one major world congress each year where advanced concepts, research results and deployment activities could be presented and discussed. It was agreed that each congress would include a display of new equipment and operating practices. Beginning in Paris in 1994, the event has subsequently rotated around the three participating regions.

Bringing together the world's automobile manufacturers with government representatives from many countries, in particular from ministries of transport or communications, the annual ITS World Congress has achieved great results, such as the implementation of electric toll collection.

Concepts demonstrated at the 20th congress showed that the history of achievement continues. For example, the Study Group for Promotion of Advanced Safety Vehicle, a joint initiative involving industry, academia and government, headed by Japan's Ministry of Transport, has developed communication-based advanced safe driving assistance systems, which were demonstrated during the congress.

Driving assistance systems with vehicle-to-vehicle and vehicle-to-pedestrian communication can improve safety in different traffic conditions. For instance, the systems can prevent accidents when visibility is poor by providing drivers with information on potential hazards such as the approach of vehicles or pedestrians. They can also support drivers by providing information on traffic conditions.

In another example, Toyota demonstrated a new concept of a driving assistance system using cooperative adaptive cruise control and lane trace control to reduce traffic jams, accidents and driver workload. The cooperative adaptive cruise control system manages inter-vehicle distance, while the lane trace control system keeps vehicles in the centre of their lanes and prevents weaving. Both these demonstrations used 700 MHz vehicle-to-vehicle and roadway-to-vehicle communication systems.

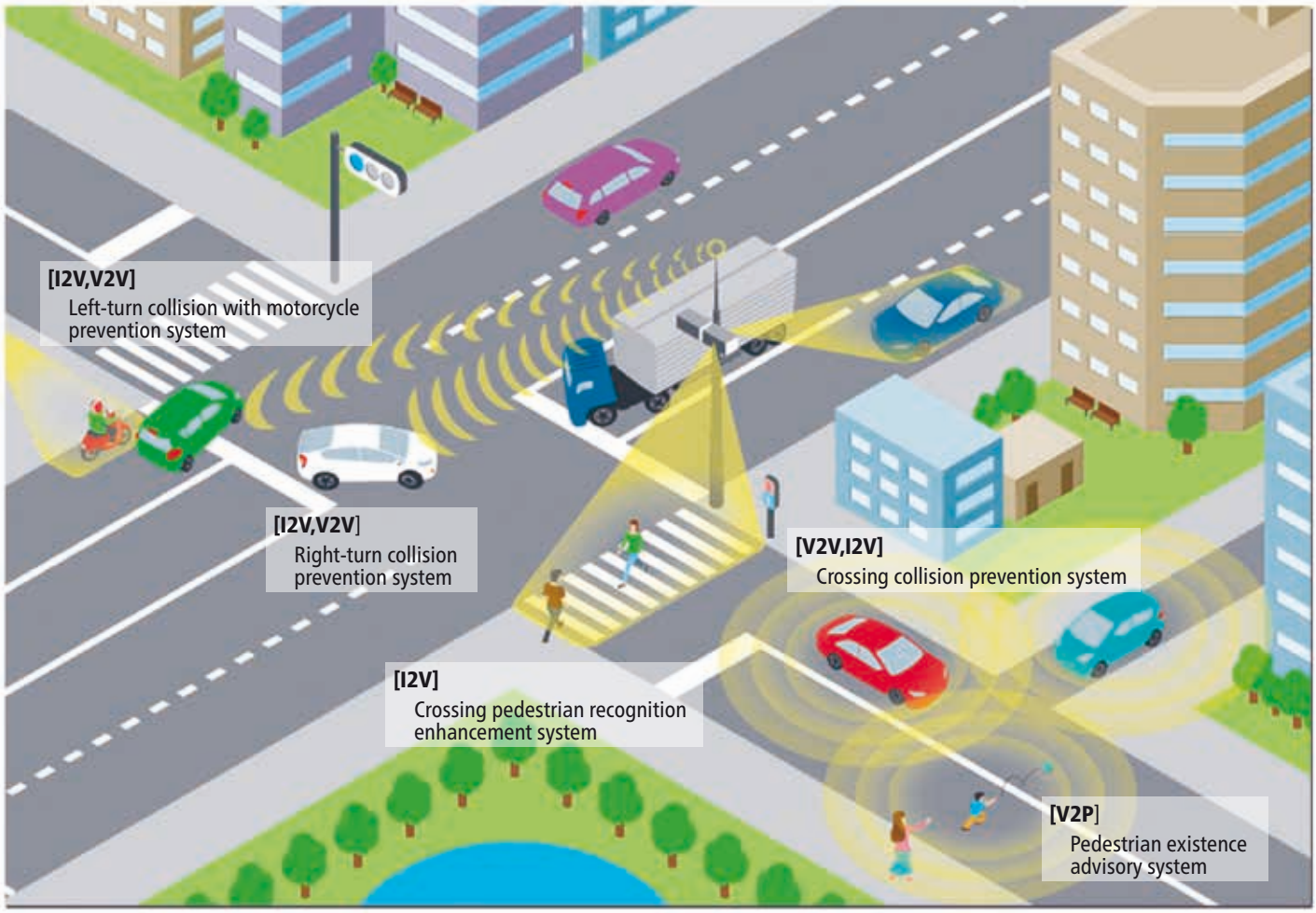
Using part of the 700 MHz band to support safe driving

