CHAPTER 1.5

Mobile Broadband: Redefining Internet Access and Empowering Individuals

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With more than 6 billion connections worldwide and US$1.3 trillion in annual revenue,[1] mobile telephony has become the largest information and communication technology (ICT) in history. Mobile connects four times as many people as landline telephony because of its better reach, convenience, and functionality and its lower costs.[2] Mobile telephony also surpasses the landline Internet by more than 3.5 billion users,[3] while driving economic growth and important societal benefits, as documented in the World Economic Forum's *Global Information Technology Report 2008–2009: Mobility in a Networked World* and other research.

While the global scale of mobile telephony and its economic impacts are well understood by ICT industry participants and governments today, we envision that mobile broadband—with its ability to connect people to the Internet in an ultra-personal and pervasive manner—will have a far greater impact.

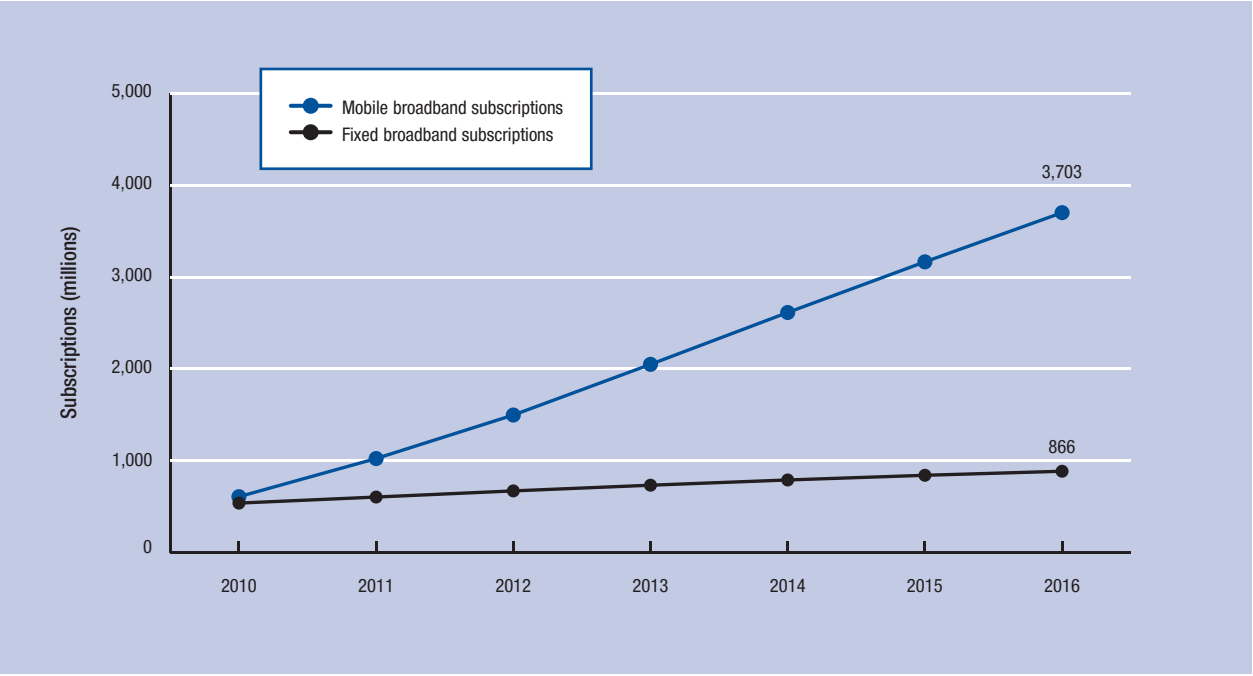
Mobile broadband, or high-speed access to the Internet and other data services over mobile networks, is already changing the way people across the globe access the Internet. It promises to drive even stronger economic growth than mobile telephony alone and to fundamentally change the way in which we live, learn, work, and collaborate. This in turn is driving seismic shifts across the communications and computing industries. Perhaps most importantly, it provides unprecedented opportunities to empower individuals across all socioeconomic classes.

In this chapter, we will discuss this view within the framework of two fundamental shifts, or tipping points, and related trends that underscore how mobile broadband is changing the way people access the Internet and, in turn, how the Internet itself is changing. We will also explore some of the transformative opportunities these shifts create in areas such as healthcare and education, as well as some key steps stakeholders can take to both enable and take advantage of these new possibilities.

TIPPING POINT: MOBILE BECOMES THE PRIMARY WAY PEOPLE ACCESS THE INTERNET

Not only has mobile broadband emerged over the past decade to meaningfully extend the reach of the Internet, it has actually become the primary method of access for people around the world. By the end of 2010, the number of broadband Internet subscriptions over mobile technologies surpassed the number of broadband subscriptions over fixed technologies (see Figure 1). This tipping point indicates that mobile is the first, and perhaps only, way people in emerging regions access the Internet. But it also substantiates the notion that the Internet itself is shifting from a desktop experience to an "on-the-go" experience for developing and developed nations alike. This shift provides unprecedented opportunities and benefits that will be explored in this chapter.

Figure 1: Global broadband subscriptions: Mobile at 80 percent by 2016



Sources: Industry analyst firm forecasts. For mobile broadband subscriptions: HSPA, EV-DO, TD-SCDMA, and LTE subscribers: Wireless Intelligence Database, February 2012; for WiMax: ABI Database, February 2012; for fixed broadband subscriptions: Informa Telecoms & Media (WBIS) Database, February 2012.
Note: Mobile broadband technologies include EV-DO, HSPA, TD-SCDMA, LTE, WiMax, and their respective evolutions.

