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ITU NEWS

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The future of voice

The road to next-generation networks

Reforming spectrum management





Communication has always been a human need.



We believe it is also a human right.

At the International Telecommunication Union (ITU), we believe that no human right, including the right to communicate, can survive unless it is made real and relevant. As the United Nations specialized agency for telecommunications, it is our mission to bring the benefits of information and communication technologies to as many of the world's people as possible. This is why our 191 Member States and 650 private sector members work together to set universal telecommunication standards, establish international agreements and promote global development. Everyone has the right to communicate. We help give them the means. www.itu.int

Helping the world communicate



**International
Telecommunication
Union**



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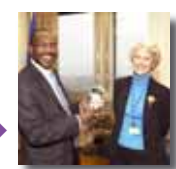
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ITU at a glance

Cisco Partnership Award for ITU

ITU has received a "Cisco Partnership Award" in recognition of the excellent collaboration between the Union and Cisco Systems Inc., an Internet networking technology company based in the United States. In particular, the award recognizes the successful ITU-Cisco Internet Training Centre initiative, launched in 2002. So far, more than 65 centres have been set up to provide training in computers and networks to students in developing countries.



ITU's Acharya

The Cisco award was presented to ITU Secretary-General Hamadoun I. Touré by Rebecca Bender, Senior Manager, International Development Aid & Strategic Partnerships, Corporate Affairs, Cisco Systems, Inc.

ITU goes to Silicon Valley

On 28 February, ITU Secretary-General Hamadoun I. Touré attended the "UN Meets Silicon Valley" meeting in California, United States. The event was jointly organized by the United Nations Global Alliance for ICT and Development and Intel Corporation. Its aim was to identify areas where the United Nations and Silicon Valley can work together to expand the benefits of ICT in the developing world. Among the participants were executives from such firms as Intel, Cisco Systems, Nokia Siemens Networks, Hewlett Packard, Google, IBM Venture Capital Group, Visa International, and Microsoft, as well as representatives of Stanford University and the University of California, Berkeley.

Bringing down the costs of Internet access could set off the same wave of connectivity that has made mobile phone usage commonplace in developing countries, said innovators and corporate leaders from some of the world's leading technology firms. But making available low-cost computers and cheap Internet access depends on a complex chain of practicalities, of which technological innovation is only one component, pointed out Intel Corporation Chairman Craig Barrett, who is also Chairman of the Global Alliance.

A sound regulatory system that encourages fair competition and innovative business models is also a pre-requisite, said ITU Secretary-General Hamadoun I. Touré. "I want to challenge you to think beyond the borders of Silicon Valley, beyond even the borders of the United States, to the emerging markets in the rest of the world," the Secretary-General told the meeting. He urged industry in Silicon Valley to join ITU, through Sector membership or through other partnerships, "so that we can together respond to the challenge of connecting the world."

On 27 February, Dr Touré also addressed a meeting of the Global Alliance Steering Committee, of which he is a member. Participants focused on the Alliance's Flagship Partnership Initiatives, such as improving broadband connectivity in Africa and expanding telecentres in developing countries.

Preparatory meeting paves the way for WRC-07

The Conference Preparatory Meeting (CPM-07), which took place in Geneva from 19 February to 2 March, adopted a report that will form the basis for the work of the World Radiocommunication Conference (WRC-07) taking place later this year. Nearly

1100 participants from over 100 countries attended the meeting, which addressed a variety of frequency-related matters.

CPM-07 reached consensus on the additional spectrum needed for the future development of 3G mobile communications, including IMT-2000 and IMT-Advanced, as well as the management of existing band usage. Discussions took into account both terrestrial and satellite aspects, with special attention to the needs of developing countries. Agreement was also reached on the technical basis and compatibility studies for the upgrade of radiolocation services to primary status in the 9000–9200 MHz and 9300–9500 MHz.

There is mounting pressure to shorten timescales for the development of new aircraft. WRC-07 will consider the growing demand for spectrum for aeronautical telemetry and telecommand systems. Flight tests led to CPM-07 identifying five candidate bands: 4400–4940 MHz, 5030–5091 MHz, 5091–5150 MHz, 5150–5250 MHz and 5925–6700 MHz. CPM-07 also discussed aeronautical mobile services, the allocation of additional spectrum in parts of the bands between 108 MHz and 6 GHz, and the modernization of civil aviation telecommunication systems.

Discussions on fixed-satellite, mobile-satellite and broadcasting-satellite services below 3 GHz saw agreement on the protection of terrestrial digital television services in the 620–790 MHz band. However, WRC-07 is likely to witness intense debate on space and terrestrial services sharing the 2500–2690 GHz band.

A proposal has been formulated that gives better protection to maritime frequencies around 156.5 MHz used for distress and safety purposes.

CPM-07 also discussed technical sharing and regulatory issues for the operation of high altitude platform stations (HAPS), which are capable of providing expanded coverage of high-capacity, competitive services to urban and rural areas, especially in tropical countries experiencing high rainfall.

WRC-07 will also take decisions on new frequency bands to be allocated for science services. Earth-exploration and meteorological satellites provide valuable services worldwide. CPM-07 examined approaches that explore further development and protection of different science services, including radio astronomy services.

CPM-07 outlined possible options to improve the effectiveness of the Radio Regulations in the areas of spectrum usage and operational characteristics of electronic news gathering systems (ENG), technical parameters for planning broadcasting-satellite service in the band 21.4–22 GHz in Regions 1 and 3, and using spectrum at frequencies above 3000 GHz.

Valery Timofeev, Director of ITU's Radiocommunication Bureau, explained that the CPM Report represents a complete and up-to-date description of the technical, operational and regulatory environment upon which WRC-07 can make its decisions. CPM Chairman, Kavouss Arasteh of the Islamic Republic of Iran, said that, at the meeting, "one basic principle prevailed, that of consensus building".

Agreement signed on improving access in developing countries

ITU and the GSM Association (GSMA) have agreed to join forces to boost mobile access in developing countries. On 6 February, during the ITU Global Symposium for Regulators held in Dubai, a Memorandum of Understanding (MoU) was signed by ITU Secretary-General Hamadoun I. Touré and Tom Phillips, Chief Government and Regulatory Affairs Officer of the GSMA, whose members serve more than 2 billion mobile phone customers worldwide. Under the MoU, ITU and the GSMA will, among other things, support projects to create low-cost access to ICT in underserved areas. They will also compile a comprehensive, shared resource of key industry performance indicators and benchmarks.



A farmer in Bangladesh

The changing environment for telephony



Houlin Zhao
Deputy Secretary-General of ITU

On 15–16 January, ITU held an important workshop in Geneva on “The Future of Voice”. It was the first meeting that I had the honour of opening in my new role as Deputy Secretary-General.

In a survey conducted under the ITU New Initiatives Programme, our Member States and Sector Members said that the future of voice services is a fundamental strategic issue for today’s telecommunication industry. For many years, these services have been the principal source of revenue for telecommunication operators. But now, convergence and the migration to an infrastructure based on the Internet protocol (IP) pose challenges to traditional business models.

Convergence is a growing reality at different levels: between voice and data, for example, as well as between fixed and mobile telephony. Delivery of multiple services over one network is no longer a technical challenge. In fact, in some countries, it is now regarded as the new standard.

Migration to an all IP-based environment has significant implications for the industry, including market structure, competition and regulation. Network operators are responding to this transition by investing in multi-billion-dollar modernization programmes, by changing their business models and by introducing new services with the potential to generate future revenue streams.

Innovation and new technologies offer prospects for enhanced economic growth. Nevertheless, policy-makers, regulators, and user groups around the world must seriously consider how best to protect the public interest in a converged environment, as traditional concepts of “voice” as a universal service continue to evolve. Questions are being asked as to whether voice communication will remain a marketable commodity and whether network access will be affordable for everyone. Regulatory paradigms too must be adjusted to the requirements of an industry in which boundaries between telecommunications, Internet and broadcasting services are blurring, changing the structure of the traffic over the networks.

Widely diverging opinions have been expressed on these complex issues — and that is one of the reasons the ITU event provided a forum for an open and frank debate. It allowed experts and industry representatives to share experiences and exchange views on how the future of voice will evolve in an all IP-enabled environment in all the regions of the world, and how best to respond to this transition.

I would like to express my appreciation to the speakers and moderators for their active role in making this workshop a success.

The future of voice

Despite the advanced, new services that are on offer via telecommunications, most people still use their phones simply to speak to someone at a distance. In this sense, the future of voice is secure. However, big changes are occurring in the way phone conversations are transmitted. Now, as well as sending calls through a copper wire or radio waves, you can use the Internet.

Internet influence

Operators have been investing heavily in next-generation networks (NGN) that are based on the Internet protocol (IP). These broadband “pipes” allow massive flows of several kinds of data, among which voice over Internet protocol (VoIP) calls can also be carried. And as long as you can find an Internet connection, you can use your VoIP phone number anywhere. Mobile calls are possible too, through wireless systems for Internet access. VoIP technology makes location, distance, or the length of a call, irrelevant. Thus, in future, phone calls could be “free” just as e-mails are, once you are connected to the web.

The new infrastructure makes it cheaper for operators to provide services — but, in liberalized markets, it also makes it easier for newcomers to compete. Using Internet access provided by telecommunication or cable companies, VoIP services can be offered by other firms. These competitors could also

enter the territory of mobile phone companies that provide Internet access: once connected to the web, you can switch to a VoIP service instead.

Club together

To protect incumbent carriers, some administrations have tried to block VoIP services. However, the technology is likely to be the wave of the future. The challenge for service providers is to adopt or adapt.