Japan's Ministry of Internal Affairs and Communications shared its vision of cutting-edge ICT for intelligent transport systems, such as the 700 MHz vehicle-to-vehicle and roadway-to-vehicle communications systems supporting safe driving and the 79 GHz high-resolution collision-prevention radar for pedestrian safety.

Following a study on possible uses of the frequency bands made available as a result of the digitization of terrestrial broadcasting, the Information and Communications Council of Japan's Ministry of Internal Affairs and Communications concluded in June 2007 that part of the 700 MHz band should be used for advanced intelligent transport systems to create safer transport infrastructure. Following research on the matter, the Information and Communications Council considered the technical requirements (in particular relating to interference) for the 700 MHz band to support driving safety through vehicle-to-vehicle and roadside-to-vehicle communications. This led, in December 2011, to a revision of the related technical regulations.

Intelligent transport systems using the 700 MHz band send and receive information, such as positions and speeds of automobiles and other surrounding vehicles, in two ways: between vehicles with built-in radio devices (in-vehicle devices);

Safety driving support by 700 MHz band communication system



[V2V]
Approaching emergency vehicle information system

[V2V]
Road-works vehicle information system

[I2V]
Signal information drive system

MIC/Japan

I2V — Information to vehicle | **V2V** — Vehicle to vehicle | **V2P** — Vehicle to pedestrian

and from stations located on roadways (roadside devices) to in-vehicle devices.

Radio waves in the 700 MHz band used by these systems have the feature of wrapping around buildings and behind large vehicles, into areas out of the field of view. This gives access to information about vehicles in the driver's blind spots and can prevent collisions at intersections where visibility is poor.

Vehicle-to-vehicle communication can be used anywhere, regardless of whether base stations have been installed or not. Where base stations have been installed, roadside-to-vehicle communication is able to provide information to vehicles — such stations are expected to be effective in areas that are prone to traffic accidents.

Starting from 1 April 2013, it became possible to license roadside devices in all regions of Japan, and also to use in-vehicle devices. Studies are now focusing on introducing pedestrian-to-vehicle communication, using radio devices carried by pedestrians.

Pedestrian safety

To prevent accidents involving people and bicycles near vehicles, there has been demand in Japan for high-resolution radar able to detect small objects. Accordingly, the Ministry of Internal Affairs and Communications has drawn up a policy for the use of 79 GHz band radar, because radar in this band is able to detect small objects such as pedestrians. Regulatory revision is currently under way.

Many fatal accidents involving pedestrians occur while they are crossing the road. High-resolution radar can distinguish between parked cars, roadside structures and humans, and provide precise information to the driver. High-resolution radar also detects the location of objects more accurately. For example, to prevent accidents at pedestrian crossings, it is necessary to be able to detect individuals within groups of people. This is possible with high-resolution radar.

High-resolution radar systems using the 79 GHz band hold out the promise of protecting pedestrians both by warning drivers and by linking danger alerts to braking controls in the vehicle.

Another common cause of fatal accidents involves motorcycles. Accidents often occur when vehicles are passing each other on straight roads or when making turns. In such cases, it is more important to detect the small fast-moving motorcycle than the automobile.