Before discussing some of the underlying trends that have driven mobile broadband's dramatic growth, we provide a more detailed definition of mobile broadband and review its key enabling technologies.

Mobile technologies deliver true broadband rates

For the purposes of this chapter, *mobile broadband* is defined as any mobile (or cellular) technology that delivers minimum data rates in the hundreds of kilobits per second (kb/s) to end users and peak rates in the Megabits per second (Mb/s). This aligns well with definitions offered by the GSM Association and other industry bodies, as well as the 256 kb/s minimum data rate set out by International Telecommunication Union (ITU) to qualify fixed broadband services. In more practical terms, once mobile technologies were capable of delivering these minimum rates, all major notebook manufacturers decided to embed them in their products. In short, these minimum rates represent the starting point for delivering meaningful mobile broadband experiences.

Today, newer third-generation (3G) and fourth-generation (4G) mobile technologies easily surpass these minimums and provide the majority of mobile broadband connections worldwide. Key 3G and 4G technologies include HSPA,[4] EV-DO,[5] LTE,[6] and their evolutions. The latest HSPA+ and LTE commercial deployments now support peak data rates greater than 42 Mb/s, with typical user rates registering well above 1 Mb/s.

The wide majority of mobile operators have launched 3G services; a significant number are launching 4G services. As of January 2012, more than 451 operators had launched commercial HSPA networks, 270 had launched EV-DO networks, and 49 had launched LTE networks.[7] Combined, these networks serve more than 1 billion mobile broadband subscribers globally.[8]

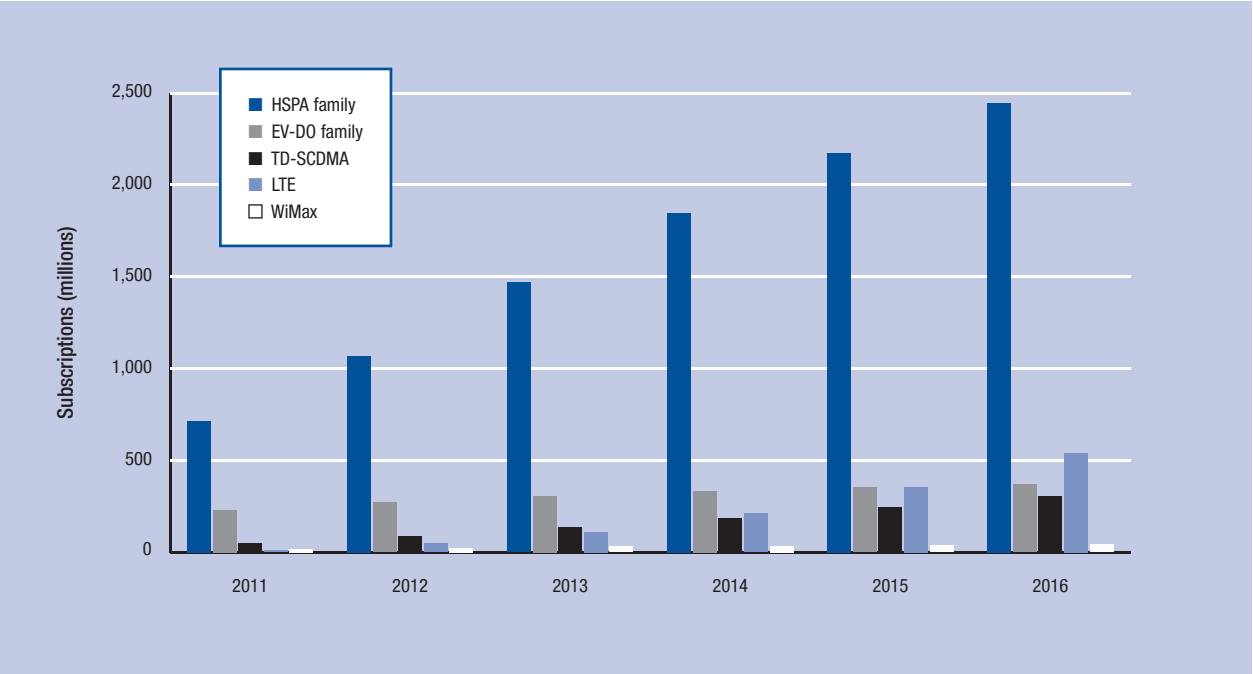
Forecasts are even more telling. By 2016, more than 80 percent of broadband connections will be mobile.[9] And with an estimated 1 million connections being added every day, 3G is fueling most of them (see Figure 2).

Data traffic surpasses voice over mobile networks

The rapid emergence of mobile broadband is tied to the global scale, interoperability, and ongoing investments made by mobile operators and an ecosystem of companies that are working to further technological innovations. Large-scale mobile networks were initially deployed for voice services. Operators have since been reinvesting revenues from their voice services to upgrade their networks, which now also form the backbone for delivering advanced mobile broadband services.

