

# Trends in Accessibility of Services and Networks

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By P. Tournassoud

Anytime, anywhere communications services depend on ubiquitous network availability. Unfortunately, many markets remain under-served, particularly with respect to broadband capabilities. This applies not just to developing countries, but also to developed economies, where truly universal access to broadband services remains elusive.

While the challenges faced by service providers in developing and developed economies may differ in scope and focus, there is a range of wireless solutions emerging that, together, form a toolkit that can be adapted to the very different circumstances of these diverse environments.

## A New Toolkit

The broadband wireless “toolkit” of the next few years will consist of third generation (3G) systems – UMTS<sup>1</sup> and CDMA<sup>2</sup> 2000 – in the already deployed bands and WiMAX<sup>3</sup> at 2.5 GHz and 3.5 GHz to support higher bitrates, along with the extension of these systems into new, lower bands to improve rural and indoor coverage. In addition, new “femto” systems, i.e. small-form-factor base stations, will be deployed indoors where fixed broadband is available, to deliver both higher bitrate and improved coverage for indoor domestic service.

Lower-frequency bands are an important part of the economic equation. Coverage depends on the geographical, regulatory and economical constraints on the deployment of base stations, with the most important factor being the frequency of the carrier. The lower the frequency, the larger the cells for a given waveform and emission power. To limit the investment required to deploy new cells, rural coverage will only be improved by radio systems deployed at low frequencies (UHF), liberated by the migration of broadcast TV services from analog to digital – the so-called “Digital Dividend.” Simulations show that low UHF frequencies cut investment in half. They can also reduce the minimum subscriber base penetration rate needed to guarantee profitability by a factor of 2.5.

UMTS at 900 MHz systems and CDMA at 450 and 800 MHz will be a first stage, but their capacity remains limited by technology and available spectrum. Wireless broadband services will then be further enhanced with the allocation of additional bandwidth below 1 GHz (700-800 MHz), permitting the deployment of new-generation Orthogonal Frequency-Division Multiplexing systems – WiMAX 802.16e and, later on, Long Term Evolution or Ultra Mobile Broadband.

## Developing Economies Require Cost-effective Solutions

The world’s developing regions generally face huge challenges as they attempt to find cost-effective solutions for offering simple dial tone to their populations: it should be no surprise, therefore, that these areas lag behind in broadband deployment. For example, only 1% of the world’s broadband subscribers are located in Africa or the Middle East.<sup>4</sup> This is significant, because economic development correlates strongly with broadband penetration. For every 1% increase in broadband penetration, there is an approximate \$2,000 per capita GDP benefit (Figure 1).