With 79 GHz band high-resolution radar, it is possible to detect objects over a wide range of distances, from short distances around an intersection to longer distances along a straight roadway. Efforts are now being made to develop technologies to increase the detection-range angle for 79 GHz band high-resolution radar, in order to meet an increasing range of needs in the future.

Reinventing transportation in our connected world

The 20th ITS World Congress closed with the ceremonial passing of a globe to Detroit, United States, where the 21st ITS World Congress will be held on 7–11 September 2014 under the theme "Reinventing Transportation in our Connected World".

"Our theme … is a great story of reinvention of our transportation systems", says the chairman of the organizing committee for the 2014 congress, James Barbaresso, Vice President of Intelligent Transportation Systems, HNTB Corporation, and Organizing Committee Chairman of the 21st World Congress. The theme covers vehicles, people, mobile devices, and roads and infrastructure. Detroit now has more than 200 miles of freeway covered by the latest intelligent transport technology. More than 238 closed-circuit television cameras constantly monitor the condition of the roadways, while 78 electronic message signs update drivers on road works or delays. There are also traffic signals with centralized and adaptive control systems to improve traffic flow. "Detroit is made of grit, but we're also made of silicon", says Mr Barbaresso.

Consumer electronics

What's here and what's coming

Highlights from 2014 International CES

The International CES consumer electronics show held in Las Vegas on 7–10 January 2014 highlighted a line-up of gadgets on the horizon. From connected socks to baby clothing, wearable technology was an overriding theme. Connected eyewear and apps for Google Glass were prominent, as was the first-ever "wrist revolution" zone.

Ultra-high-definition televisions shared the stage with many connected objects. DigiWorld Institute estimates that the number of connected objects worldwide will grow from the current 15 billion to 80 billion by 2020. Here are some of the highlights of this year's consumer electronics show from *Agence France Presse* (AFP).

Televisions: The major manufacturers showed off their biggest displays, including ultra-high-definition, curved screens and interactive features. Technology and entertainment industries unveiled new partnerships that will deliver high-definition content that takes advantage of these new features.

Automobiles: A number of automakers exhibited at the show, highlighting the importance of technology in the vehicle. Driverless parking was demonstrated, and General Motors announced that some cars would have 4G Internet connections.

Smartphones: Many apps leveraging the computing power of the smartphone were unveiled and some powerful new "phablets" (something between a smartphone and a tablet), as well as bendable displays were introduced.

Robotics: For play, work or entertainment, robotics took up an increasing amount of floor space. Robots designed to teach children programming were showcased.

Drones: Grabbing a lot of attention were exhibitors of personal drones to be used as toys, or for professional photography and cinematography.

Smart homes: Home appliance titans LG and Samsung added their might to a trend of letting people command and even exchange text messages with stoves, washing machines, vacuum cleaners and other household equipment, for tending to the demands of daily life. Another novelty at the show came from makers of Internet-enabled door locks.

Intuitive computing: Some technology firms want to get rid of the mouse and touchpad. New computer and gaming hardware was imbued with software that recognizes gesture, voice and even eye movements, freeing people to interact with devices naturally instead of having to click on icons or use touchscreens.

Ultra-high-definition televisions with curved screens at the 2014 International CES in Las Vegas

AFP

Ultra-high-definition television

Television giants touted the wonders of ultra-high-definition screens. The new screens offer picture resolution about four times more vivid than current high-definition sets.

Sony unveiled new cameras for capturing video in ultra-high-definition (or 4K as the technology is also known) as well as screens designed to display the rich footage in all its glory.

Recognizing that content is king, Sony's Video Unlimited service boasts a library of more than 140 titles, including the full catalogue of the hit series Breaking Bad. Sony is also working with Google-owned YouTube and popular online video streaming service Netflix to feature 4K content on television sets.

The Internet is seen as the natural medium to deliver 4K shows or films to televisions. Content creators are excited about 4K and what it allows them to show in storytelling.

Samsung showed an ultra-high-definition television with a 105-inch curved screen, to provide something similar to a cinematic experience. Samsung also introduced a striking bendable television that can be converted from flat to curved screen at the touch of a button. Samsung has 4K content partnerships with Netflix and Amazon, as well as film studios Paramount and 20th Century Fox.