Accordingly, mobile network traffic has been shifting from voice to data, and in December 2009, data traffic exceeded the volume of voice calls across the world's mobile networks for the first time.[10] Global mobile data traffic continues to grow at a staggering rate. It more than doubled in 2010,[11] achieving volumes three

Figure 2: Growth in mobile broadband subscriptions fueled by 3G



Sources: Subscriptions for HSPA, EV-DO, TD-SCDMA, and LTE technologies: Wireless Intelligence Database, February 2012; subscriptions for WiMax: ABI Database, February 2012.
Note: Mobile broadband subscriptions are expected to grow at approximately 29 percent CAGR from 2011 to 2016, led by 3G and its evolution.

times larger than all the data traffic generated by the entire global Internet (both fixed and mobile) in 2000.[12] As mobile broadband networks are increasingly able to deliver rich Internet access and data services, mobile data traffic will continue its phenomenal growth. In 2014, *monthly* mobile data traffic is predicted to exceed mobile data traffic for all of 2008.[13] Overall, mobile data traffic is expected to grow 10 to 12 times between 2010 and 2015.[14]

Operators have a number of tools to help them meet this rapidly growing data demand. They are acquiring spectrum in new bands, migrating subscribers to the most efficient 3G and 4G technologies, employing technologies that reduce interference, and they are also deploying smaller cells that can more dynamically supply capacity to users in specific locations.

Mobile drives broadband Internet access in emerging regions

Mobile broadband growth is particularly accelerating in emerging countries, rising from 61 percent of all broadband connections in these regions in 2011 to 84 percent in 2016 (see Table 1). At this pace, emerging regions will surpass the developed world in terms of the number of mobile broadband connections in first half of 2013.

Unlike fixed broadband services, which have limited reach and high capital expenditures—particularly when compared with the available consumer spending in many emerging regions—mobile broadband offerings provide significant economies of scale and a more affordable means of reaching mass markets.

Table 1: Broadband connections in emerging regions

	2011 Connections (millions)	2016 Connections (millions)
Mobile broadband in emerging regions	415	2,366
Total broadband in emerging regions	676	2,826
Mobile broadband (as a % of total)	61%	84%

Sources: Mobile broadband: Wireless Intelligence Database, February 2012; fixed broadband: Informa Telecoms & Media (WBIS) Database, February 2012.

While mobile broadband services provide better reach and lower costs, personal computer (PC) penetration remains quite low in most emerging regions. Mobile broadband–enabled PCs (either through USB modems or embedded notebook solutions) have been successful in the market, but smartphones will have far greater impact, providing the first and primary way that people access the Internet in many regions.

In India, for example, mobile broadband became available in late 2009. Less than 18 months later, the number of subscriptions over mobile broadband networks surpassed the number of fixed broadband subscriptions. Usage has been with mobile devices rather than PCs.

Box 1: Mobile broadband and healthcare: Providing access to information for South African nurses

In South Africa, healthcare providers are challenged to deliver adequate care to large populations, especially those with infectious diseases. Providing healthcare to the poorest populations increasingly falls on the nurses.

Many nurses in South Africa lack Internet access. They are unable to share information with the global health community on rare and complex medical cases, keep abreast of the latest information on epidemics, or obtain information in real time for patient evaluation.

The Mobile Health Information System (MHIS) project leveraged 3G wireless technology to enable nurses to provide better care. The MHIS began as a collaborative effort involving the Eastern Cape Department of Health, Port Elizabeth Hospital Complex (PEHC), MTN-South Africa, and the Nelson Mandela Metropolitan University. The pilot phase provided nurses at PEHC with smartphones that were pre-loaded with a library of pertinent resources, enabling the nurses to access locally relevant, reliable, and accurate clinical information at the point of care.

Nurses integrated the smartphones into their daily activities. They reported using the newly accessible information to update their clinical knowledge, diagnose and treat and provide accurate information to patients, teach students, and share information with colleagues.

Rochelle Gelandt is a registered nurse at Livingstone Hospital Wellness Clinic, a comprehensive care and management facility for adults and children infected with HIV/AIDS. "I found the device most valuable when we did not have a doctor for months at a time in our clinic," she said.

"As some of the clients have chronic conditions such as hypertension, diabetes and epilepsy, I used the device to check if prescribed chronic medication is not contraindicated (causing adverse side-effect or risk due to precondition) when using ARVs (antiretroviral drugs). On many occasions I have had to advocate for patients regarding drugs prescribed by our doctor who was new to the HIV program."[1]

Note

1 Interview with nurses in the Eastern Cape in the fall of 2010. See also WIPO 2011.http://www.wipo.int/wipo_magazine/en/2011/03/article_0004.html.

Source

Qualcomm Wireless Reach™ Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care.

Mobile broadband delivers economic impact

Growth of mobile broadband services affects the economic activity of wireless operators, their suppliers, and the workers they employ. It also influences the economic activity of organizations, households, and individuals who use the new networks as well as the overall economic competitiveness of countries.

Although systematic correlations between more traditional mobile telephony and GDP levels across geographies have been made by the World Bank and others, mobile broadband has grown so quickly that these same measures are not yet widely available. There is, however, a small sampling of country-specific studies that find strong, positive economic impacts.