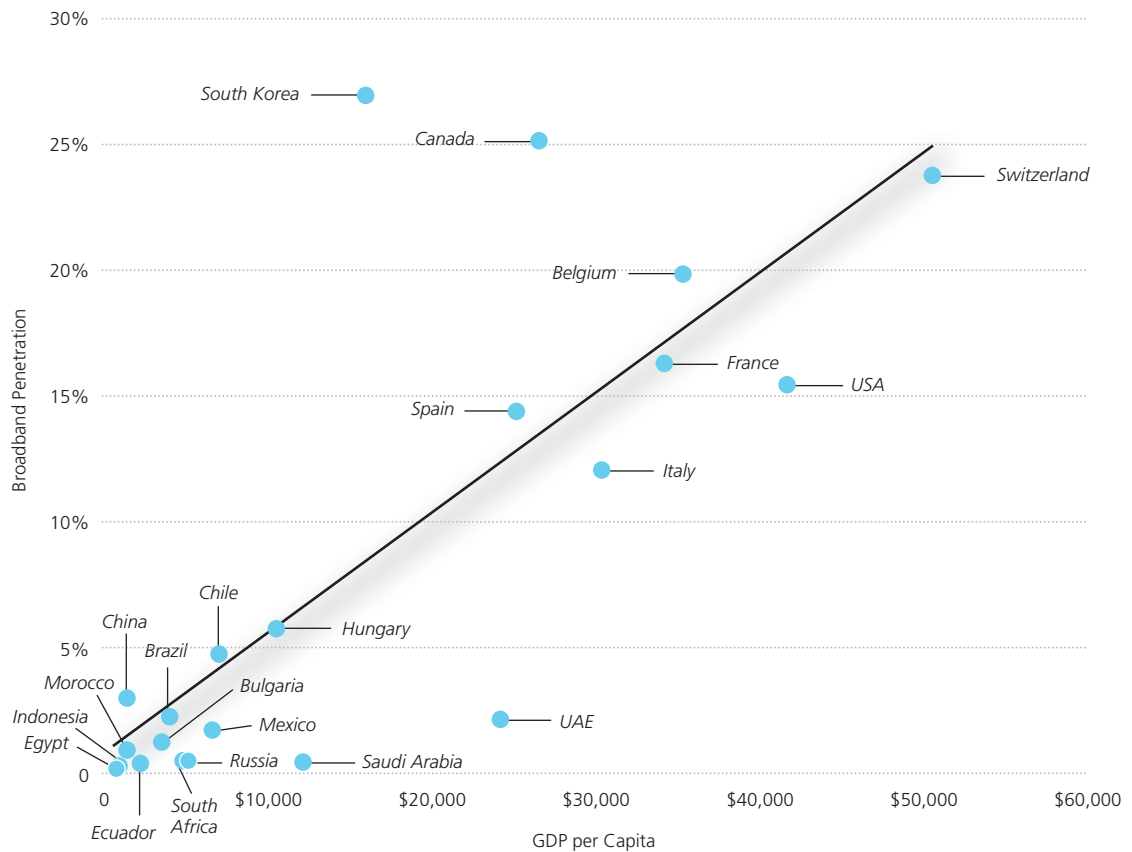
1 Universal Mobile Telecommunications System

2 Code Division Multiple Access

3 Worldwide Interoperability for Microwave Access

4 ©2007, *Broadband for Development in the ESCWA Region*, Alcatel-Lucent, UN-ESCWA.

Figure 1: Broadband penetration vs. GDP per capita



Consumers and businesses in high-growth markets in Africa, the Middle East, Southeast Asia and Latin America are eager for broadband connectivity. Recent Alcatel-Lucent research shows that 73% of Internet Café users in Southeast Asia are very interested in personal broadband services and intend to subscribe when available.<sup>5</sup>

In Venezuela, 86% of enterprises with broadband were willing to pay a premium for new blended services running over that connection. Nearly one third of the enterprises surveyed were willing to pay 30,000 VEB (approximately 14 USD/10 Euros) per month for these services over broadband. Of the Venezuelan enterprises surveyed, 71% indicated making the purchase decision within 6 months. Micro-sized businesses (1-10 employees) were most likely to be in the early adopter population.<sup>6</sup>

In Africa, where price sensitivity concerns were expected to hamper the introduction of mobile services, mobile networks are being deployed by a growing community of operators to provide ubiquitous voice and basic broadband services.

These trends will in turn create the need for increasingly high-performance wireless broadband communications, ensuring both urban and rural coverage at optimal cost. Alcatel-Lucent is convinced that this will enable presently under-served markets to leapfrog to new personal multimedia communications, as well as e-health, e-education and e-business services. The vision is of a broadband service bundle including PC and network connectivity for around \$100.

5 ©2007, Alcatel-Lucent Broadband for All Research. Indonesia, Malaysia, Philippines, Vietnam.

6 ©2006, Alcatel-Lucent Blended Services Research.

Applying the toolkit mentioned above to developing markets should enable the deployment of cost-effective wireless solutions for widespread coverage of their populations.

In suburban and rural areas, the greatest improvement in coverage should come from the deployment of WiMAX in the lower 700-800 MHz bands. Alternatively, rural areas should experience great improvements from UMTS in 900 MHz and CDMA in 450 and 700-800 MHz bands. For sparsely populated areas, fixed installations with external antennas (“fixed wireless”) would deliver much higher levels of service when the terminal is located in the zone of coverage.