LG also weighed in with ultra-high-definition televisions that feature curved screens. Among new LG television models is one with a frame to display art or personal photographs when the screen is not in use. LG announced an alliance with Netflix to stream 4K shows to new televisions.

Analysts, however, remain skeptical that 4K will be enough to convince people to spend thousands of dollars to replace their current high-definition

flat-screen televisions. They think that the most important thing that will happen in television in 2014 will be the continued expansion of online video onto the television screen via over-the-top (OTT) devices and services such as Xbox One, Roku, and Google's Chromecast. Unlike 4K television, these OTT devices and services lower consumer costs while expanding viewing options. Roku technology is now being built into televisions.

Streaming rich 4K data smoothly requires high-capacity broadband connections, which can be costly or unavailable. Meanwhile, Dolby has developed technology that lets film or television show makers create visually stunning content that can be displayed over televisions that people already own.

3D printing

With three-dimensional (3D) printing, shoes, belts, eyeglass frames, toys and more can be printed at home as easily as documents.

Music star will.i.am made his debut at International CES in Las Vegas as creative officer for 3D Systems, predicting that the technology will do for many basic items what iTunes did to the way people get songs.

He predicted that, within a decade, 3D printers will be as common in homes as refrigerators, televisions and microwaves, and people will print out things instead of dashing to a shop to buy the items.

3D printing has been around for about 25 years but has seen a surge in popularity as the technology improves and costs drop to a point accessible for hobbyists, artists and entrepreneurs. Brooklyn-based MakerBot was the only 3D printer company at CES five years ago. Now, it is surrounded by rivals. For example, Singapore-based Pirate 3D introduced its Buccaneer home printer that sells for USD 497.

Printers aimed at the home market typically use corn-based biodegradable plastic, layered and shaped using lasers and heated plates. The process can be thought of as laying layers and layers of microscopic bricks.

Entrepreneurs without major financial backing can create prototypes themselves and even do small-scale manufacturing. Along with objects such as figurines, chess pieces and appliance handles, printers can pump out ball bearings, gears and components for creations with moving parts.

MakerBot printers have been used in Africa to make prosthetic hands at a fraction of what they might typically cost. Digital plans for the "robo-hand" have been downloaded 55 000 times, according to MakerBot, which makes a vast library of digital blueprints available free at its website. Fifth-generation MakerBot printers range in price from USD 1375 to USD 6500. Despite growing interest, it remains to be seen whether 3D printing becomes mainstream.

Candies made from a 3D system printer showcased at the 2014 International CES in Las Vegas

AFP

Wearable computing

Computer chip giant Intel unveiled its push into wearables and connecting everyday devices, as it seeks to leapfrog the competition in mobile computing. On its own or with partners, Intel will produce a range of products, from a health monitor integrated into baby clothes to a heart monitor in earbuds. A turtle-shaped sensor on baby clothing will send information to a smart coffee cup about an infant's breathing, temperature and position. Earbuds will enable runners and athletes — who already listen to music while exercising — to get detailed health information in real time.

Intel's new "personal assistant", dubbed Jarvis, is the company's answer to the voice-activated Google Now and Apple's Siri. Intel will also be producing a smartwatch with "geofencing", which alerts families if children or elderly people leave a specific geographic area.

To address questions of security, Intel will offer its McAfee mobile software free of charge. Intel also said that its new chips would allow for a "dual boot" that enables computer makers to include Microsoft Windows and Google Android on a single device, with users able to change from one to the other at the touch of a button.