Studies assessing the direct and indirect impact of mobile broadband in economies such as India; South Africa; Nigeria; Taiwan, China; and the United States show that a 10 percent increase in mobile broadband penetration is likely to yield an impact of between 1 and 1.8 percent in GDP.[15]

More specifically, Analysys Mason estimates that for India, every 10 percent increase in mobile broadband penetration will generate incremental revenue growth of 1,622 billion Indian rupees, or 1.1 percent of the entire Indian GDP. This impact is forecasted to build to 1.5 percent of Indian GDP in 2015, based on 12.5 percent mobile broadband penetration that year.[16] A 2009 LECG study found that an investment of US$20 billion in 3G networks over the next five years will benefit India's economy by more than US$70 billion and create up to 14 million jobs.[17]

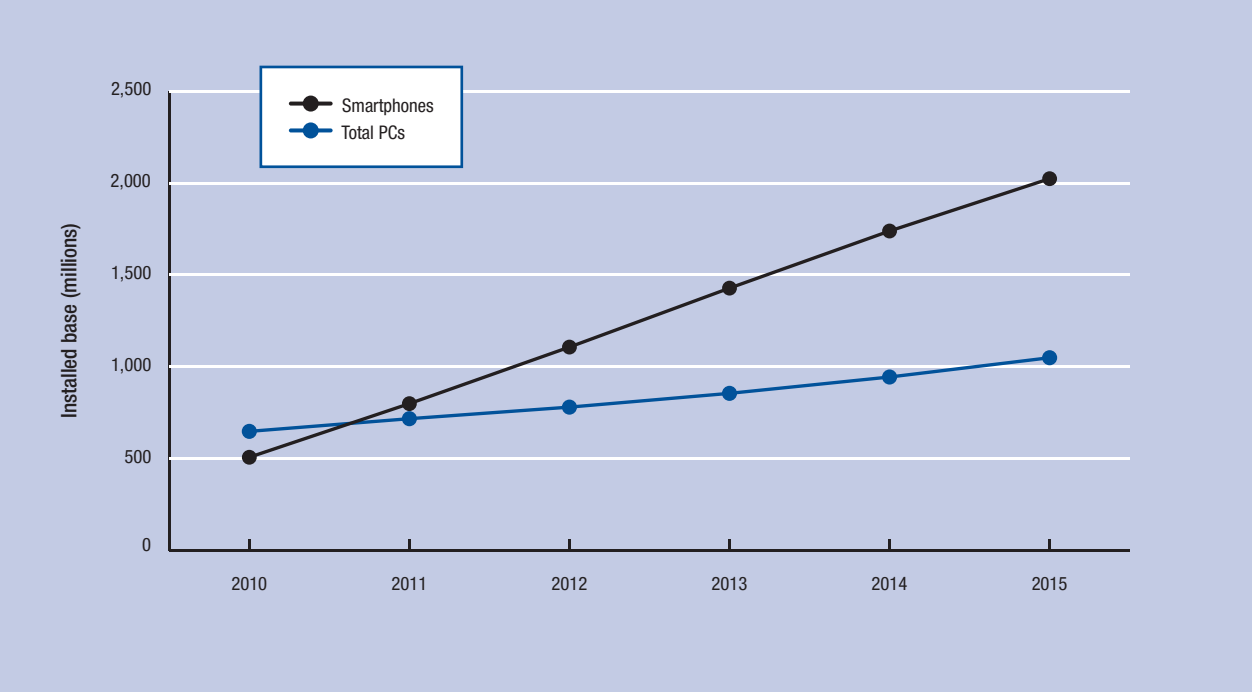
Similar assessments have produced analogous findings for other countries. In South Africa, mobile broadband and related industries could generate about 28,000 new jobs and 1.8 percent of GDP by 2015 if sufficient spectrum is allocated.[18] In Nigeria, mobile broadband could contribute over 1 percent of GDP (and 1.7 percent of non-oil GDP) in 2015, supporting diversification of the country's economy.[19]

The positive economic impact is not limited to emerging regions. In Taiwan, China, a developed region that is core to the manufacturing of computing and consumer electronics, mobile broadband technologies are predicted to contribute US$11.6 billion to the economy by 2015, an equivalent of 1.8 percent of GDP.[20] Furthermore, a recent Deloitte study focused on the United States identified a GDP growth opportunity of US$73 billion to $151 billion and an estimated 371,000 to 771,000 new jobs as a result of 4G technologies.[21]

These figures compare quite favorably with the economic impacts associated separately with mobile telephony and fixed Internet penetration. According to the World Bank, a 10 percent increase in mobile phone penetration correlates to a 0.8 percent increase of per capita GDP, while a 10 percent increase in Internet penetration increases per capita GDP by 1.4 percent in developing countries.[22]

We have discussed how mobile broadband has emerged as the primary way in which the world

Figure 3: Smartphones: The newest wave of computing



Source: Strategy Analytics, September 2011; December 2011.
Notes: *Smartphones installed base* is the total number of functioning and active cellular handsets with a high-level operating system at year's end. *Total PCs* include only IP-network enabled desktop, notebook, and netbook PCs and exclude PCs without connectivity.

accesses the Internet, how it is becoming the first and only Internet experience in emerging regions, and how it drives potential economic impacts. Mobile broadband is also driving the rapid growth of smartphones and other mobile broadband devices, as evidenced in the next tipping point.

TIPPING POINT: MOBILE BECOMES THE LEADING COMPUTING PLATFORM

The global scale and rapid growth of mobile broadband is driving another important trend within the mobile space: the emergence of mobile computing. Smartphones represent the newest wave of mobile phones and now comprise the largest segment of mobile broadband shipments. The installed base of smartphones exceeded that of PCs in 2011 and is growing more than three times faster than PCs.[23] Looking forward, approximately 4 billion smartphones are expected to ship between 2011 and 2015,[24] clearly establishing them as the most pervasive computing and Internet access device today and in the future (see Figure 3).