For many, the answer is convergence — of industry sectors and of services. In several countries, telecommunication firms now have “triple play” or “quadruple play” offerings combining fixed and mobile telephony with television and Internet access. These converged multimedia services often come about through mergers or agreements between incumbent carriers and mobile phone companies. Cable television firms (which are adding phone calls to their original television service) are also joining the market.



The future of voice is likely to be mobile and based on the Internet protocol





*Professor Glenn Woroch
chaired the ITU workshop*

ITU workshop looks at the issues

These were among issues considered at an ITU workshop in mid-January on "The Future of Voice." Some 100 participants, including experts from industry and academia, policy-makers, regulators, and representatives of international organizations, focused on the role of voice services in a ubiquitous network environment.

The event was opened by ITU Deputy Secretary-General Houlin Zhao. It was chaired by Glenn Woroch, Professor of Economics and Executive Director of the Center for Research in Telecommunication Policy, University of California, Berkeley, United States. He summarized the discussions during the workshop under three headings that described the level of agreement or debate on the future of voice services: consensus, confusion and contention.

Consensus

Still a core service

Participants noted that voice services are still at the core of telecommunication revenues, and have remained broadly stable. According to ITU statistics, they were around 85 per cent of total telecommunication revenue worldwide in 1991, and 82 per cent in 2004. This is true even in the industrialized member countries of the Organisation for Economic Co-operation and Development (OECD). Taylor Reynolds, from the OECD's Directorate for Science, Technology and Industry, told the workshop that voice services represent at least 79 per cent of total telecommunication revenues in OECD countries. And although the number of fixed lines is falling in some regions, it is still rising worldwide.



Workshop participants

*Details of the ITU workshop on "The future of voice" can be found on the ITU website at:
www.itu.int/osg/spu/ni/voice/meeting.phtml*

Meanwhile, mobile telephony is booming. It is the principal source of growth in voice telephony, in terms of access and usage. According to Nokia, a fifty-fifty split between fixed and mobile traffic is likely to be achieved this year. Jean-Pierre Bienaimé, Chairman of the UMTS Forum, (which is concerned with mobile networks), said that voice will remain a key service. He said the UMTS Forum predicts that in 2012, voice will still be "the first service category in terms of daily traffic volumes".

Moving from PSTN to IP

The workshop agreed that voice traffic is increasingly shifting from public switched telephone networks (PSTN) to those based on the Internet protocol (IP) which can carry data too. Margit Brandl, a Vice President at Siemens and Chairman of the European Telecommunications Platform, noted that, by 2012, voice could become just another data application. Eric Burger, the Deputy CTO of BEA Systems Inc, stressed that resisting VoIP technology might "inhibit the development of new, wealth-creating applications, often worth more than the displaced voice revenues".

Data services are growing

Broadband Internet connections, which carry many types of data including voice, are spreading fast in developed countries. Earnings from data services in the European Union will rise to 43 per cent of total fixed-line revenues in 2007, said Harald Gruber, Deputy Economic Advisor, Projects Directorate, European Investment Bank. As regards mobile data services, Mr Woroch cited a report from the United Kingdom's regulator,

Ofcom, that says mobile data services provide a growing proportion of total telecommunication revenue in OECD countries.

The benefits of bundling

Workshop participants generally agreed that voice is likely to find its future in being bundled with other data services. Some said market expectations are high that television via the Internet (IPTV), for example, can replace lost voice revenues. Andrew Odlyzko, Director of the Digital Technology Center at the University of Minnesota, United States, said that opportunities for voice services include higher-quality and toll-free calling, and commercial opportunities could also come from innovative applications that allow people to speak to each other when using online social networking sites. Zygmunt Lozinski, the Technical Leader for IBM's Telecommunication Industry in Northern Europe, also noted the strong growth in social networking sites and user-generated content. People will still communicate, he said, but the mechanisms will change.

The problem of pricing

Now that phone calls are increasingly being carried over data channels, pricing calls according to distance or length is becoming irrelevant. This is a challenge for telecommunication companies as they try to sustain their incomes in the new environment. Mr Reynolds noted that, with the transition to VoIP, the marginal cost of a phone call has dropped to nearly zero. Consequently, voice tariffs will fall, said Sergio Antocicco, Chairman of the International Telecommunication Users Group, and operators must try to offset this by offering new applications.



Mario Alberto Magallanes: Tre



Geunhyung Kim, of the KT Group, Republic of Korea, suggested that the market for voice services is evolving from a price-driven one centring on operators, to an application-driven market centring on consumers

Geunhyung Kim, of the BcN Business Unit, KT Group, Republic of Korea, suggested that the market for voice services is evolving from a price-driven one centring on operators, to an application-driven market centring on consumers. As VoIP offers enhanced features and becomes more widespread, customers' usage patterns will change and the market will become more segmented. Companies could try to retain their market share, he said, through segmentation, branding and bundling of voice services to suit customers' needs.

Confusion

While sharing a similar view of today's telecommunication environment, the participants in the "Future of Voice" workshop expressed uncertainty about some aspects.

Regulation

ITU's background paper on the status of VoIP worldwide gave the workshop an overview of regulatory approaches to VoIP in some 130 countries (see pages 10–12). At the meeting, there were varying opinions on the topic. Some participants, such as Ilsa Godlovich, Head of Regulatory Affairs at the European Competitive Telecommunications Association, and Mr Gruber from the European Investment Bank, said that regulators must ensure that markets are as competitive as possible. On the other hand, Ms Brandl said that it is vital to have general rules (such as those on emergency calls) and quality of service obligations for VoIP providers. At the same time, regulations must not be discriminatory: new entrants should be subject to regulation, as traditional carriers are now.

Numbering in a borderless world

One of the issues to be considered by regulators is numbering. What should happen to telephone numbers when there is no longer any geography associated with the network? Each user might have to use a PSTN number, an IP-number, and a network identifier. Mr Antocicco suggested that a worldwide VoIP numbering scheme, with a number for each citizen, could be overseen by ITU.

Connection bottlenecks

Another topic for regulators is the issue of how to structure the interconnection pricing of asymmetric networks and VoIP services. Ms Godlovich suggested that VoIP/PSTN termination remains a bottleneck. Operators with large customer bases have a lot of bargaining power — and thus little incentive to interconnect with competitors, so regulatory intervention is essential where there are dominant operators, she said. Eli Katz, CEO of XConnect, United States, pointed out that the launch of new services needs cross-network availability and end-to-end IP connectivity. This means that VoIP providers must agree to carry each other's traffic ("peering"). Federated (multilateral) peering would permit scalable, cross-network VoIP interconnections among what are now isolated "VoIP islands".

Contention

There were some areas upon which agreement was not reached at the workshop. The most fundamental concerned the future of telecommunication companies.

New business models

Given the shift of voice towards mobile and IP telephony, some participants thought that traditional firms would become simply providers of “hollow pipes” to carry other companies’ services. Other participants saw a future for incumbents as providers of converged services. Mr Lozinski, for example, suggested that the challenge for operators is to transform their networks into multimedia platforms that can drive future growth.

However, Kali Kan observed that there is a massive surplus of optical bandwidth and its cost has fallen to nearly zero. (Mr Kan is Professor and Director of the Policy and Development Institute of Information Industries, at Beijing University of Posts and Telecommunications, China.) He said this makes it hard for traditional carriers to insist on providing the full range of services from infrastructure to consumer (“vertical integration”). Instead, they would have no choice but to become hollow pipe providers. Regarding mobile phone companies, Mr Kan predicted that they will “become extinct” as they do not even have hollow pipes to sell.

Unbundling rules

Michael Bartholomew, Director of the European Telecommunications Network Providers’ Association, described how innovation and investment can be affected by regulations. Rules that make incumbents open their networks to newcomers (“unbundling”) do not encourage the high-risk investments involved in NGN, he said, and operators should be able to negotiate access to their networks on their own com-

mercial terms. However, Stephen Banable, from the European Commission’s Information Society and Media Directorate-General, said the EU regulatory framework provides a good model, with its objectives of promoting competition, consolidating the single market and protecting consumers. Regulation should be removed once competition is effective, he said, arguing that a market-based approach facilitates convergence. This viewpoint was shared by Mr Gruber, who said regulation must encourage investment and should not represent a permanent claim on incumbents’ assets, but rather stimulate facility-based competition. (Regulatory issues for NGN are examined in the article on pages 15–18.)

Conclusion

Chairman Glenn Woroch noted the complex and continually evolving relationship between voice and data services. Data came first, he said, with the invention of the telegraph, before being displaced by voice, in the form of the telephone. “The rise of the Internet has reasserted the role of data, while mobile telephony has promoted voice, but also enabled data as well,” he added.

Voice and data can be competitors on either platform. Looking to the future, however, Mr Woroch suggested that they will increasingly be used together and to complement each other in converged services. This interplay will affect the pace and direction of innovation in communications, he said, adding that “the transition to IP will open up new markets and could help to close the digital divide”.



BT

Voice over Internet protocol (VoIP) broadly includes:

- ▶ *Voice over broadband (VoB)*
- ▶ *Voice over digital subscriber line (DSL)*
- ▶ *Voice over Internet (VoI)*
- ▶ *Voice over wireless local area network, and*
- ▶ *Internet telephony.*

All these technologies involve the digitization, conversion and compression of voice signals into data packets that are transmitted over an IP network, to be reassembled and converted back into voice communication at the receiver's end.

The status of VoIP

▮ Around the world, voice over Internet protocol (VoIP) services are being offered by local and long-distance telephone operators, cable television companies, Internet service providers, non-facilities-based independent providers and mobile operators. VoIP is showing strong growth in the number of subscribers and the revenues it generates.

Why VoIP is gaining ground

The main factors driving VoIP take-up and deployment include:

For businesses:

- ▶ ***Security at a lower cost:*** For institutional and business users, a private network can offer cost efficiencies as well as greater security and reliability, with no discernible loss in quality of service.

For consumers:

- ▶ ***Cheaper and simpler pricing:*** The explosive growth of companies such as Skype and Vonage demonstrates the power of consumer demand in driving the growth of VoIP. Consumers can also find bundling and flat-rate pricing packages attractive in an increasingly complex multimedia environment.

For service providers

- ▶ ***Lower investment, capital and operating costs:*** These can be achieved through innovation, economies of scale, reductions in the bandwidth required to send a voice message, and the possibility of offering converged services over a single, unified network.
- ▶ ***Entry into new markets:*** IP networks can be used to offer telephony, Internet access, and a host of other services. This may expand incumbents' dominance, but it also means that VoIP can be offered by firms that previously specialized in content, for example. VoIP can also lower barriers to entering new geographical markets. VoIP revenues could compensate for flagging traditional voice revenues and enable operators to enter the growing broadband market.
- ▶ ***Enhanced innovation:*** It is relatively simple to add media to IP-based communications. New services can also be offered over a converged IP network, and some of these can be added via interfaces with existing PSTN equipment.
- ▶ ***New business models:*** VoIP offers the possibility of moving to new business models, such as flat-rate pricing, or bypassing the traditional accounting rate settlement system.

The obstacles to VoIP

In some markets, however, VoIP does not seem to be achieving its full potential. Some of the obstacles to growth are:

► **Problems with QoS and reliability:**

Voice, video and high-speed data services have different requirements, so bundled products place different burdens on networks in terms of quality of service (QoS). The ability of the network to function despite power shortages is a particular problem in developing countries. In terms of security, only limited calling party information may be available over VoIP.

► **Resistance by incumbents:** Established operators may see VoIP as a threat to their PSTN revenues, mainly in countries where the market is monopoly-based or less mature.

► **Regulatory uncertainty.** Operators argue that, in order to justify heavy investment in broadband networks for VoIP, they must have a clear and predictable regulatory framework that helps to guarantee returns on investment.

► **Specific regulatory requirements:** Some countries are developing regulations on VoIP (e.g. emergency call obligations) that may make it harder for new entrants to offer VoIP services.

Market prospects

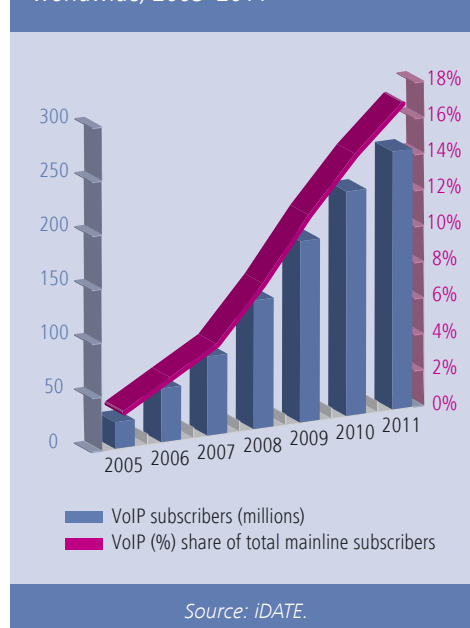
Estimates of the total VoIP market size vary significantly, in part due to the problems of definition, and because of the different technologies in use. Quantifying the number of VoIP subscribers, or minutes of

traffic, is difficult, as it is part of a general migration to IP-based services. What is clear, however, is that the VoIP market is growing rapidly worldwide in terms of subscribers, revenues and traffic.

VoIP subscribers

Excluding calls made from computer to computer, the number of subscribers to VoIP services has been estimated for the end of 2005 at 25 million worldwide, according to French research company iDATE. This number surpassed 47 million subscribers at the end of 2006, and is expected to grow to approximately 250 million by the end of 2011 (see Figure 1).

Figure 1 — Estimates of VoIP subscribers, total and as a proportion of mainlines worldwide, 2005–2011



Regulatory responses

Faced with such strong market growth of VoIP, regulatory responses can be broadly classified into those countries where:

- ▶ VoIP has been made illegal, often to protect the revenues of the incumbent (and government, where the incumbent is State-owned). These are often developing countries.
- ▶ Regulation is absent, often temporarily while the regulator reaches a decision regarding VoIP, often through public consultation.
- ▶ VoIP is unregulated, following a policy decision to that effect.
- ▶ VoIP is subject to the same (or similar) regulation as PSTN, or some forms of VoIP are subject to some or all of the PSTN regulations, depending on the technology used (hence the importance of definitions).
- ▶ Specific VoIP regulations are in place, including for licensing.

A number of countries have yet to formally decide their framework for VoIP regulation, including those which have held formal public consultations, and those where the framework is "under consideration".

Japan is the largest market for VoIP, with more than 60 per cent of the worldwide total of subscribers in March 2005, according to UK-based broadband analysts Point Topic (see Figure 2). Strong growth has been registered in France, where the regulator, Autorité de Régulation des Communications électroniques et des Postes (ARCEP), reported that the number of VoIP subscribers amounted to 1.5 million in March 2005. In the United Kingdom, the regulator, Ofcom, estimated that by March 2006, there were more than 1.8 million VoIP households. Of these, Ofcom estimated that around 1.35 million (or 75 per cent) were using such services as Skype and Vonage. This capturing of market

share by VoIP services based on computer-to-computer communication is also seen in the United States, where it represents the bulk of US subscriber growth.

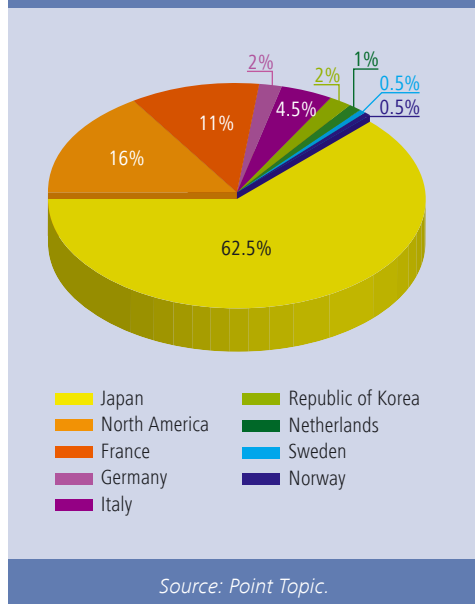
VoIP traffic and revenues

Voice traffic sent over the Internet looks no different from most other types of data, so it is difficult to discover its volume. Nevertheless, estimates have been made of the total proportion of voice traffic carried over IP networks worldwide. They show a strong upward trend.

Point Topic estimates that revenues from IP telephony services grew from USD 833 million in 2004 to USD 1 834 million in 2005, a rise of 89 per cent. US analysts Telegeography predict that revenues from VoIP will reach USD 5 billion by 2010. Other estimates are much higher. According to Juniper Research, of the United Kingdom, revenues from VoIP services in the business sector alone will reach USD 18 billion by 2010, with hosted VoIP business revenues reaching USD 7.6 billion.

In some countries, a "grey market" exists for VoIP services that are not provided legally, and significant losses of revenue are reported by legitimate operators (see article on pages 13–14). In Pakistan, for example, the Telecommunications Authority says that grey traffic costs USD 50 million each year. The grey market in African countries is similarly significant. The Nigerian operator Nitel, for instance, estimated that before its 2004 reduction in the price of international calls, 90 per cent of international calls went through the grey market.

Figure 2 — Distribution of VoIP subscribers worldwide, March 2005





Voice in the developing world

■ To get satisfactory quality in voice over Internet protocol (VoIP) services, you need a broadband connection — which in turn implies advanced infrastructure such as next-generation networks (NGN). Many industrialized countries are preparing their transition to NGN (see article on pages 19–21) but this is still some years away in other parts of the world. Meanwhile, people in developing countries are using their phones to make voice calls, mostly through mobile telephony that has low infrastructure costs. This voice market has great potential for growth.

A mass market

At the ITU workshop on “The Future of Voice” (see pages 5–9), Rauno Granath, Nokia’s Director of New Growth Markets and Networks, predicted that the worldwide number of subscribers to mobile telephony will reach 4 billion by 2010, and about 80 per cent the growth will come from lower income, emerging markets (see chart).

Loso Judijanto, Special Advisor to Indonesia’s Minister for Communication and Information Technology, told the workshop that some telecommunication firms are overlooking the market for basic voice services and moving into more advanced services that are not necessarily the most in demand. However, voice will continue to be a

core service for operators that can follow a high volume/low-cost strategy. Mr Judijanto stressed that if the bottlenecks to distribution can be broken, huge and previously neglected markets will open up — such as in Indonesia, where he said a quarter of the population (or 55 million people) live on less than USD 2 a day. Governments need to support infrastructure investment to reach this part of the population, he added.

The African example

Moving towards VoIP

A paper on the situation of voice services in Africa was presented to the ITU workshop by Russell Southwood, Chief Executive of Balancing Act, a consultancy and online publishing company specializing in African telecommunications. He explained that in 36 out of 54 countries and territories in Africa, commercial VoIP services remain forbidden, but the picture is changing fast. “In a few short years, VoIP in Africa has gone from being seen as a threat to the existing order to something that is now viewed as an inevitability. For the majority of Africa’s policymakers and regulators, the discussion is now not about if, but how, they can legalize VoIP,” said Mr Southwood.

In his paper, he quotes Ernest Ndukwe, Chief Executive Officer of the Nigerian Com-



*Russell Southwood,
Chief Executive of
Balancing Act*

Grey markets

In Africa, "grey markets" for VoIP services (which lie somewhere between the legal and the illegal) have been competing with incumbent operators for some time. According to Russell Southwood of Balancing Act, in most African countries the grey markets can be substantial (accounting for between a quarter and a third of international call revenues), and this has exerted strong downward pressure on prices.

Grey markets can offer cheaper rates because of the high profit margins that may be charged by incumbents that enjoy a monopoly. For example, a caller might have to pay the equivalent of USD 1 for an international call that costs the incumbent operator about 3 cents, according to Mr Southwood. Against this background, and despite legal crackdowns in various countries, the grey market looks set to flourish in Africa.

munications Commission, as describing VoIP as "the engine that will drive telephony in developing countries." Mr Ndukwe is quoted as saying that "a sure way to promote universal access to telecommunication services, at this stage of the industry's development, is to evolve a policy framework that recognizes the issues relating to VoIP as an engine for the development of telephony in the country."

Countries are moving towards VoIP because it is relatively cheap to build an IP network, and there are economic benefits. "VoIP service providers have contributed to lowering the cost of international calling from Africa, something that has made Africa globally more competitive for new

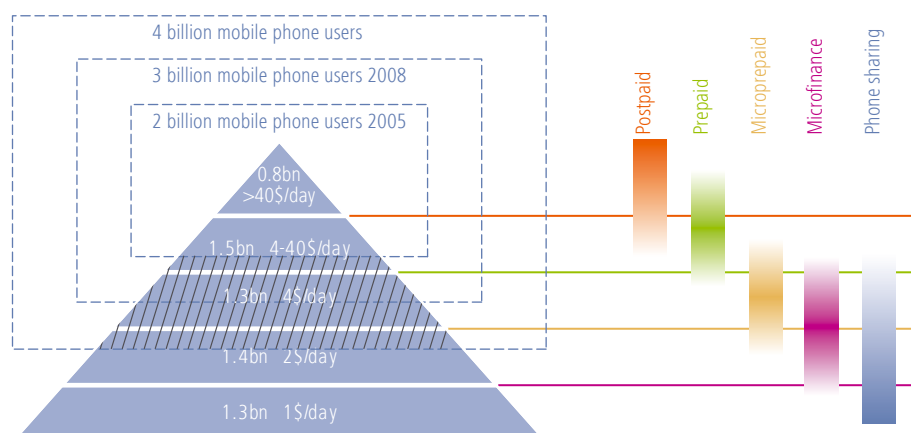
business areas like call centres," noted Mr Southwood. He stressed that "taken together with IP networks, VoIP offers the potential for creating new market structures that can simultaneously encourage local investment and deliver lower cost voice and data services to consumers."

VoIP technology does not achieve these benefits on its own, however. "Over a quarter of Africa's telecommunication incumbents have international VoIP gateways, but far fewer have passed the savings made on to their consumers," pointed out Mr Southwood. "It is VoIP taken together with wider competition that produces real change in how markets operate," he added.

Evolution of business models to reach low-income consumers. Growth in worldwide mobile subscribers from 3 billion in 2007/2008 to 4 billion in 2010 means new business models must be created to meet the needs of low-income subscribers in emerging markets.

World population split according to income segment (USD per capita per day)

Business model



Source: "Voice services in new growth markets," presentation by Rauno Granath, Nokia.

The road to next-generation networks

Global Symposium for Regulators issues best practice guidelines

Telecommunications is on the cusp of a new era: the migration to next-generation networks (NGN), based on the Internet protocol (IP). It heralds the shift from a “one network, one service” approach, to the delivery of many services over a single network.

NGN can be developed using a number of technologies, including wireless and mobile, fibre and cable, or by upgrades to existing copper lines. A number of traditional fixed-line operators have begun to deploy next-generation networks, mainly to offer television service in addition to voice calls and broadband Internet access (see pages 19–21).

Some market analysts predict that in the developed countries, full fixed-line NGN will be in place by 2012 and mobile by 2020. ITU predicts that by 2008, at least 50 per cent of all international telecommunication traffic will be carried on IP networks.

Regulatory challenges

Many of the regulatory challenges arise from the obvious technical differences between circuit-switched and packet-switched networks as most of the current regulatory principles and practices worldwide are based on a circuit-switched environment. Next-generation networks are often regarded as a combination of the telecommunication and Internet environments. However, the telecommunication regulatory model,

usually heavily regulated, is very different from the Internet model which has little or no regulation. What will be the appropriate model in a converged environment?

Regulators also have to decide between *ex ante* and *ex post* regulatory models, where these exist. Under *ex ante* regulation, rules are established to prevent anti-competitive or other undesirable activity by operators before it occurs. With *ex post* regulation, which relies primarily on competition law, few (or no) rules are set in advance, but regulatory measures can be applied later, if required, to remedy a market failure or to deal with anti-competitive behaviour.

In some countries, regulators have required incumbent operators to provide their competitors with mandatory access to their networks (local loop unbundling, bitstream or wholesale access and/or resale). But with the transition to NGN, which will require significant investments by the incumbent operators, should the new IP-based networks be subject to the same access obligations? In considering this issue, regulators are assessing the level of competition in their markets to determine whether a shift towards an *ex post* model could sustain existing levels of competition and enhance consumer welfare. On the other hand, regulators also have to determine whether NGN leads to new services and markets that should be free from existing *ex ante* regulation.



The theme of this year's Global Symposium for Regulators was "The road to next-generation networks (NGN): can regulators promote investment and achieve open access?" The meeting examined such pressing issues as investment, competition, consumer protection, universal access, and international Internet interconnection.

Discussion Papers were issued for the global gathering of regulators to help form a common understanding of key regulatory issues raised by the move to NGN. These papers are available at <http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR07/agenda-documents.html>



Developed and developing countries

Until recently, the debate regarding the appropriate regulatory framework for the NGN environment focused mainly on developed economies such as Australia, Japan, Singapore, the United States, and some European Union Member States, notably the United Kingdom, Germany, and the Netherlands. In these countries, issues such as extending existing *ex ante* access obligations to NGN, IP-interconnection, and the universal service implications of IP-based services (particularly voice) have been at the top of the regulator's agenda.

Some developing economies, such as India, have also initiated consultations and are promoting public awareness of NGN through various regulatory processes and initiatives. Also, regulators in Costa Rica, Morocco and Poland have indicated that they believe access obligations are a good way to increase broadband penetration and deployment of NGN.

Best practice guidelines

Policy-makers and regulators must respond effectively to regulatory challenges in the emerging world of NGN. To help with this, some 500 participants, including national regulators from around the world, as well as representatives of industry and international organizations, attended the 7th ITU Global Symposium for Regulators (GSR) on 5–7 February 2007. It took place in Dubai, hosted by the Telecommunications Regulatory Authority of the United Arab Emirates (UAE). The authority's Director-General, Mohamed Al Ghanim, chaired the event, which he described as "the industry's premiere symposium for ICT regulators".

UAE's Minister for the Development of the Government Sector, Sultan Bin Saeed Al Mansoori, underscored the role that telecommunications and information and communication technologies (ICT) play in driving economic and social progress. The UAE's ICT strategy is designed to support and develop the non-oil economic sectors, including trade and commerce, financial services, education, transportation and healthcare services. The minister said that the government plans to increase broadband services, and to use the best technology available for fixed-line NGN services.

Following extensive discussions, the symposium reached consensus on a set of *Best Practice Guidelines* that can serve as a road map for migration to NGN. "The migration to NGN is an ideal time for regulators to develop innovative regulatory frameworks that better enable developing countries to meet their ICT development goals," ITU Secretary-General Hamadoun I. Touré told the symposium. "We believe the best practices adopted at this meeting will ultimately offer the possibility of delivering real benefits to providers and consumers, through cost reduction as well as offering innovative new services," he added.

The *Best Practice Guidelines* for NGN cover all aspects of service provision, including authorization, access, interconnection and interoperability, numbering, universal access, quality of service, consumer awareness, and security.

Commenting on the guidelines, Sami Al Basheer Al Morshid, Director of ITU's Telecommunication Development Bureau (BDT), said that they "will be immensely useful in the difficult task faced by national regulators in developing the necessary political support to create an effective regulatory environment which leverages the benefits of



Mohamed Al Ghanim,
Director-General, UAE
Telecommunications
Regulatory Authority



Sultan Bin Saeed
Al Mansoori, UAE's
Minister for the
Development of the
Government Sector



technological and market developments". Participants in the symposium noted that national regulators may be perceived as only one of many competing voices in national debates. However, policy-makers are more likely to adopt regulatory practices which they know are supported by countries around the world.

The *Best Practice Guidelines* state that an enabling regulatory regime for NGN must include:

- ▶ establishment of an effective regulator separated from operators;
- ▶ adoption of clear and transparent regulatory processes;
- ▶ regulatory flexibility and technology neutrality to promote technological innovation;
- ▶ regulatory certainty for both incumbent and competing providers, so as not to stifle innovation;
- ▶ regular reviews to remove undue regulatory barriers to competition and innovation.

Because the deployment of NGN will take time, the best practice guidelines encourage regulators to allow for the co-existence of legacy and IP networks, alternative voice services, such as voice over Internet

protocol (VoIP), and the bundling together of voice, video and data services (commonly known as triple play). In doing so, regulators should consider applying the same rules to all operators, irrespective of how services are delivered to consumers.

Regulators are also urged to adopt investment-friendly regulation considered as of paramount importance for the success of NGN deployment, while maintaining a level playing field and protecting consumer interests. For instance, regulators should see NGN as a continuation of their broadband and convergence policies, and provide operators with a stable framework that permits them to take the risks associated with deployment of such networks. However, regulators should keep in mind that their role is not to provide incentives to make particular investments. Rather, they should ensure that incentives for efficient investment are not distorted, particularly as a result of disproportionate regulation. //



Regulators take part in "speed exchanges", a new part of the GSR programme designed for participants to share views informally at round-table meetings



Ernest Ndukwe, Chief Executive Officer, Nigerian Communications Commission, moderating the "Interactive Panel Discussion" on creating an enabling environment for NGN



*Hamadoun I. Touré,
ITU Secretary-General,
addressing the
symposium*



*Sami Al Basheer
Al Morshid,
Director of ITU's
Telecommunication
Development Bureau*



Participants in the symposium

Awards at GSR



Sami Al Basheer Al Morshid, Director of the ITU Telecommunication Development Bureau; Cuthbert Lekaukau, former Executive Chairman of the Botswana Telecommunications Authority (BTA) accompanied by his wife; and Hamadoun I. Touré, ITU Secretary-General.

Mr Lekaukau, who retired from BTA in December 2006, is the first recipient of the Honorary GSR Chairmanship Award, given in recognition of his commitment to effective regulation. "You have been a role model for all of us," Mr Al Basheer said presenting the award. Botswana was one of the first countries in Africa to establish an independent and effective regulator. Mr Lekaukau was the first Chairman of the Global Symposium for Regulators in 2000.

Hamadoun I. Touré, ITU Secretary-General receiving, on behalf of the Union, the first GSR Trophy from Mohamed Al Ghanim, Director-General of the Telecommunications Regulatory Authority of the United Arab Emirates.



Farah Khuram, Secretary-General, Afghanistan Regulatory Telecommunication Authority receives the G-REX Award from Mr Al Basheer.

Other recipients of the G-REX Award were the Telecom Regulatory Authority of India; the Pakistan Telecommunication Authority; the National Telecommunications Corporation of Sudan; the Office of the Telecommunications Authority of Hong Kong (OFTA); the Nepal Telecommunications Authority; as well as the regulators of Ethiopia, St Vincent, Ecuador, Venezuela and Peru. The annual G-REX Award is presented to the most active users of the Global Regulators' Exchange (G-REX), an online forum for regulators and policy-makers.

Early adopters of NGN



■ The deployment of next-generation networks (NGN), using the Internet protocol (IP) to support fixed, wireless and mobile voice, video, data, and broadcast television services, is expected to provide new opportunities to increase consumer choice.

Although ITU has defined NGN (see box), views still vary and operators and vendors that have begun the process of development or migration have different claims and definitions. In the Republic of Korea, Korea Telecom uses the name BcN (Broadband convergence Network), and plans to have an entirely IP-based network by 2012. Telekom Austria aims to do the same by 2009. In Canada, Telus and Bell Canada have also announced plans to implement NGN, as well as Sprint and Qwest of the United States, and Italy's Telecom Italia. Japanese carrier, NTT, is building an NGN and developing ubiquitous broadband services.

BT rolls out NGN

In the United Kingdom, BT has named its NGN the 21st Century Network, to which it transferred the first customer lines in November 2006. The firm's first NGN customers live in the village of Wick, near Cardiff in Wales. By the end of summer 2007, around 350 000 households in the area are expect-

ed to have joined them. BT will then review the project before moving (from early 2008) to the planned national upgrade of all remaining customers across the United Kingdom — some 30 million lines supported from over 5500 telephone exchanges. There is a forum where regular consultations take place with all other operators in the country, so they can understand and influence BT's plans.

"Big ideas usually start with simple thoughts," BT Wholesale Chief Executive Officer Paul Reynolds, said at ITU TELECOM WORLD 2006, commenting on his firm's first NGN system. "BT's 21st Century Network programme started life as a simple thought — BT would transform its business, eliminate cost and complexity and make life simpler and more flexible for our customers," Mr Reynolds explained.

BT says that the new network will deliver voice, data, broadband and multimedia services, more quickly and cheaply than before. These include a new generation of broadband with speeds of up to 24 Mbit/s — three times faster than those currently available for most UK customers. The company's move to an all-IP network is estimated to cost around GBP 10 billion.

ITU defines a next-generation network as a packet-based network able to provide telecommunication services including multiple broadband, which use quality of service (QoS)-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies.

Singapore's Next Generation National Infocomm Infrastructure (Next Gen NII) project, announced in February 2006, is intended to be the country's new "digital super-highway". The project comprises a wired broadband network called Next Generation National Broadband Network (or Next Gen NBN). It is planned to deliver speeds of 1 Gbit/s to all homes, offices and schools. In addition, a Wireless Broadband Network (WBN) is expected to offer "pervasive connectivity".



In future, it is expected that access networks will provide bandwidth of up to 100 Mbit/s for individual users and transmission rates in the gigabyte range for commercial customers. All of these can support multimedia services, including broadband Internet, television and fixed and mobile telephony. A sampling of bandwidth offerings at present includes 24 Mbit/s in France, and 100 Mbit/s and rising in markets such as Japan, the Republic of Korea, Hong Kong (China) and Singapore (the last having set 1 Gbit/s as a target).

Broadband policy matters

NGN evolution may differ between developed and developing countries because of access and affordability, since these remain pressing issues in the developing world. NGN development is expected to flourish in countries with robust broadband policies or extensive broadband penetration. In these countries, mainly in the developed world, consumer demand for high-end, innovative services is matched only by limitations on bandwidth.

Meanwhile, countries such as India, Pakistan and Malaysia have adopted facilitative broadband policies, making these markets ideal candidates for NGN migration.

What users want

How people pay for services is also influencing demand for NGN. Consumers want simpler billing systems that cover everything they receive through the network, and more personalized services of a higher quality. Demand is being fuelled too by increasing communication across national borders for both personal and business purposes, requiring high performance, widely available, secure voice and data services.

Business users are already looking for flexible, virtual private network (VPN) solutions. Future demand is likely to focus on innovative services and network intelligence — security, storage and ways to support better integration of their networking and information systems.

Operators seek savings and efficiency

Among the factors driving operators to migrate to NGN is the growing competition in old markets and newly liberalized ones. Falling revenues from voice calls (and the multiplicity of networks that can deliver them using VoIP technology) are prompting operators to convert to a fully IP-based architecture (see article on pages 5–9).

Traditional fixed-line carriers have generally been the leaders in broadband Internet access using digital subscriber line (DSL) technology. But they are faced with pressure from competitors such as mobile operators, new VoIP providers, or wireless carriers, as well as from cable television networks that can now support bi-directional IP-based services.

In Romania, for instance, competitive pressure from cable television operators has led the incumbent to modernize its network and decide to move towards NGN. In anticipation of joining the European Union on 1 January 2007, Romania passed legislation in 2002 that includes a general authorization regime. Its resulting regulatory framework promotes competition in infrastructure, with cable television operators offering triple-play voice, Internet and television services at the equivalent of EUR 9 per month.

Convergence and growing competition have made traditional operators invest in common IP-based core infrastructure. These investments will eventually lead to savings, through reducing the cost of running different networks while increasing the products offered and thus (potentially) the number of subscribers. Operational efficiencies can also be anticipated.



Many paths, one goal: to bridge the digital divide

Despite dramatic advances in telecommunications in many developing countries — particularly via mobile telephony — major disparities remain in providing Internet and broadband services. For example, most African countries have yet to launch high-speed Internet services, although a few, such as Morocco, offer broadband services of up to 20 Mbit/s and Sonatel in Senegal has rolled out a triple-play service bundle offering voice, Internet access and television programming. Most mobile operators have 2G (second-generation) networks. Some of these are being transformed into 2.5G or GPRS (general packet radio service) networks, but, for most people in the developing world, mobile broadband services such as GPRS and 3G are still out of reach.

Service providers in developing countries are aware of the potential cost-saving efficiency of NGN and in Brazil, India and Viet Nam, for example, they have announced plans to migrate to core NGN. Projects for FTTx (fibre-to-the-home or other building, or to the curb or node) are also being undertaken in such countries as Bangladesh, Brazil, Pakistan and Viet Nam in anticipation of moving to NGN, although they are mostly concentrated in highly populated, high-income areas.

The technological innovations that can be leveraged when migrating to NGN such as Wi-Fi or broadband wireless access (BWA)

technologies are already changing the way universal access is being extended to rural and remote areas in both developed and developing countries. In Mongolia, for example, rural areas are being given spectrum free of charge for Wi-MAX and Wi-Fi in order to improve Internet access.

India's Telecom Regulatory Authority has recommended measures to de-license spectrum in the 5.1 GHz and 5.3 GHz bands and to earmark additional spectrum bands that are not in high usage for deployment of BWA networks.

The Dominican Republic, which has already launched 3G services, plans to introduce Wi-MAX soon. Its state-of-the-art operators use soft switches, with other operators still offering services based on circuit-switched systems. The road to NGN may take many paths. But developing countries also have certain advantages in the migration process to NGN. Compared to more developed markets, service providers in the developing world generally have fewer legacy products in their core networks (for example, ISDN, IP, ATM, FR, and SHDS). This makes it easier for them to "leapfrog" to all IP-based systems. Limited deployment and penetration of copper networks, and the falling cost of fibre, can also facilitate "greenfield" deployment of FTTx projects. In some developing countries, the absence of complex access-based *ex ante* regulations also means that there are fewer regulatory commitments to consider. ▀



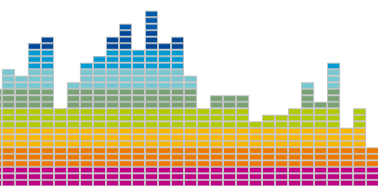
South Africa is to host the 2010 Football World Cup. In preparation, it is capitalizing on advances in 3G and digital migration to ensure that every mobile phone in the country can receive mobile television, while visitors from around the world will be able to use mobile multimedia services to send images and video footage of the action at South African stadiums.

Sources:

GSR Discussion Paper on NGN Overview, by Tracy Cohen, Councillor, Independent Communications Authority of South Africa (ICASA).

GSR Discussion paper on NGN Enabling Environment, by Janet Hernández, Senior Vice President, Telecommunications Management Group, Inc., United States.

Report of the Chairman, 7th ITU Global Symposium for Regulators (GSR). All of these documents are available at <http://www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR07/agenda-documents.html>



Gianluigi Ferri

The workshop was chaired by William Lehr of the Massachusetts Institute of Technology, United States



Gianluigi Ferri

"Spectrum management does not deal with megahertz; it deals with the future of communications" said Guido Salerno of the Ugo Bordoni Foundation

New ways to manage spectrum

Tomorrow's information and communication technologies (ICT) will be required to provide the necessary flexibility, coverage and transparency for an environment of ubiquitous connectivity. But this infrastructure can only be created if the radio-frequency spectrum — a limited resource — is shared and used in innovative ways.

As traditional "command and control" techniques of spectrum management are slowly being replaced by market mechanisms, how can the goals of spectrum efficiency and equitable allocation be reconciled? Should spectrum be regarded as a tradable commodity, or as a public resource that can only be leased for particular purposes? Is it possible to have different spectrum management systems among neighbouring countries and still maintain a harmonized approach at the regional and international levels?

Workshop draws international experts

These were among the issues considered at a workshop in Geneva on 22–23 January. Called "Market Mechanisms for Spectrum Management," it was held jointly by ITU and the Ugo Bordoni Foundation, a telecommunications research institute in Italy. The event was organized within the framework of ITU's *Shaping Tomorrow's Networks*

Initiative and was chaired by William Lehr, Research Associate at the Center for Technology, Policy and Industrial Development at Massachusetts Institute of Technology, United States.

Some 200 participants took part, including experts from industry and academia, government policy-makers and regulators, and representatives of international organizations, telecommunication operators, ICT companies and other stakeholders. The aim of the workshop was to identify global trends and good practice in radio spectrum management.

Comprehensive strategy is required

Guido Salerno, General Manager of the Ugo Bordoni Foundation, opened the workshop by highlighting the great economic and social significance of the growth in ICT. He said that, in order to reach today's goal of ubiquitous connectivity, it is crucial to adopt an innovative approach to spectrum management, and he recognized the vital role played by ITU in this field.

Now that Internet access, broadcasting and mobile telephony are competing for radio-frequency spectrum, the issue of its management is one of public policy that requires a comprehensive strategy, Mr Salerno said. Rational use of the spectrum means managing various aspects, such as:

- ▶ a user-driven approach, amid growing demands for spectrum;
- ▶ guaranteeing the availability of specific radio-based services, such as emergency response;
- ▶ reduction of the digital divide, through worldwide, harmonized allotment of spectrum for radio access to networks;
- ▶ faster digitization, and use of the resulting 'digital dividend' to allow new operators and services to enter the market;
- ▶ introduction of new technologies and innovative architecture for radio-based networks;
- ▶ convergence onto Internet protocol (IP) networks;
- ▶ protection of operators' investments to obtain the sole right to use specific frequencies;
- ▶ flexibility in the use of different technologies related to the same service, according to fair competition principles;
- ▶ interoperability of consumers' digital devices with existing analogue networks;
- ▶ ensuring quality of service, particularly in planned networks based on the sole right to use specific frequencies.

The overall aim is to provide a reliable framework for the modern world. "Spectrum management does not deal with megahertz; it deals with the future of communications," Mr Salerno said.

Executive Round Table

An Executive Round Table was held as part of the workshop. It provided top-level representatives of governments, international organizations and the ICT industry with the opportunity to share their views on the future of spectrum management.

Participants were asked their opinions on the contribution that spectrum might make to economic development. ITU Secretary-General Hamadoun I. Touré responded by emphasizing the need for international cooperation. The airwaves are not only an important economic resource, but one that is equally available to all countries, he said. Catalin Marinescu, President of the General Inspectorate for Communications and Information Technology of Romania, stated that data is the lifeblood of the information economy. Erkki Ormala, Vice President, Technology Policy, Nokia Corporation, agreed. Dimitri Ypsilanti, Head of the Telecommunication and Information Policy Section at the Organisation for Economic Co-operation and Development (OECD), pointed out that, in richer countries, value creation comes mostly from the service sector, in which the availability of spectrum plays a crucial part.

Italy's Minister of Communications Paolo Gentiloni agreed that spectrum policy is important for economic growth, but emphasized that it also serves important social and cultural functions. Censu Galea, Malta's Minister for Competitiveness and Communications, expressed a similar view. This led to a discussion of whether market mechanisms should be applied to broadcasting. A definite "no" was the response of Brendan Tuohy, Secretary General of Ireland's Department of Communications, Marine and Natural Resources. He said that discussions about spectrum must include a wide range of stakeholders, since broadcasting is such an important medium for cultural transmission. Don Whiteside, Vice President, Technical Policy and Standards, Intel Corporation, argued that ubiquitous broadband is the key



Italy's Minister of Communications Paolo Gentiloni told a press conference after the workshop that "having rational use of the spectrum is absolutely essential — not only for the future, but now"



Full details of the ITU workshop, including links to the ITU Survey on Spectrum Management and other background materials, can be found at: www.itu.int/spectrum
You can also learn more about ITU's "Shaping Tomorrow's Networks Initiative" at www.itu.int/stn

ITU Survey on Spectrum Management

Launched at the workshop — and providing a background to it — was the ITU Survey on Spectrum Management, which gathers together information on the most important issues related to spectrum management policies around the world. This includes details of the initiatives undertaken by authorities responsible for the allocation of radio frequencies in each country. The survey shows that there does not appear to be one single solution that would bring about complete technical and economic efficiency. Because of the multitude of forces influencing frequency management, countries have been investigating and implementing various solutions. “The challenge for policy-makers is to create a regulatory environment, especially in the management of the radio spectrum, that allows innovation (particularly new wireless technologies) to flourish,” the survey says.

to closing the digital divide and empowering citizens around the world, but said it was a complement to — rather than a replacement for — broadcasting.

Sharing the future

There was general agreement at the workshop on a number of issues, including the critical role of wireless services in the future of ICT, and that those services will rely on sharing the radio-frequency spectrum. Among the many such factors that are driving moves towards spectrum sharing, Mr Lehr highlighted technical innovations that enable more intensive sharing of spectrum, as well as demand from consumers for continuous, ubiquitous, seamless mobility of applications across different platforms. In addition, he cited the need to control the cost of provisioning networks, especially given the increase in bandwidth-hungry multimedia applications. Mr Lehr also said that spectrum sharing is being encouraged by regulatory reform that recognizes the need to change legacy rules to eliminate artificial spectrum scarcity arising from restrictive regulatory systems.

Market mechanisms, and other options

Workshop participants agreed that market mechanisms should be introduced into spectrum management, but they differed about the pace of change. Generally, incumbent mobile operators and broadcasters called for an evolutionary approach that would ensure protection for legacy interests. New entrants to the market, and vendors of new technology such as WiMAX, wanted a faster transition. A number of speakers

stressed the importance of considering more than just commercial interests and market efficiency when weighing spectrum management reforms. They stressed that it is also important to consider matters of public interest, such as broadcasting, and protection of safety and emergency response.

The workshop heard several options for reforming spectrum management, highlighting that there is no one approach that is best for all situations. There is a role for command and control, market-based flexible licensing, and unlicensed systems. Finally, a recurring theme was how to measure spectrum scarcity, and how to share spectrum while balancing market flexibility with the need to prevent radio-frequency interference.

Continuing dialogue

At the end of the workshop, chairman Mr Lehr summarized some of the insights that it had revealed. He said that an important theme had been the need to improve the multidisciplinary dialogue between policy-makers, economists, lawyers and engineers; between industry, government, and academia — and between nations. “There is much important work left to be done,” said Mr Lehr in his closing remarks. “While the challenges are great, the need for reform is also great and it is important that progress continues to be made towards increased reliance on market forces in managing how spectrum is used.”

Telemedicine in Zambia

Remote diagnosis

/// In Zambia, ITU funded the establishment of a *Women-led Multi-Purpose Telehealth Centre* in 2005 at the town of Chipata, close to the border with Malawi. In January 2006, Internet access was installed to allow use of an online application called Medoctor. It is an automated medical diagnostic system that can perform a differential diagnosis of almost all primary care diseases and conditions, as well as create an electronic medical record for each user.

Using the system means first logging onto the website of Medoctor Inc., a company based in the United States. A patient's medical history can be entered, and then an interactive interview begins in which questions are asked (in layman's language) about the patient's symptoms. These begin with such simple topics as "How long have you had the problem?" and "Where does it hurt?" Eventually, after an average of 50 questions have been answered, a diagnosis is presented giving the three most likely diseases or conditions.

The Medoctor program achieves this result after making up to one billion calculations, and this amount of data has ensured an accuracy rate of more than 90 per cent. It is also very efficient. The number of diagnostic questions are far more than a doctor normally has time to ask each patient, and the system also produces an electronic or

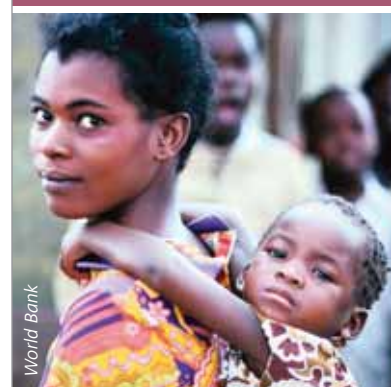
printed record that can be passed on to a physician. Moreover, because more patients can be seen quickly, early detection of disease can save resources and save lives.

Training for the future

The Medoctor system has been designed to be totally secure. It operates in English, French, German, Italian and Spanish, and an inexpensive, high-speed version has been designed for use in developing countries. ITU covered the cost of setting up the software and the necessary training at the Zambia project. Around 3000 women will use the system for training in basic medical skills. The aim is to help create a pool of nurse practitioners who can significantly improve local health care.

The Africa Telehealth Group, which supports the Zambia project, will develop and regularly update a database of medications and treatments applicable to the range of diagnoses that the system generates. This will be done in partnership with the pharmaceutical industry, the Zambia Ministry of Health, the Medical Association of Zambia, and other stakeholders. This will help to ensure that recommended treatments are available locally. ///

People living in rural and remote areas often find it difficult to visit a clinic or receive a visit from a doctor. This is particularly true in developing countries. One way to solve the problem is telemedicine; that is, using information and communication technologies (ICT) to connect health experts with the patients, to aid diagnosis, and to assist in sharing and storing medical information. And when there is a shortage of resources, ICT can help to make the most efficient use of those that are available.



World Bank

Telemedicine can help rural communities in Zambia



Cyrus W. Field (1819–1892)
The entrepreneur behind the transatlantic cable, Field was born in Massachusetts in the United States in 1819, and became wealthy through a paper-making business.



The wooden HMS Agamemnon encounters a whale while laying the first transatlantic telegraph cable

Transatlantic telegraphy

International, submarine telegraphy began in 1850 with a line between Britain and France, as mentioned in *Pioneers' Page* for December 2006. In that article, we asked how a flagpole in Liverpool, United Kingdom, connects the engineer Isambard Kingdom Brunel with the Atlantic Telegraph Company. The answer is Brunel's last creation: the *Great Eastern*, a ship which laid the first, successful transatlantic telegraph cable. After the ship was broken up in 1888, one of its masts became a flagpole outside Liverpool Football Club. And it was in Liverpool that the first meeting of the Atlantic Telegraph Company took place in 1856.

The Field force

Making transatlantic telegraphy into a reality required not only technical advances, such as the use of gutta percha to insulate submarine cables (see December's *Pioneers' Page*); it also required an entrepreneur with vision. That person was Cyrus West Field — the force behind the project.

In 1854, Field was asked by the British engineer Frederick Gisbourne to invest in a telegraph line between Newfoundland in Canada and New York. This would allow messages from Europe to reach the United States more quickly, as ships could signal ahead as soon as they reached the Canadian coast. Field agreed to finance completion

of the project — adding the ultimate aim of extending the telegraph across the Atlantic itself. Instead of taking up to 12 days for a message to be sent from London to New York, it might only take a few minutes.

The first link

The planned route of the transatlantic cable was just over 3000 km long and involved depths of up to 2400 fathoms (4.39 km). Success would require accomplishing an unprecedented technical feat. It also meant overcoming political opposition in the United States and a lack of American finance during an economic downturn. However, Field found backing in Britain's main commercial centres, as well as from the British government. He launched the Atlantic Telegraph Company with a board of directors that included Samuel Morse, as well as John Watkins Brett, who had opened the telegraph between Britain and France a few years before.

Attempts to lay a transatlantic cable began in 1857, when *USS Niagara* from the United States Navy set off from Valentia, an island off County Kerry in south-west Ireland, bound for Trinity Bay on the coast of Newfoundland. It could only carry half the required length of cable, with the rest aboard the accompanying Royal Navy ship *HMS Agamemnon*. The two halves were

Question for next time

On board *HMS Agamemnon* and *Great Eastern* was the inventor of an important piece of equipment for telegraphy. He is said to have envisioned it as he idly twirled his monocle and observed the light patterns it caused. Who was he?

to be spliced together in mid-Atlantic, and then *Agamemnon* would carry the cable to its destination.

Cable was played out from *Niagara*, while, from time to time, signals were sent back along the line to test it remained intact. The cable comprised seven copper wires covered with three coats of gutta percha, and wound with tarred hemp and dense spirals of iron wire. Unfortunately, it snapped less than half way across the ocean.

The same two vessels tried again a year later, this time sailing to mid-ocean and joining their halves of the cable before returning to opposite sides of the Atlantic. After several mishaps, the first transatlantic telegraph link was completed in August 1858. Britain's Queen Victoria and US President James Buchanan used it to exchange congratulatory telegrams. However, the cable could not transmit messages reliably and the line failed after a few weeks.

Success at last

Field did not give up. Despite delays caused by the American Civil War, he was able to raise finance for a new attempt to span the Atlantic. This used a much stronger cable, weighing twice as much as the earlier ones. Only one ship was capable of carrying the entire load: the *Great Eastern*.

In July 1865, it left Valentia for Trinity Bay. On two occasions, it seemed that the cable had been sabotaged by having a spike driven through it to cause a short circuit. And after reaching three-quarters of the way to Canada, the line snapped.

Nevertheless, the attempt had demonstrated that *Great Eastern* could lay a deep-sea cable, and on 13 July 1866, the huge ship left on its mission once more. This voyage was uneventful. On 27 July, *Great Eastern* landed at the tiny Canadian port of Heart's Content. Field later wrote how sailors took the cable ashore: "I see them now as they dragged the shore end up the beach at Heart's Content, hugging it in their brawny arms as if it were a shipwrecked child whom they had rescued from the dangers of the sea."

Only four weeks later, *Great Eastern* returned to Heart's Content with a second triumph for Field. The end of the 1865 cable had been grappled from the seabed and joined to a new section to complete another link between Ireland and Canada. By the end of the 19th century, 15 transatlantic telegraph cables had been laid — five of them by *Great Eastern*.

The biggest ship in the world

Brunel was born in Portsmouth, England, in 1806. As well as many railway projects, he designed the *Great Britain*, launched in 1843 and the first iron-hulled, propeller-driven ship to cross the Atlantic. For the route to India and Australia, Brunel built the world's biggest ever ship, the *Great Eastern*. It was more than 200 metres in length, could carry 4000 people, and was intended to travel from London to Sydney without needing to refuel.

In 1859, while inspecting the *Great Eastern* before its maiden voyage, Brunel suffered a stroke and died a few days later. He did not live to see the ship's failure as a commercial venture, despite its speed and luxury. In 1864, the *Great Eastern* was sold for refitting as a cable-laying ship.



Great Eastern at the port of Heart's Content, Canada. The huge ship was the first to have a double hull.



Isambard Kingdom Brunel (1806–1859)



Professor Ilija Stojanovic (1924–2007)

■ In January, the ITU family and the telecommunication world lost an eminent and well-loved figure: Professor Ilija Stojanovic. He marked many generations of telecommunication experts and participants in ITU activities.

The professional career of Professor Stojanovic was closely associated with ITU and he made significant contributions to the Union's activities for more than 40 years, beginning in 1961 with the milestone European VHF/UHF Broadcasting Conference in Stockholm.

In 1984, Professor Stojanovic served as Chairman of the Planning Committee at the Regional Administrative Conference for planning the VHF sound broadcasting service. This conference established the GE84 Plan, which is still in force. In 1985 and 1988, he chaired the first and second sessions of the World Administrative Radio Conference (WARC ORB-85 and WARC ORB-88) on the use of the geostationary-satellite orbit and the planning of the space services using it. His personal involvement in the decision-making process at these conferences was highly appreciated, as it allowed solutions to be reached at critical moments. For example, WARC ORB-85 adopted the broadcasting-satellite service (BSS) Plan and the associated BSS feeder links Plan for Region 2 (the Americas). These plans are still in force.

WARC ORB-88 accomplished numerous tasks. It adopted the BSS feeder links Plan for Region 1 (Africa and Europe) and Region 3 (Asia and Australasia). These plans were modified by the World Radiocommunication Conferences of 2000 and 2003. It also adopted the allotment plan (still in force) for the fixed-satellite service (FSS) for all three regions in several frequency bands, and established the regulatory framework to govern the use of these bands. All of these subjects were so complex that, at times, it seemed unlikely the conference would come up with results. However, Professor Stojanovic's tact made it possible to reach decisions on every issue to the full satisfaction of the ITU membership.

As an outstanding scientist and expert in telecommunications, Professor Stojanovic played an active role in many study group meetings of the International Radio Consultative Committee (CCIR), the forerunner of ITU's Radiocommunication Sector (ITU-R). He chaired the CCIR's 16th General Assembly in Dubrovnik in 1986. He also promoted the CCIR's work in the former Yugoslavia and had its Recommendations incorporated into national standards. He co-founded the Yugoslav National Committee for CCIR and served as its president from 1976 to 1988.

A man of vision, Professor Stojanovic was involved in planning structural reforms of ITU. During 1986–1988, he was Chairman of the ITU Panel of Experts on the future of the International Frequency Registration Board (IFRB), which became the Radio Regulations Board (RRB). And in 1990–1991, he was a member of the High-Level Committee on the review of ITU's structure and functioning. Some of the recommendations of these two bodies culminated in the adoption, by the Additional Plenipotentiary Conference held in Geneva in 1992, of structural changes to ITU.

Professor Stojanovic had a deep knowledge of radiocommunication services and their evolution, and from 1991 to 1994 took part in the Voluntary Group of Experts (VGE) on the simplification of the Radio Regulations. The VGE reviewed the overall concept of the international radio regulatory arrangements and proposed recommendations that were later implemented through the decisions of the World Radiocommunication Conferences of 1995 and 1997.

Beyond ITU, Professor Stojanovic was active in many national and international forums dealing with telecommunications. He founded the Department of Telecommunications at the University of Belgrade,

Serbia, and lectured at four universities for almost 40 years. He also headed numerous telecommunication projects in Serbia and in the former Yugoslavia and was a member of the Serbian Academy of Sciences and Arts. The author of numerous books and scientific papers, Professor Stojanovic received several prestigious awards for his work. He remained professionally active to the end of his life, as an adviser to a telecommunication operator in the Republic of Serbia.

The final ITU event in which Professor Stojanovic took part was the celebration to mark the 100th anniversary of the first ITU Radio Regulations, in October 2006. Everyone at the event in Geneva was very moved when he cut the jubilee cake and wished a long life to ITU. ▀

***Goodbye Ilija, and rest in peace.
You are with us as long as our
memories last.***

*Valery Timofeev, Director of the ITU
Radiocommunication Bureau*



Professor Stojanovic cutting the jubilee cake to mark the 100th anniversary of the first ITU Radio Regulations (30 October 2006)



From official sources*

Constitution and Convention of ITU (Geneva, 1992)

The Government of **Afghanistan** has ratified the above-mentioned Constitution and Convention. The instrument of ratification was deposited with the Secretary-General on 5 November 2006. This ratification applies to the Constitution and Convention as amended by the Plenipotentiary Conferences of Kyoto, 1994; Minneapolis, 1998; and Marrakesh, 2002.

The Government of the **Republic of Angola** has acceded to the above-mentioned Constitution and Convention. The instrument of accession was deposited with the Secretary-General on 10 November 2006. This accession applies to the Constitution and Convention as amended by the Plenipotentiary Conferences of Kyoto, 1994; Minneapolis, 1998; and Marrakesh, 2002.

The Government of the **Republic of Montenegro** has acceded to the above-mentioned Constitution and Convention. This accession applies to the Constitution and Convention as amended by the Plenipotentiary Conferences of Kyoto, 1994; Minneapolis, 1998; and Marrakesh, 2002. The instrument of accession was deposited with the Secretary-General on 21 July 2006, date on which the Republic of Montenegro became the 191st Member State of ITU.

Instruments amending the Constitution and the Convention of ITU (Kyoto, 1994; Minneapolis, 1998; and Marrakesh, 2002)

The Government of the **Republic of Lithuania** has approved the above-mentioned instruments amending the Constitution and Convention. The instruments of approval were deposited with the Secretary-General on 7 December 2006.

Instruments amending the Constitution and the Convention of ITU (Marrakesh, 2002)

The Government of the **Republic of Rwanda** has ratified the above-mentioned instruments amending the Constitution and Convention. The instrument of ratification was deposited with the Secretary-General on 5 October 2006.

The Government of **Peru** has ratified the above-mentioned instruments amending the Constitution and Convention. The instrument of ratification was deposited with the Secretary-General on 18 October 2006.

The Government of the **Republic of South Africa** has ratified the above-mentioned instruments amending the Constitution and Convention. The instrument of ratification was deposited with the Secretary-General on 18 October 2006.

The Government of the **Republic of Botswana** has ratified the above-mentioned instruments amending the Constitution and Convention. The instrument of ratification was deposited with the Secretary-General on 14 November 2006.

The Government of the Federal **Republic of Germany** has accepted the above-mentioned instruments amending the Constitution and Convention. The instrument of acceptance was deposited with the Secretary-General on 6 December 2006.

Change of name

In the **Togolese Republic**, the Ministry of Equipment, Transport, Posts and Telecommunications has changed its name to the *Ministry representing the Presidency of the Republic, responsible for Equipment, Transport, Posts and Telecommunications and Technological Innovations*.

The Agency for Telecommunications of the Republic of Montenegro, a Sector Member of ITU-R, ITU-T and ITU-D, has changed its name to *Agency for telecommunications and postal affairs (Podgorica, Republic of Montenegro)*.

The Broadcasting Agency of Montenegro, a Sector Member of ITU-R, has changed its name to *Broadcasting Agency (Podgorica, Republic of Montenegro)*.

ITT Industries Inc., a Sector Member of ITU-R, has changed its name to ITT Corporation (Herndon, Virginia, United States).

JAPAN TELECOM Co. Ltd., a Sector Member of ITU-R, ITU-T and ITU-D, has changed its name to *SOFTBANK TELECOM Corp.* (Tokyo, Japan).

Jasper Systems, Inc., a Sector Member of ITU-T, has changed its name to *Jasper Wireless, Inc.* (Sunnyvale, California, United States).

Marconi plc, a Sector Member of ITU-T, has changed its name to *Ericsson UK* (Coventry, United Kingdom).

Mobile Telecommunications Serbia BK PTT (MOBTEL), a Sector Member of ITU-R, ITU-T and ITU-D, has changed its name to *TELENOR Ltd BELGRADE* (Belgrade, Republic of Serbia).

New Skies Satellite, a Sector Member of ITU-R and ITU-D, has changed its name to *SES New Skies B.V.* (The Hague, Netherlands).

Siemens AG, a Sector Member of ITU-R, ITU-T and ITU-D, has changed its name to *Siemens Networks GmbH & Co. KG* (Munich, Germany).

Siemens S.p.A., a Sector Member of ITU-R and ITU-T, has changed its name to *Siemens Networks S.p.A.* (Milan, Italy).

Vee Networks Limited, a Sector Member of ITU-T and ITU-D, has changed its name to *Celtel Nigeria Limited* (Lagos, Nigeria).

Vodafone K.K., a Sector Member of ITU-R and ITU-T, has changed its name to *SOFTBANK MOBILE Corp.* (Tokyo, Japan).

VT Merlin Communications Limited, a Sector Member of ITU-R, has changed its name to *VT Communications Limited* (London, United Kingdom).

Change of status

Maxim Integrated Products, Inc. (Dallas, Texas, United States) and *Operax AB* (Lulea, Sweden), formerly Associates, are now Sector Members of ITU-T.

Structural change

In the **United Arab Emirates**, the Ministry of Communications has been abrogated and the *Telecommunications Regulatory Authority (TRA)* will be responsible for regulating, policy-making and licensing the telecommunication services in that country.

New Sector Members

Telecommunication Standardization Sector

The Boeing Company (Arlington, Virginia, United States) has been admitted to take part in the work of this Sector.

Telecommunication Development Sector

Intercai Mondiale Ltd (Marlow, United Kingdom), *Southern Aerospace and Telecom Consulting* (Toulouse, France) and *Terrestar Networks* (Bermuda)

Limited (London, United Kingdom) have been admitted to take part in the work of this Sector.

New Associates

Radiocommunication Sector

Gennum Corporation (Burlington, Ontario, Canada) and *FLO Forum* (Fremont, California, United States) have been admitted to take part in the work of Study Group 6.

Telecommunication Standardization Sector

Oy Cubio Communications Ltd (Helsinki, Finland) has been admitted to take part in the work of Study Group 2.

Brüel & Kjaer Sound & Vibration Measurements A/S (Naerum, Denmark) and *Audience, Inc.* (Mountain View, California, United States) have been admitted to take part in the work of Study Group 12.

Wintegra, Inc. (Austin, Texas, United States), *Intellon Corporation* (Ocala, Florida, United States), *Actiontec Electronics Inc.* (Sunnyvale, California, United States) and *Teradyne Inc.* (Deerfield, Illinois, United States) have been admitted to take part in the work of Study Group 15.

DSP Group (Herzlia, Israel) has been admitted to take part in the work of Study Group 16.

Official Visits

During February 2007, courtesy visits were made to ITU Secretary-General Hamadoun I. Touré by the following ministers, and by ambassadors and permanent representatives to the United Nations Office and other international organizations in Geneva



Lesotho's Ambassador
Mothae Anthony Maruping



The United Kingdom's Ambassador
Nicholas Thorne



Democratic Republic of Korea's
Ambassador Ri Tcheul



Senegal's Ambassador
Moussa Bocar Ly



Deputy Permanent Representative
of the United States Permanent
Mission Judith Chammas



Venezuela's Minister of
Telecommunications and
Information Jesse Chacon



Venezuela's Ambassador
Oscar Carvalho Valencia



Greece's Ambassador
Franciscos Verros



Argentina's Ambassador
Alberto J. Dumont



Romania's Secretary of State,
Communications and Information
Technology Balint Porcsalmi



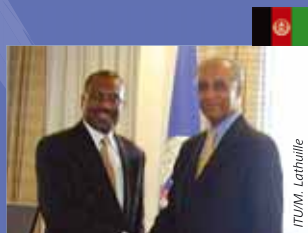
Monaco's Ambassador
Robert Fillion



Burkina Faso's Chargé d'affaires
Bedializoun Moussa Nebie



Lithuania's Ambassador
Edvardas Borisovas



Afghanistan's Ambassador
Nanjyalai Tarzi



Serbia's Ambassador
Slobodan Vukcevic



INTELLIGENT TRANSPORT SYSTEMS



Handbook on Land Mobile (including Wireless Access)

Volume 4
(Edition 2006)





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