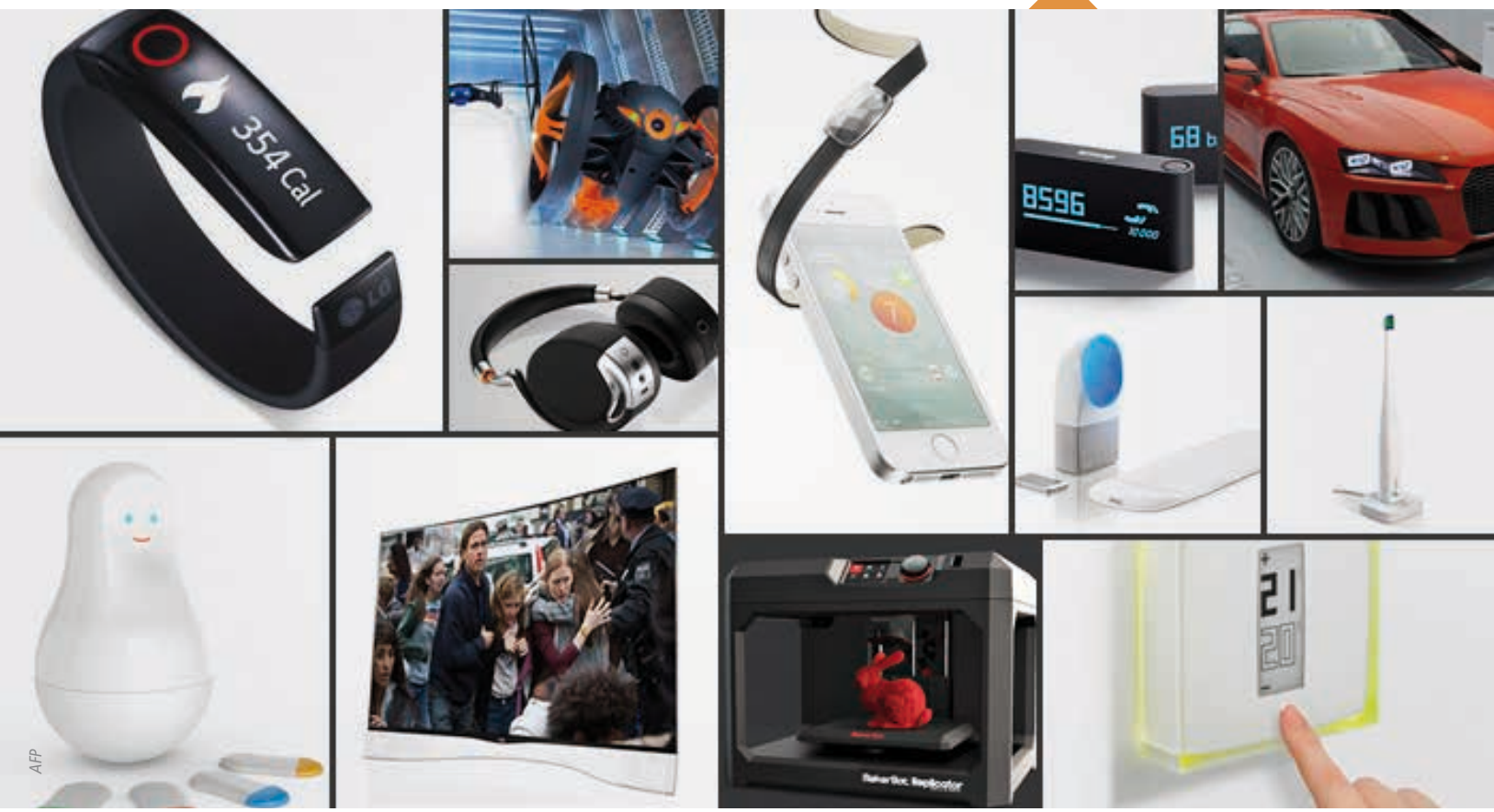
Intel also unveiled a new 3D camera called RealSense which can be integrated into tablets and enable users to produce and manipulate three-dimensional images. A user will be able to design a toy or other object and then send it to a 3D printer. Intel demonstrated the technology at International CES by producing chocolate bars.

First Formula E racing car?

An upcoming motor racing competition will put electric vehicles on the map. The first Formula E car, the Spark-Renault SRT-01E, capable of speeds above 225 kilometres per hour, will compete in the first Formula E Championship which begins in Beijing in September 2014; part of 10 races sponsored by the International Automobile Federation (FIA), the global governing body for motor racing.

a) Qualcomm, one of the corporate sponsors of Formula E, is working with automakers to get more connectivity for vehicle navigation, convenience and other functions, and has a long-term project seeking ways to wirelessly charge electric vehicles, through embedded devices in highways. The hope is that Formula E will change the perception of electric vehicles, giving them a more racy image.

The consumer technology horizon



AFP

Shutterstock

Mobile high-definition voice services go mainstream

A total of 93 operators have commercially launched high-definition voice services on mobile networks in 66 countries, according to *Mobile HD voice: Global Update,* a report published by GSA (Global mobile Suppliers Association) on 3 January 2014.