Today's smartphones deliver increasingly rich experiences, including full web browsing and computing capabilities, high-definition video, 3D gaming that rivals fixed game consoles, access to social networks, and many other compelling services. They are our most personal device since they are always on, always connected, and are always with us. They offer all-day battery life and, with GPS and other proximity technologies integrated inside, are location-aware and able to deliver a compelling array of new personalized services that build on these capabilities.

In many respects, today's smartphones are more powerful computers than PCs were just a few years ago. The computational power of smartphones has increased exponentially over the past decade. In the early 2000s, mobile phones ran in the tens of MHz in terms of processing power. In 2008, they surpassed 1 GHz (1,000 MHz) for the first time. Solutions on the near horizon will support dual- and quad-core processors with clock cycles up to 2.5 GHz—more powerful than many notebooks in use today. These processors, built with mobile in mind, are also driving today's tablet computers and other forms of consumer computing devices.

Smartphones already play an important role in providing access to the Internet. In the United States, more than one-quarter of mobile phone owners use their smartphones rather than a PC to access the Internet.[25] The success of smartphones extends beyond developed regions. In Brazil, for example, the smartphone's share in monthly 3G handset sales rose from 45 percent in May 2010 to 76 percent in May 2011—tripling in terms of unit volumes during the same period.[26]

A pilot project in South Africa (see Box 1) demonstrates how smartphones and mobile broadband technologies can be leveraged by nurses to improve access to healthcare within underserved communities.

Merging the best of both the computing and mobile worlds, advanced smartphones and tablets represent a new, highly personalized, rich computing experience

Box 2: Mobile broadband and healthcare: Detecting cardiovascular diseases in China

According to the World Health Organization, chronic diseases such as cardiovascular diseases (CVDs) place a grave economic burden on countries. In fact, China will lose US$558 billion between 2005 and 2015 in national income as a result of heart disease, stroke and diabetes.[1]

CVD is the leading cause of death in China, claiming about 3 million lives a year.[2] A pilot project involving Life Care Networks and the Community Health Association of China uses mobile broadband technologies to address the prevention and care of CVDs in underserved communities.

China's Wireless Heart Health project is deploying a 3G-enabled cardiovascular screening and monitoring system among resource-scarce community health clinics. The system includes smartphones with built-in electrocardiogram (ECG) sensors. The smartphones send patient heart data to cardiac specialists at a 24-hour call center in Beijing. As part of the service, doctors can provide real-time feedback to their patients via text or phone call.

This project demonstrates how 3G mobile broadband can extend the reach of specialized physicians into underserved areas and enable community health clinics to treat more patients effectively.

Notes

1 WHO 2005.

2 China National Center for Cardiovascular Diseases 2010.

Source

Qualcomm Wireless Reach™ Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care.

that we take with us wherever we go. This is driving both consumer demand and important shifts within the industry. Technology companies previously associated with PCs and fixed Internet experiences—such as Amazon, Apple, Facebook, Google, and Microsoft—are now focused heavily on mobile. A few points help illustrate the strength of this focus:

- Smartphones and tablets are driving two-thirds of semiconductor industry revenue growth through 2013, according to Gartner.[27]
- According to Facebook, more than 250 million people actively use Facebook through mobile devices and are twice as active on Facebook as non-mobile users.[28]
- Google reported that mobile access of Google Maps was higher than desktop usage for the first time during the 2010 Christmas holiday season.[29]
- In addition, Gartner reported in May 2011 that total downloads of mobile applications reached 8 billion in 2010 and should surpass 100 billion by 2015.[30]
- Microsoft's next PC operating system, Windows 8, is being designed to run on processors using ARM Holdings–based architecture, which are found in nearly every smartphone today.

We have discussed two fundamental tipping points to help underscore our view on mobile broadband and its growing impact: first, the emergence of its networks and services as the primary way we access the Internet; and second, the rise of its devices, specifically smartphones, as our primary computing platform. These factors in turn are redefining the way we interact with the Internet, with each other, and with the world around us. We now bring the Internet with us wherever we go rather than go to a place to access it. We now have real-time access, all the time. And because smartphones are our most personal device, they provide us highly personalized experiences, tailored to our needs and interests.

But the benefits delivered through these tipping points can become truly transformational once we examine what they can do to reshape areas such as healthcare, education, and, more generally, the empowerment of individuals.

THE TRANSFORMATIVE EFFECT OF MOBILE BROADBAND: THE POTENTIAL TO IMPROVE SOCIETIES AND EMPOWER INDIVIDUALS

Mobile broadband has the potential to impact important aspects of societies such as healthcare, education, and different socioeconomic groups. Combine this with highly personalized and pervasive experiences enabled by mobile smartphones and other always-on, always-connected devices, and the opportunity exists to empower individuals in transformative ways that were hard to imagine even just a few years ago.

Transforming access to healthcare

Within the healthcare sector, mobile broadband technologies can improve access to health services, enhance self-care, address rising costs, increase productivity, and help address the increasing demands of chronic disease and an aging population.

Mobile health solutions—whether used to automate electronic health records or treat chronic diseases—enable governments to more easily, quickly, and cost-effectively bring the benefits associated with access to comprehensive healthcare services to their citizens (see Box 2).

Mobile remote monitoring devices and services that transmit information about the condition of patients and applications that remind patients when to take their medications will allow many more people to lead healthier, more independent lives. A recent McKinsey study for the GSM Association estimated that remote monitoring through mobile devices can save US$175 billion to $200 billion in annual healthcare costs for managing chronic diseases in OECD and BRIC countries alone.[31] Accordingly, a recent Juniper Research study forecasted

remote patient monitoring using mobile networks to be a US$1.9 billion market by 2014.[32]

These solutions improve the reach, productivity, and outcomes within the healthcare sector. But more importantly, mobile broadband can empower people to participate more actively in understanding and managing their own health and wellness, and thus improving the quality of their lives. Better health education and information, real-time measurements of vitals through sensors, and closed-loop communications between patients and healthcare professionals can be achieved in a more proactive, preventive, and personalized manner.

Transforming education

Mobile broadband is also changing the way people learn and share information. While the use of always-on, always-connected mobile devices is providing access to resources previously not available to students in the developing world, it also transforms educational methods to improve educational outcomes in the developed world (see Box 3).

Empowering socioeconomic groups

There is evidence that socioeconomic groups are also empowered by mobile broadband. According to an August 2011 Pew Internet report on smartphones in America, 78 percent of under-30, non-white, low-income, and less-educated smartphone owners use their phones to access the Internet; and 38 percent of them use their handsets as their primary means of doing so. These rates are notably higher than in the average population.[33]

And in developing regions where people who lack Internet access are cut off from educational tools, access to mobile broadband helps them develop the skills to compete in the 21st century and provide new economic opportunities. A project in Indonesia (see Box 4) shows how mobile broadband economically empowers the underserved—particularly women.

Although mobile phone ownership has soared in recent years, there are 300 million fewer female than male subscribers. This means a woman is 21 percent less likely to own a phone than her male counterpart. The figure rises to 23 percent in Africa, 24 percent in the Middle East, and 37 percent in South Asia.[34]

Mobile phone ownership benefits women with improved access to educational, healthcare, and business opportunities. Women surveyed in low- and middle-income countries said they believe that owning a mobile phone helps them lead more secure, connected, and productive lives. Up to 41 percent of respondents said they increased their incomes or professional opportunities because of their mobile phones.[35]

In order to bridge the digital divide, governments and institutions have traditionally focused on fostering fixed Internet connections. However, mobile broadband provides a more pervasive, personal, and cost-efficient

Box 3: Mobile broadband and education: Improving educational outcomes for at-risk students in the United States

Smartphones and mobile broadband connectivity are creating new ways for at-risk students in North Carolina to learn mathematics.

Project K-Nect was launched in 2008 to determine whether smartphones with digital algebra I content and 24/7 connectivity could improve educational outcomes of students who scored poorly in math.

Qualifying students received 3G-enabled smartphones to wirelessly connect to supplemental math content aligned with their teachers' lesson plans, relevant web-based resources, and online collaboration tools. The devices also enabled students to communicate with their teachers and engage in peer learning.

As schools educate the next generation of society, mobile technology provides students a more efficient and convenient way to engage with their learning materials and each other 24/7. Mobile devices provide unprecedented access to learning resources, peers, and advisors—inside and outside the classroom, regardless of their location—at school, on the bus, or at home.

For four years running, Project K-Nect students have continued to outperform their peers, with students participating in Project K-Nect increased their proficiency rates by at least 30 percent on the State of North Carolina's End of Course exam, compared with classes not in Project K-Nect but taught by the same teacher.[1] Of those students, 50 percent reported a greater interest in attending college and one-third reported a greater interest in pursuing a degree and a career that uses their math skills.

Based on positive results from Project K-Nect, the Department of Defense Education Activity granted a participating school district $2.5 million to expand the reach of mobile learning to all algebra I students in Onslow County, North Carolina. In 2011, the US Federal Communications Commission chose Project K-Nect as one of 20 pilot projects to demonstrate the use of off-campus broadband as part of their Learning On-The-Go wireless pilot project. Today, Project K-Nect has expanded to three states and now reaches more than 4,500 students in grades 8 through 12.

Project K-Nect leverages the full capability of mobile broadband technologies and devices to help transform learning. The global reach of mobile broadband and the growing proliferation of smartphones will enable educational innovations using mobile devices for learning to expand to other countries.

Note

1 Project K-Nect Evaluation Report July 2007, available at http://www.tomorrow.org/docs/Project_k-Nect_Evaluationreport_Final_Jul7.pdf.

Source

Qualcomm Wireless Reach™: Project, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/education.

Box 4: Mobile broadband and gender parity: Giving female entrepreneurs new tools for success

In Indonesia, the world's fourth most populous nation, underserved residents—many of whom are women—use mobile technology to access unique business opportunities and gain the skills needed to lift themselves out of poverty.

The Grameen Foundation, along with partners from private and public sectors and its Application Laboratory (AppLab) initiative, is establishing a multi-tier suite of data services that use existing SMS technology and increasingly available 3G technologies built on a mobile platform.

Designed to increase incomes of the nation's poor, these services can be accessed through two distribution channels:

- Village Phone Operators (VPOs), a social network of women entrepreneurs who own and operate mobile micro-franchise businesses, and
- commercially available phones available in collaboration with Bakrie Telecom.

For example, AppLab's Jual Pulsa (Top Up) application allows the poor to become entrepreneurs by selling airtime to customers. The Info Kerja (Day Job Search) application connects the poor to job opportunities, thus increasing the chances of stable income for their families.

As of January 2012, over 10,000 entrepreneurs have served more than 1 million unique customers. An estimated 47 percent of the entrepreneurs who stay in the portfolio for more than four months have moved above the poverty line, which the World Bank defines as US$2.50 per day. Currently, more than 83 percent of the businesses are owned by women and 100 percent are profitable.

Source

Qualcomm Wireless Reach™ Project, available at: http://www.qualcomm.com/citizenship/wireless-reach/projects/entrepreneurship#indonesia---village-phone.

way to connect the unconnected. Smartphones, in particular, allow people to take matters into their own hands and find effective ways to engage the knowledge economy.[36]

THE PATH FORWARD

To ensure the ongoing success of mobile broadband and its economic and societal benefits, governments and other stakeholders around the world have an important role in ensuring the availability of the tools and incentives that are needed to spur innovation, new technologies, and new products:

- Spectrum is crucial for mobile communications. Its allocation is a key area where cooperation between governments and industry is critical. Although the latest mobile broadband technologies use spectrum much more efficiently than their predecessors, they are approaching the theoretical limits of spectral efficiency. This, combined with the phenomenal growth in mobile broadband, is resulting in a new challenge to find additional spectrum to support the tremendous growth in data usage. The benefits of mobile broadband depend upon the availability of adequate and appropriate spectrum that is harmonized to the greatest extent possible across borders. Industry must continue to innovate and find more effective ways to utilize spectrum while governments need to allocate and assign spectrum to the highest-value use, such as for commercial mobile broadband. Close cooperation between governments and industry is critical to finding solutions that will ensure that advanced services can continue to grow.
- A core driver of innovation and growth within the mobile broadband sector is the commitment by public and private institutions to establish and invest in the infrastructure and technological capacity required to meet the demand of the various services described in this chapter. Today, mobile phones and services provide greater quality, reliability, and functionality than ever before. And they do this often at a price that is lower than that of earlier, less-advanced, wireless technologies introduced just a few years ago.

  This could not have been realized without large investments in research and development and an intellectual property system that ensures protection of those inventions. Government policy and funding can play an important role in the early successes of the mobile broadband industry by providing incentives to spur innovation, technologies, and new products and by establishing a system that is able to examine, evaluate, and respond to these fast-moving market dynamics in a timely manner that leads to the development of high-quality inventions.

  It is important that policymakers take into account innovative technology opportunities when developing regulations and avoid arbitrarily stifling market opportunities that have great promise for providing societal, environmental, and economic value. Moreover, these policies must maintain technology neutrality to ensure an open and dynamic environment for innovation.

To better account for the full impact that mobile broadband is having around the world, we also propose that the 2012 and future *Global Information Technology Report*s (GITRs) include two additional Network Readiness Index (NRI) indicators at the country and global level:

- A mobile broadband connectivity metric, as part of the overall broadband Internet access indicators, that will help us more fully understand how many people in a given country are accessing the Internet and participating in the networked society. Current GITR metrics reflect only fixed Internet connections.
- A separate personal Internet connectivity metric that more precisely measures how many people are experiencing the new, hyperconnected Internet through personal devices that are always with us and always connected to real-time services deliver-

Box 5: Three examples of public-private collaborations using mobile broadband

This box provides examples of broadband solutions from three very different parts of the world.

Wireless Wireless Access for Health in the Philippines

In Tarlac Province in the Philippines, a project that began in 2009 has been implemented in 16 rural health units in order to reduce the time required for reporting and to improve access to accurate and timely patient information. The Wireless Access for Health project is made possible through collaboration between the Philippines Department of Health, the provincial government of Tarlac, Philippine universities, and private industry.[1] It uses 3G to build on and strengthen an existing electronic medical records system developed by the University of the Philippines, Manila. As of December 2011, approximately 150,000 patient consultations have been recorded through the program, patient care has improved, and patient visits are more efficient. Patient information is now fed electronically into the Philippine Field Health Service Information System—the government's major resource for managing public health data in order to collate reports for policy planning and analysis, which had traditionally taken a year to compile. Meanwhile, the recording of clinic-level information is enabling the health units to manage drug supplies and identify human resource needs, while municipal-, district-, regional-, and provincial-level information is helping to identify disease outbreaks and inform decision makers about the most efficient allocation of resources. Because of the success of the pilot project, the Tarlac provincial government has committed staff and financial resources to replicate the project in all 38 health clinics in the province; the pilot will serve as a model for other health units across the country.

National Broadband Plan in the United States

In the United States, the Federal Communication Commission's (FCC) National Broadband Plan provided a comprehensive analysis of the ways in which broadband in general and mobile broadband in particular has the potential to change many facets of American life, including healthcare, energy consumption, public safety, and education. The FCC has begun implementing one important aspect of its plan to support the use of mobile broadband for primary and secondary school students. Since passage of the Telecommunications Act of 1996, the FCC's e-rate program has been used to wire schools for fixed broadband and to fund wireless use on school grounds. As a result, the FCC has begun to extend this program to subsidize mobile broadband off school grounds to provide students with 24/7 connectivity. The E-rate Deployed Ubiquitously 2011 Pilot Program (EDU2011) is enabling 35,000 students at 14 schools in 20 states to get low-cost mobile broadband connectivity when they are away from school to support anywhere, anytime learning. EDU2011 is an important step toward achieving 21st century primary and secondary education in the United States through the use of mobile broadband connectivity, devices, and software learning applications offered by the mobile communications industry.