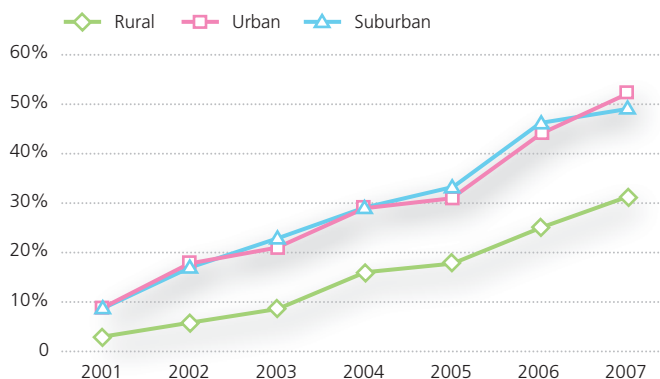
New business models will soon emerge to help finance the expansion of wireless services in developing countries. For example, a high-rise building in a high-density urban or suburban area could contain hundreds of small businesses. Collectively, they could afford excellent broadband connectivity. Other business models abound: service could be subsidized by advertising; its costs shared between members of a community; or even publicly funded. Regardless of the technology deployed, profitable business models will emerge.

Believing in the positive economic and social impact of broadband access, Alcatel-Lucent has developed an initiative for pilot deployments of wireless broadband access in association with local stakeholders in developing countries. These offer services aimed at improving local economic and social conditions. One example is the use of simple applications using short messaging services (SMS) to help farmers and fishermen obtain current market prices for their produce. Alcatel-Lucent also developed a way to use SMS certificates as payment to encourage e-commerce in populations which do not own credit cards. These applications, which can have a significantly beneficial effect on local communities and economies, only require inexpensive, high-density, high-bandwidth services and a reliable mix of wireline and wireless communications to be made available to all.

### Broadband Access Gaps in Developed Economies

Even developed countries have two sets of users with limited service accessibility – those in rural areas and those within buildings. In the United States, the Government Accountability Office reported that cost of broadband service remains a barrier to some and that rural populations are underserved.<sup>7</sup> A June 2007 report (Figure 2) shows home broadband penetration in rural areas at 31%.<sup>8</sup>

Figure 2: Home broadband penetration by community type



7 ©2006, *Broadband Deployment Is Extensive...* GAO.

8 ©2007, *Home Broadband Adoption 2007* Pew Internet and American Life Project.

Indoor accessibility can be poor even in dense urban areas. We expect that as data usage increases through devices such as Blackberries, indoor coverage will become more important. Also, given that 30% of 911 emergency calls in the United States are made from cell phones, accessibility and coverage everywhere become significant concerns.<sup>9</sup>

Urban and suburban areas in developed countries will see the massive deployment of fiber for fixed connectivity, as well as an increase in the density of 3G and WiMAX networks. Wireless deployments will piggy-back on fiber plant, thus changing the way wireless solutions are deployed: from large cells optimized for coverage and reduction of backhaul cost, to small grids designed for very high capacity hot zones. In rural areas, sub-1GHz bands freed by the Digital Dividend will also be a major enabler to ensure nationwide wireless broadband coverage, eventually facilitated by Private-Public Partnerships initiatives.

These same sub-1GHz frequency bands will also improve urban indoor coverage. However, the best solution to improve indoor service is femto base stations in domestic cases where fixed broadband networks are widely deployed and the use of small “pico” cell sites and distributed antenna systems in public areas and enterprises.

Mobile operators are actively seeking ways to deliver a compelling mobile broadband service inside homes and other indoor environments. This increased focus on in-building services has precipitated the growth of a potentially large market for small-form-factor base stations such as femtocells and picocells that can – in effect – ensure that subscribers enjoy a “five-bars” mobile experience in their living room, with a favorable tariff plan and some additional fixed-mobile-convergent services while at home.