High-definition technology dramatically improves the quality and clarity of voice calls. This technology eliminates background noise in such a way that your conversations are crystal clear — when you are talking to someone, it sounds almost like you are both in the same room, or face-to-face. How does it work? The technology works by opening up the phone's audio range, allowing it to capture and transmit sounds across a wider band of frequencies. This makes high-definition calls sound clearer and more natural than a standard mobile or landline call.

The first commercial high-definition voice service was launched in 2009, and today these services are being offered on third-generation/high speed packet access (3G/HSPA) networks by 81 operators,

on both HSPA and GSM networks by 5 operators, on GSM-only networks by 2 operators, and on Voice-over-Long-Term Evolution (VoLTE) networks by 5 operators.

High-definition voice is particularly widespread in Europe, being available on mobile networks in over 85 per cent of the 28 Member countries of the European Union, for example. However, the service extends to mobile networks in most other regions of the world too.

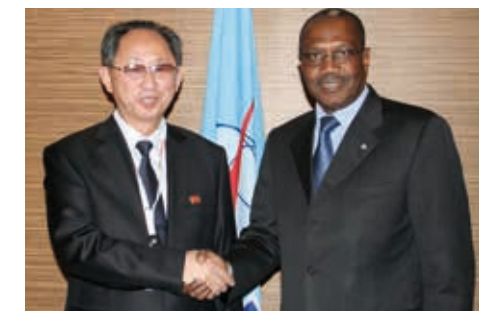
Mobile high-definition voice services use adaptive multi-rate wideband (W-AMR) technology, enabling high-quality voice calls and an improved user experience. Enabling interconnection between competing networks for end-to-end high-definition voice calling is now a priority for the industry. Some 20 countries have at least two mobile high-definition voice networks.

More progress is expected this year on the handling of international high-definition voice calls, and for high-definition voice calling between fixed and mobile networks. The number of high-definition voice compatible products also continues to rise, with at least 250 products being officially announced by leading manufacturers including Acer, AETA Audio Systems, Apple, Blackberry, Gigabyte, Glensound, HTC, Huawei, LG, Motorola, Nokia, Pantech, Samsung, Sony, TCL (includes Alcatel brand), TechFaith, and ZTE. Depending on the model, compatible phones are available for use on 3G/HSPA, GSM or LTE networks.

Operator commitment to providing voice services for users on their VoLTE networks has significantly strengthened as network coverage improves, and smartphone penetration and usage have increased. More than 30 operators have committed to VoLTE deployments or trials. VoLTE technology is maturing.

Corrigendum

An error crept into the caption of this photo, published in the December 2013 issue of ITU News *(page 84).*
The country name should read "Democratic People's Republic of Korea", and not "Republic of Korea".



Chol Ho Sim,
Minister of Posts and Telecommunications,
Democratic People's Republic of Korea

Official Visits

During December 2013 and January 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.

December 2013

From left to right: Dr Hamadoun I. Touré, ITU Secretary-General; Carmelo Martin Modu Ebuka, Equatorial Guinea's Deputy Minister of Transportation, Technology, Postal Services and Telecommunications; and Brahima Sanou, Director of the ITU Telecommunication Development Bureau

From left to right: Dr Jürgen Foag, Director International Relations ITU/United Nations, Rohde & Schwarz; Gerhard Geier, President and COO, Rohde & Schwarz; Dr Hamadoun I. Touré, ITU Secretary-General; and Hans von Geldern, ITU Liaison Officer, Rohde & Schwarz

From left to right: Azouaou Mehmel, *Président Directeur Général, Groupe Algérie Télécom*; Dr Hamadoun I. Touré, ITU Secretary-General; and Mokrane Akli, Chairman of ITU–D Study Group 2, *Groupe Algérie Télécom*

Mohamed Khamlichi, Ambassador of the League of Arab States

Pavel Filip,
Moldova's Minister of Information Technology and Communications

Christian Roisse,
Executive Secretary, Eutelsat IGO, France

Houlin Zhao, ITU Deputy Secretary-General and Michel de Rosen, Chief Executive Officer, Eutelsat Communications

Eduardo Neri González Martínez,
President of Paraguay's National Telecommunications Commission

Dr Mohammed Ahmed Al Amer,
Chairman of the Board of Bahrain's Telecommunications Regulation Authority

Henryka Mościcka-Dendys,
Undersecretary of State at Poland's Ministry of Foreign Affairs

Rahma Salih Elobied, Ambassador of Sudan and Ghanim Ahmed Yahia, First Secretary

Dr Ahmet E. Çavuşoğlu,
Head of Department for International Affairs, Information and Communications Technologies Authority of Turkey

All photos are by Ivan Wood/ITU.

January 2014

Dilip Sinha,
Ambassador of India

Mohamad Benrasali,
Libya's Deputy Minister of Communications and Informatics

Juan Raúl Heredia Acosta,
Ambassador, Deputy Permanent Representative, Mexico

Chae Sub Lee,
Chairman of ITU's Telecommunication Standardization Sector Study Group 13

Andreas Ignatiou,
Ambassador of Cyprus

From left to right: Houlin Zhao, ITU Deputy Secretary-General; Sergey Fedosov, Senior Counsellor, Permanent Mission of the Russian Federation to the United Nations; and Dr Hamadoun I. Touré, ITU Secretary-General

From left to right: Jonathan V. Siverling, Technical Relations Specialist; Houlin Zhao, ITU Deputy Secretary-General; and Guillermo Montenegro,Engineering Manager, Argentina's National Communications Commission

Faisal bin Hassan Trad,
Ambassador of Saudi Arabia

Sunoor Verma,
Executive Director of the Geneva Health Forum

From left to right: Houlin Zhao, ITU Deputy Secretary-General; Mohamed Siad Doualeh, Ambassador of Djibouti and Dr Hamadoun I. Touré, ITU Secretary-General

Eviatar Manor,
Ambassador of the State of Israel

Jorge Lomónaco,
Ambassador of Mexico

So Se Pyong,
Ambassador of the Democratic People's Republic of Korea

Marcos Bezerra Abbott Galvão,
Ambassador of Brazil

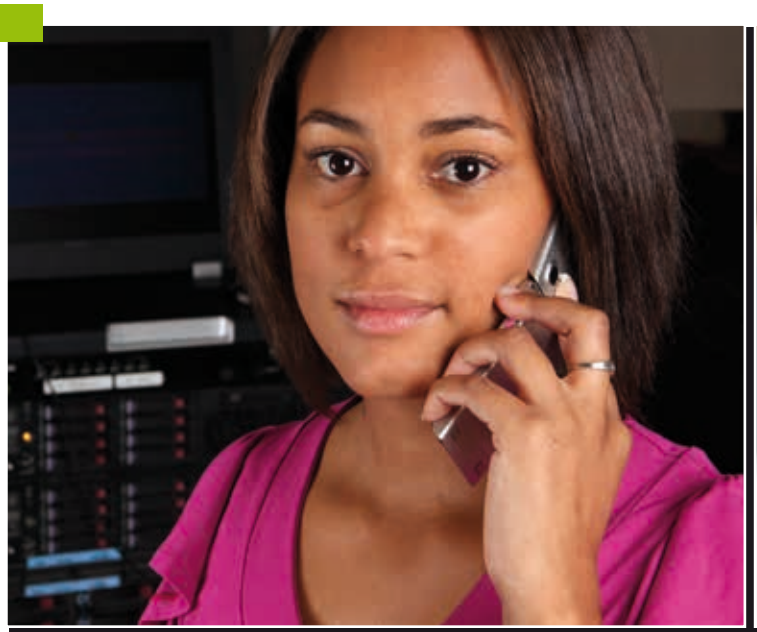
Lolia Emakpore,
Director, Policy and Competition,
Nigeria Communications Commission

All photos are by Ivan Wood/ITU.

ITU NEWS

More than a magazine — Content that connects you with the world

Advertise with us and spread your word far and wide.



For advertising information, contact:
International Telecommunication Union | ITU News
Place des Nations | CH–1211 Geneva 20 | Switzerland
Tel.: +41 22 730 5234 | E-mail: itunews@itu.int

itunews.itu.int

Join us in Doha, Qatar

2014

to continue
the conversation
that matters

ITU TELECOM WORLD '14

Doha, December