Connected Brazil

In Brazil, the telecommunications sector government agencies have a long-standing and active engagement with industry, utilizing mechanisms such as public consultations and keeping an ongoing dialogue on key issues. The Ministry of Communications and ANATEL, the National Telecommunications Agency, are very active in key international policy and regulatory organizations that are working to address mobile communications. By including industry in the decision-making process, the results better reflect the needs of both the government's objectives and the private sector's interests. ANATEL is an example of a regulator that has proactively taken steps to manage spectrum in order to maximize frequency harmonization at the international level and leverage economies of scale. In addition, some of the objectives of Brazil's National Broadband Program (PNBL), Connected Brazil, are to create opportunities, speed up economic and social development, promote social inclusion, reduce social and regional differences, and promote job creation and capacity building for the population to use information technologies.[2] The Connected Brazil Forum is composed of almost 60 institutions from diverse sectors, public and private, and directly linked with broadband program goals. Mobile communications will play a pivotal role in fulfilling PNBL's theme of a "fast Internet for all of Brazil" and aid in accelerating mobile broadband access and adoption, increasing local applications development, and decreasing device and service costs.

Notes

1 Qualcomm Wireless Reach™ Project: Health Care: Philippines – Wireless Access for Health, available at http://www.qualcomm.com/citizenship/wireless-reach/projects/health-care#philippines.

2 PNBL (Plana Nacional de Banda Larga): Brasil Conectado, available at http://www4.planalto.gov.br/brasilconectado/pnbl/.

ing social and environmental information about the world around us.

CONCLUSION

For people in many parts of the world, mobile broadband offers the first-ever means of accessing the Internet. And for many, particularly in emerging regions, mobile broadband will likely be their *only* means of access. At the same time, it is rapidly becoming integral to modern life for people in more developed countries, continually opening up new Internet experiences and unlocking new opportunities. In short, mobile broadband has become a force for change across all socioeconomic levels and in every corner of the globe. In many profound ways, this technology is an economic development tool for the 21st century.

While mobile broadband leverages the ubiquitous nature and scale of mobile telephony, it is positioned for a far greater impact if challenges such as securing appropriate spectrum and establishing policies and

systems that encourage and protect technical innovation are addressed. And, for reasons discussed in this chapter, it will also likely have far greater impact than the traditional Internet does today.

We have already begun to see the benefits of public and private collaborations that utilize mobile broadband solutions to bring services to citizens (Box 5).

Mobile broadband not only allows people to connect to one other, but it also provides unprecedented access to highly personalized Internet and computing experiences. There is significant opportunity on the horizon for many more people to participate in those experiences and benefit from those opportunities. Mobile broadband uniquely provides this potential to empower individuals across the world as never before.

NOTES

1 Chetan Sharma Consulting 2011.

2 ITU 2011.

3 Internet World Stats: Usage and Population Statistics. March 31, 2011, available at http://www.internetworldstats.com/.

4 HSPA refers to high-speed packet access, standardized by 3GPP as an evolution of UMTS/WCDMA networks.

5 EV-DO refers to evolution-data optimized, standardized by 3GPP2 for CDMA2000 networks.

6 LTE refers to long-term evolution, standardized by 3GPP and deployed by both UMTS/WCDMA and CDMA2000 operators.

7 See CDMA Development Group (CDG), available at http://www.cdg.org/resources/cdma_stats.asp, and Global Mobile Suppliers Association (GSA), available at http://www.gsacom.com/news/gsa_fastfacts.php4 (accessed January 2012).

8 Wireless Intelligence database, Q4 2011, available at https://www.wirelessintelligence.com/home/.

9 Wireless Intelligence database, February 2012, available at http://www.wirelessintelligence.com/analysis/.

10 Ericsson 2010.

11 Strategy Analytics Quarterly Research: Mobile Broadband Trends Q2 2011 (Prepared for Qualcomm), Strategy Analytics, July 2011.

12 Cisco 2011.

13 ABI Research 2009.

14 Strategy Analytics, July 2011.

15 See notes 16–21.

16 Analysys Mason 2010a.

17 LECG 2009.

18 Analysys Mason 2010b.

19 Analysys Mason 2011a.

20 Analysys Mason 2011b.

21 Deloitte 2011.

22 Qiang et al. 2009.

23 Strategy Analytics, September 2011 and December 2011.

24 This figure is the average of data on worldwide mobile devices for 2008–15, from Gartner, 2011a, *Q3 Smartphone Forecast Database;* Strategy Analytics, 2011, *Quarterly Forecast Database;* and IDC, 2011, *Quarterly Forecast Database.*

25 Pew Internet, survey sample of 2,277 people, July 2011.

26 See GfK Retail and Technology, July 2011, available at www.gfkrt.com.

27 Gartner 2011b.

28 Digital Stats 2011.

29 See http://www.bgr.com/2011/03/13/google-vp-marissa-mayer-dishes-google-mobile-stats-150m-mobile-users/, March 2011.

30 Gartner 2011c.

31 McKinsey & Company and GSMA 2010. OECD countries are those in the Organisation for Economic Co-operation and Development; the BRIC countries are Brazil, the Russian Federation, India, and China.

32 Juniper Research Press Release, April 13, 2011.

33 Pew Research Center 2011.

34 GSMA et al. 2010.

35 GSMA et al. 2010.

36 Hood 2011.

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