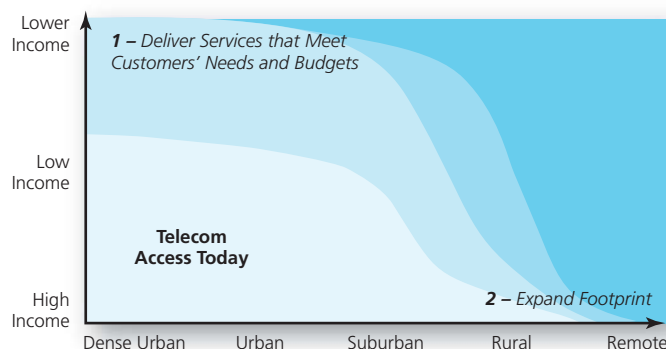
From a home coverage perspective, ABI Research projects that 102 million people worldwide will be on home base stations by 2011, and that some 36 million femtocells access points will ship in 2012, compared with just 50,000 in 2007.<sup>10</sup>

### Thinking Out of the Box

Given end-user pressure for universal broadband access and the obvious economic benefits that connectivity can offer, now is the time for operators worldwide to start examining how they too can think out of the box to offer affordable services profitably to the under-served communities of the world – in both the developed and developing nations.

These applications argue for inexpensive, high density, high bandwidth and a reliable mix of wireline and wireless communications to be made available to all (Figure 3).

Figure 3: Expanding access capabilities to deliver new and affordable services in cities while expanding coverage footprint across the entire country



9 ©2007, National Emergency Number Association.

10 ©2007, Femtocell Market Challenges and Opportunities, ABI Research.

Alcatel-Lucent continues to be committed to the goal of extending broadband access to unserved and under-served communities around the world. It offers a wide range of wired and wireless solutions that offer cost-effective deployment scenarios to service providers – both fixed and wireless – seeking to widen their geographical coverage and penetration.

Furthermore, the company has devised a number of innovative business models that enable service providers to offer networks and solutions according to their needs: from fully-hosted scenarios to pay-as-you-grow schemes that scale to match business expansion.

With today's technologies, plus business models adapted to network expansion in all areas of the world, the time is right to start filling in the gaps in the coverage map. ●

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## Public Safety Use of Commercial Broadband Wireless Technologies

By Dr. K. Budka

Many existing public safety networks in the United States, Europe and other parts of the world are plagued by interoperability problems. The inability for first responders (police, firefighters and other emergency response personnel) to communicate seamlessly in times of crisis is an issue that strategic planners around the globe are trying to address.

*“An incident commander makes 90% of a fire assessment within 15 seconds of arriving on the scene. If we can see a fire before we arrive via helicopter, traffic cameras, civilian picture phones or the media – then our response time can mean the difference between life and death and can turn a major fire into a much shorter event by getting the right people and equipment to the scene sooner.”*

– Major in Prince George's County Fire/EMS, Maryland, USA

Access to sufficient radio frequency spectrum is the foundation for interoperable and unfettered high-quality communications systems in the public safety arena. Recent action by the U.S. Congress and U.S. Federal Communications Commission has provided public safety agencies access to highly valuable 700 MHz spectrum, capable of economically serving wide areas with broadband speeds.

This is a major step forward for public safety organizations. Wide area wireless data services, if they exist at all, often operate at speeds of less than 10 kilobits per second, far too low to support the multimedia applications needed by first responders to meet the challenges they face today.

Armed with this new segment of spectrum, Alcatel-Lucent and LGS, a subsidiary of Alcatel-Lucent focused on the U.S. federal government market, are working to bridge the interoperability gap and provide public safety agencies with new broadband data tools supported by commercial broadband wireless technologies. As a result of these efforts, Alcatel-Lucent and LGS launched the first 700 MHz public safety wireless broadband network in the U.S. in Washington, D.C. and surrounding areas, based on CDMA2000.

The Alcatel-Lucent solution enables the National Capital Region (the area in and around Washington, D.C.) to deliver multimedia content, mission-critical data and collaborative capabilities into the hands of first responders. Broadband tools can support remote surveillance, distribute helicopter video transmission and push mug shots of suspects to the field. This technology will also play a major role in chemical and biological weapon detection, bomb squad support and other activities that prevent or mitigate attacks or enhance the ability to respond to emergency situations.

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