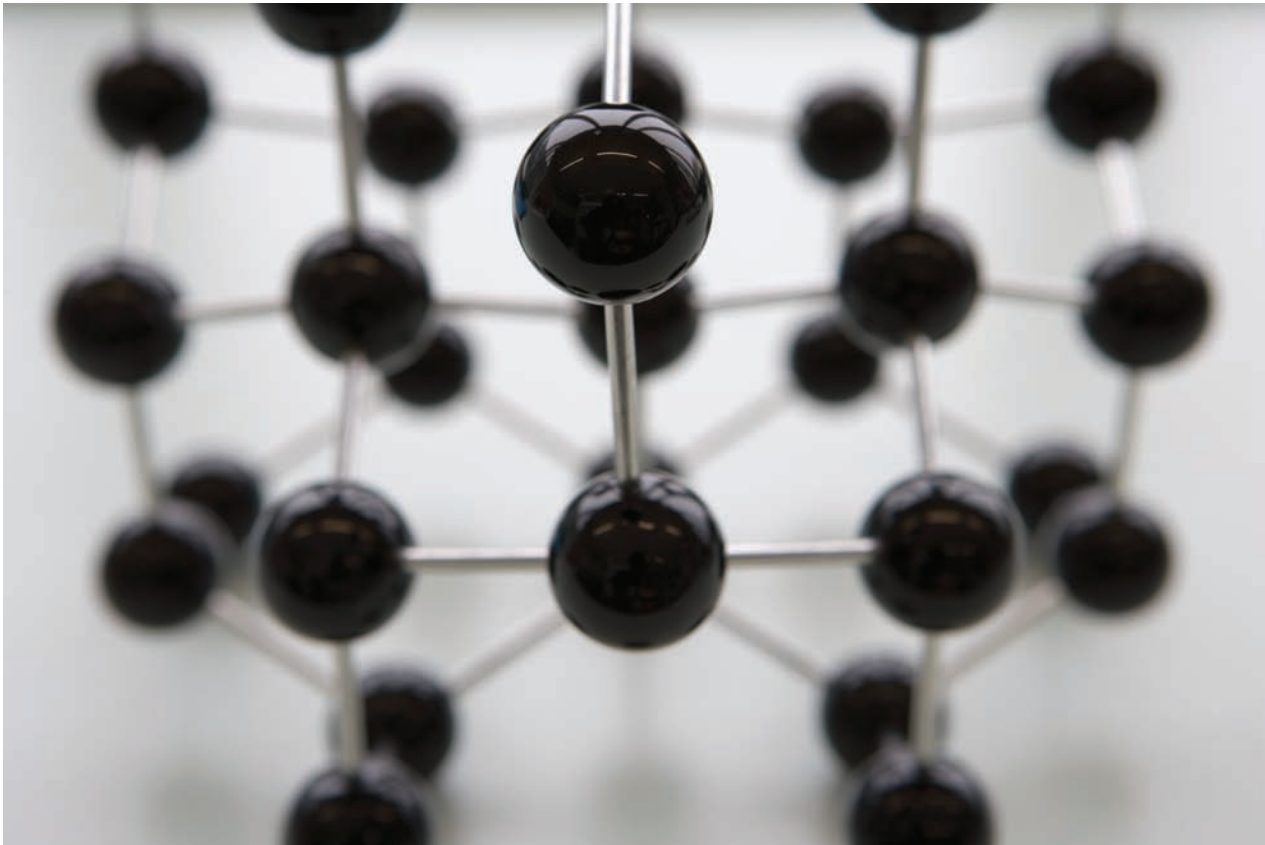


Perspective

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Building Communities Around Digital Highways

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EXECUTIVE SUMMARY

As governments around the world press ahead in their efforts to spark social and economic growth, they continue to turn to the development of “digital highways”: nationwide high-speed broadband networks. This advanced combination of fixed and wireless networks boosts socioeconomic growth by enhancing productivity, fostering investment, and bringing access to education, healthcare, and government services to a greater number of citizens.

However, such digital highways become truly effective only when “digital communities” spring up beside them, with functions such as e-health, e-government, e-education, and smart grids being developed to take advantage of the connectivity that broadband offers. Building such communities requires increased effort and cooperation on the part of those involved in the entire broadband ecosystem—policymakers, network operators, manufacturers, and applications providers. Policymakers will need to encourage the development and use of applications; operators will have to identify new revenue streams; manufacturers and applications developers will need to collaborate with

one another and operators to develop the most appealing services and products for users.

Furthermore, all of these broadband participants will need to work with their counterparts in other sectors (including transportation, education, healthcare, and energy).

To deliver on the promise of the benefits of digital highways, all involved stakeholders need to step up with a collaborative, focused, determined, and capable effort. Communities that facilitate stakeholders’ innovation and collaboration will realize the extraordinary potential of broadband.

KEY HIGHLIGHTS

- The transformational impact of ICT and accelerating customer and technology industry trends are intensifying the need for digital highways in developed as well as emerging economies.
- