

Next-generation networks

A paradigm shift in telecommunications

Spotlight | Next-generation network technology

ITU leads march into new digital age

Convergence is here. It is changing the nature of what we once called telecommunications services, reshaping the way we consume and access those services — and transforming the networks by which they are delivered.

Next-generation network (NGN) technology is replacing our legacy circuit-switched phone systems with a new packet-switched architecture, most commonly based on the Internet protocol (IP), to deliver a plethora of previously disparate services — ranging from broadband Internet to fixed, wireless and mobile voice and data, and even broadcast television — over a single network with guaranteed quality of service.

The International Telecommunication Union, the United Nations agency charged with developing global standards and policy guidelines for the world's telecommunication and information and communication technology (ICT) resources, is currently leading one of the most massive standards-development projects ever undertaken in an effort to build a global road map of the technologies and services that will define the shape of our increasingly digital age.

NGN promises seamless global connectivity over any network, any device, any time and any place. A highly flexible transport mechanism that can carry just about any kind of electronic information, IP makes it possible for new rivals like cable TV providers, broadband Internet service providers (ISPs) and other digital-age companies to encroach on the territory traditionally dominated by telecom companies and state-

run broadcasters, allowing them to deliver bundled voice, Internet and entertainment services over a single connection. ITU predicts that by 2008, at least 50 percent of all international telecommunication traffic will be carried on IP networks.

New game, new rules

With the decline of revenues in voice traffic, many telcos are looking for new streams of revenue while reducing costs to remain competitive.

Working through the Study Groups that make up ITU's Telecommunication Standardization Sector (ITU-T) and Radiocommunication Sector (ITU-R), these companies, along with the world's leading equipment vendors and researchers, are pushing the envelope toward a fully integrated single network architecture capable of seamlessly delivering just about any service users want, on about any device.

"NGN takes into account new realities for operators, such as the need to converge and optimize networks in order to reduce costs," says Malcolm Johnson, director of ITU's Telecommunication Standardization Bureau. "By rolling out and operating, on a single network, multiple services — including fixed and mobile voice, high-speed Internet and multichannel digital TV — operators, providers and users are bound to benefit. And since services effectively run independent of the network and each layer is well defined, NGN means a much more competitive offering among providers, and therefore choice and lower prices for the network operator and consumer while protecting the investments

made, irrespective of the evolution of services or network technologies."

Consumers, Johnson points out, are looking for attractive, affordable services with the same quality of service as provided by legacy networks and with the same kind of access to all services everywhere. "The worldwide success of mobile telephony has created a culture of mobility that has changed the way consumers relate to their daily communication needs," Johnson says. "They're increasingly expecting the same features and performance from all services, along with simpler, bundled packages. They want personalized services that correspond to their own needs, and that offer speed and performance as well as ease of access."

At the same time, he says, NGN means network operators and providers will be able to achieve tremendous economies of scale by being able to offer all services independently over the same infrastructure.

Few users realize it, but early implementations of NGN are already up and running — though often under different guises. BT's 21st Century Network began NGN deployment in Wick, near Cardiff in South Wales, last year, with full national migration expected to be completed by the end of 2012.

Korea Telecom's Broadband Convergence Network, meanwhile, will see customers using an all-IP network within five years, while Japan's NTT is quickly building NGN infrastructure in a bid to offer ubiquitous national broadband services. In North America, Sprint, Qwest, Bell Canada and Telus have all announced NGN rollouts, while in Europe, Telecom Italia and Telekom Austria have been among the most bullish in moving to all-IP platforms.

That's not to say, however, that most of the standards needed to support next-generation services are already in the bag. While some component systems may be finalized, Johnson says there's still a long road ahead in terms of realizing the vision of globally ubiquitous, increasingly personalized services delivered over a wide range of different devices. "NGN represents one of the most complex technological transitions ever," he says. To give some idea of the scale of the task, he cites a single meeting of ITU's NGN Lead Study Group last year, which had to evaluate some 650 different technical proposals.

Global playing field

ITU undertakes that mammoth effort to assure both the ongoing success of the industry it serves and the best-quality, most affordable products for consumers. "Global standards give access to global markets," Johnson says. "They also help keep prices



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NGN delivers previously disparate services, ranging from broadband Internet to broadcast TV, over a single network.

down, through competition and economies of scale. Today's ICT industry is backing NGN to the tune of billions of dollars so we're proud to have been entrusted with this work. Manufacturers and operators alike understand that global standards will stimulate innovation, deliver better technology and enable full interoperability across any kind of system, protecting their current and future investments. ITU is the only agency with the reach and authority to ensure full convergence between different NGN platforms on a global scale."

While Johnson readily says that achieving consensus on technological approaches developed by rival companies isn't always easy, he shrugs off the difficulty. "It's what we do," he says, "and we've been doing it with considerable success since the deployment of the first telegraph systems more than 140 years ago. Our standards already underpin the entire global communications framework — and will soon serve as the platform for a whole range of as yet undreamed-of services." ■

Global standards: ITU shows the way

In response to an urgent market call for global standards, the International Telecommunication Union established an NGN Focus Group back in 2003 to define priorities and work plans encompassing almost all 20 ITU Study Groups involved in developing telecommunication and radiocommunication standards. Eighteen months later, the group had produced 900 pages of deliverables defining the high-level architecture frameworks for tomorrow's networks. That road map now serves as the basis of the NGN Global Standards Initiative, under the coordination of ITU-T Study Group 13. In addition to actively developing its own NGN standards, ITU has set up a joint coordination activity to ensure that the thousands of new standards comprised by NGN systems are developed in the most appropriate industry forum, to avoid duplication of effort. "NGN represents an unprecedented example of convergence, both technical and operational, bringing together every major player in the ICT sector to develop standards that will benefit the industry as a whole," says ITU Secretary General Hamadoun Touré. "Our members have risen to this enormous challenge, and we're well on track to ensure the next digital revolution rests on a very solid foundation."

Developing world | Cost benefits

Can NGN help bridge the digital divide?

While next-generation network (NGN) deployment is expected to flourish first in countries with a fast-growing market for broadband services, the potential cost benefits are already attracting the attention of operators in the developing world. Senegal's Sonatel, for example, recently rolled out a triple-play offering that comprises voice, Internet and TV, targeting that country's growing middle class. Brazil, India and Vietnam have announced plans to migrate their core national networks to NGN; Bangladesh, Brazil, Pakistan and Vietnam are also currently investing in building fiber networks whose direct links to apartment buildings, local neighborhoods or even individual homes will deliver unprecedented levels of bandwidth to consumers.

While operators in developing countries often wrestle with a chronic lack of invest-

ment capital and limited consumer-spending power, they enjoy some advantages when it comes to migrating to NGN. Compared with the aging networks of fixed-line operators in developed markets, public switched telephone networks in the developing world tend to have less legacy technology buried deep in the core, making it easier and cheaper to leapfrog to an all-IP (Internet protocol) architecture. Given the spectacular growth in mobile networks in these countries, it is expected that for many developing countries, the migration path to NGN will mainly rely on the use of wireless technologies. The ratio for the relative number of mobile to wired connections may reach 20 to 1. Solutions for both NGN providers and user applications will need to cater for such environments in a bid to access these markets. In addition, the limited scale of copper-line infrastructure,

combined with the falling price of optical fiber, is helping spur greenfield development of fiber to the apartment, curb or home (FT-Tx), with operators free to look to next-generation systems rather than being constrained to try to squeeze the last drop of value out of investments in old technology.

As part of efforts to spur NGN uptake in the developing world, ITU is working with regional organizations and industry bodies to ensure that the key building blocks of an enabling environment, such as regulatory frameworks and global standards, are readily available. For example, last month, the agency held a workshop in Bangkok in partnership with the Asia Pacific Telecommunity, designed to highlight regional issues and exchange views on practical ways to plan the migration to NGN cost-effectively, particularly in low-income, remote and rural areas. ■

Television | Entering the digital age

Out of the box: IPTV gives control back to the users

Even the humble TV is morphing into a digital-age device. In Europe and elsewhere, IPTV — television delivered over Internet protocol-based networks, instead of over the airwaves — is replacing the paradigm of fixed-program schedules interspersed by advertising breaks that dominated broadcasting since its inception.

Instead, IPTV viewers determine their own viewing schedules, receiving the programs they want to watch directly from their service provider at any time — and potentially from anywhere in the world. What's more, the kind of device viewers use to access those programs no longer needs to be a traditional television set — it can be a desktop or laptop computer, a Web-enabled PDA, or even a GPRS or 3G mobile phone.

The power to deliver TV services over IP networks is paving the way for telecom companies and others to set themselves up as TV content providers — often in partnership with strongly branded traditional broadcasters. "NGN technology is giving telcos triple- or quad-play capabilities covering voice, data, video and interactive services," says Simon Jones, vice chairman of ITU's Focus Group on IPTV. "As revenues from voice and simple data services decline, traditional operators are looking to capitalize on that new functionality to create a 'single relationship' with the customer through the provision of competitively priced bundled services."

In Europe, incumbent operators in Austria, France, Germany, Italy, the Netherlands, Spain and the United Kingdom have already launched local IPTV offerings; now, many are beginning to look outside their national territories to establish TV offerings further afield. Not to be outmaneuvered, existing pay-TV operators are joining the fray; BSKyB acquired the United Kingdom's DSL-provider EasyNet in 2006, while Austria's UPC took control of Inode, another DSL provider.

For ITU's Focus Group on IPTV, the challenge is to harmonize and integrate the vari-

ous standards that are being developed for NGN components into a unified global standard that will maximize interoperability across networks and markets worldwide.

"In the absence of a firm global standards framework, many players have launched proprietary-developed IPTV services in the rush to be early-to-market," says Jones. "Interoperability hasn't been seen as a pressing need, but that will change as NGN technology becomes widely deployed, and telcos, broadcasters and others vie for a larger slice of an increasingly global pie." The group has focused its efforts on those requirements of immediate use to the IPTV industry, namely architecture, quality of service, security, digit-

al-rights management, middleware and home networks, all of which are expected to be adopted by the end of this year.

Jones says his group aims to coordinate and promote the development of global IPTV standards, taking into account the existing standards development efforts of a wide range of organizations, with a view to defining an optimum set of blueprints that will help the fast-growing IPTV sector to flourish. "Our focus is on interoperability, while maintaining the degree of flexibility IPTV providers need to develop their own unique service models," he says. "We're not in the business of dictating what shape IPTV offerings will ultimately take — that's for the market to decide." ■

'With IPTV, we're heading into uncharted waters'

By breaking down traditional broadcasting models, the rapid rise of IPTV has created regulatory challenges. With individuals in the driving seat — both as consumers and, increasingly, as generators of content — how will or even should governments maintain the degree of control necessary to ensure offensive or exploitative material is not broadcast? And in a world where any content can be accessed at any time, how can minors be protected? "Convergence is setting two very different regulatory cultures on a rapid collision course," says ITU's Robert Shaw, head of the agency's ICT Applications and Cybersecurity Division. "Broadcasting regulation has traditionally been highly interventionist, while the regulation of telecommunication services has been mainly concerned with delivery, not content." To complicate matters further, he adds, control of audiovisual material is a highly sensitive issue closely tied to societal, cultural and, in some countries, religious values.

In Europe, this has been tackled in an updated Television Without Frontiers Directive — now more accurately named the Audiovisual Media Services Directive, implicitly recognizing that regulating 500 or more IPTV channels, many of which may be based abroad, will be very different from overseeing three or four national stations. For its part, ITU is currently working to define a set of principles that could help guide regulators through what looks like a digital minefield. As the only global organization with a membership spanning the entire ICT industry, the organization is uniquely placed to serve as an impartial, accessible forum for all stakeholders to build consensus on the need for, and shape of, future action. "With IPTV, we're really again heading into uncharted waters, and a paradigm shift is inevitable," says Shaw. "The Church in Europe in the Middle Ages tried to prevent the Bible being published in Martin Luther's German because it broke the power of an elite who used only Latin. As in Luther's time, convergence is likely to lead to a modern-day reformation where digital content is in the hands of many rather than just a few."

Selected NGN initiatives

- Africa: Gateway Communications boasts having deployed the world's first long-distance NGN in 2006, linking mobile networks across 30 African countries.
- Austria: Telekom Austria has chosen a multiyear program aimed at a smooth migration to NGN, allowing for the development of innovative services while optimizing network costs by using existing infrastructure.
- Brazil: All major operators in Brazil have announced plans to migrate to core NGN. An FTTx project is under way.
- Canada: Bell Canada and Telus have also announced plans to implement NGN.
- Chile: VTR launches triple-play services on IP-NGN architecture.
- China: Jilin Mobile Communications uses a mobile NGN solution to deliver services to 30 million subscribers in Jilin province. China Netcom has started deploying an NGN long-distance trial network covering all 31 provinces of China; it is also rolling out tandem and local NGN networks in two provinces. Shanghai Telecom and Chunghwa Telecom have been undertaking NGN deployment since 2003.

- France: France Telecom carried out its first trials in 2002 and started deployment of NGN in 2007.
- India: MTNL has announced plans to migrate to core NGN and tendered to add capacity in Delhi and Mumbai based on NGN. An IP-MPLS Core network will also aggregate all the next-generation network switching, data broadband and video traffic.
- Italy: In January, Telecom Italia announced it was starting to roll out its fiber-optic network, or NGN, this year. The network will cost €6.5 billion (\$8.8 billion) to build over a 10-year period.
- Japan: In November 2004, the NTT Group announced its plans for building a next-generation network and developing ubiquitous broadband services.
- Korea (Rep. of): Korea Telecom started its migration to NGN in 2002 and intends to migrate all its networks onto a NGN-based broadband converged network by 2012.
- Romania: Rom Telecom announced plans to move to NGN. It adopted a new regulatory framework in 2002 promoting triple-play services.

- Russia: In 2006, the regional operator JSC Sakhatelcom announced its NGN plans.
- Singapore: In February 2006, SingTel announced its next-generation national broadband network (or next-gen NBN) to deliver speeds of 1 Gbit/s to all homes, offices and schools, as well as a wireless broadband network (WBN) to offer "pervasive connectivity."
- United Kingdom: BT's 21st Century Network began deployment of NGN in Wick at the end of 2006 and expects its core national infrastructure to have migrated to NGN by March 2008. The full national migration is scheduled for 2012, adding customers at the rate of 150,000 per week. In October 2006, Cable and Wireless announced it had completed the rollout of its NGN infrastructure.
- United States: Sprint announced its move toward NGN, and Qwest says it has completed a transcontinental domestic IP network.
- Vietnam: VNPT has announced plans to migrate to core NGN.

Regulations | Challenges ahead

Regulating for the next generation: Guidelines are necessary

If next-generation network (NGN) technology streamlines content and service delivery, it also raises regulatory challenges. "Somewhere between the telecoms and Internet worlds, NGN creates a raft of new issues that need to be addressed by regulators worldwide," says Sami Al-Basheer Al-Morshid, director of ITU's Telecommunication Development Bureau (BDT). To that end, the BDT's annual regulatory gathering, the Global Symposium for Regulators, which took place in Dubai in February, focused entirely on the

implications of NGN and the challenge of fostering strong investment while assuring open markets.

Before convergence transformed the landscape of information and communications technology (ICT), separate services ran on separate networks — fixed line over copper and fiber links, mobile over wireless networks based on GSM (global system for mobile communications), CDMA (code division multiple access) or regional systems, television via broadcast antennas and satellites.

Not surprisingly, networks were optimized for the kinds of services they carried, so that the public switched telephone network (PSTN) delivered excellent voice quality, the Internet was geared to the cheap transportation of packets (at the expense of service quality and security) and broadcasting networks delivered one-way video and audio in line with strict national broadcast regulations.

Now, as more and more of these services — video, voice, radio, television — begin to move onto IP-based networks, the digital bits and bytes are, in Nicholas Negroponte's words, commingling so that one service becomes indistinguishable from another as it travels across the network. In an NGN world, should different bit streams be regulated differently — and if so, how?

For the moment, the answer is still far from clear. At one extreme are those who favor the tight regulation that has traditionally characterized the broadcasting sphere; at the other, some are lobbying hard for the early Internet's "Wild West" ethos, where any kind of control is viewed as anathema.

"NGN introduces a radical new paradigm that requires a complete review of current regulatory frameworks," says Doreen Bogdan, head of ITU's Regulatory and Market Environment Division. "Our role is to foster open, in-depth international dialogue and to promote the sharing of experiences and approaches, as well as assisting nations that lack resources to reap the full rewards of the potential of NGN to reduce operators' costs and extend access to consumers."

To help policymakers and regulators respond effectively to these and other challenges, ITU's Global Symposium for Regulators reached consensus on a set of Best Practice Guidelines that can serve as a regulatory road map for migration to NGN.

The new guidelines cover all aspects of service provision, including authorization, access, interconnection and interoperability, numbering, universal access, quality of service, consumer awareness and security; they also promote good governance and regulatory independence. In addition, they recommend that regulators consider applying "technology neutral" rules to all providers, regardless of how services are delivered to the consumer.

Investment-friendly policies will also be

important, particularly in the developing world where the possibility of leapfrogging to NGN systems could have a dramatic impact on access and affordability.

Addressing the 470 assembled regulatory experts from around the world, ITU Secretary General Hamadoun Touré said that migration to NGN represented an ideal opportunity for regulators to develop innovative new frameworks that better enable developing countries to meet their ICT development goals. BDT's Al-Basheer added that the new guidelines will assist regulators in the immensely difficult task of garnering political support for effective regulatory frameworks that will help countries leverage the benefits for emerging technological and market developments. ■

Next-generation networks: A paradigm shift in telecommunications did not involve the reporting or editorial departments of the IHT. It was sponsored by the International Telecommunication Union, which provided the text.

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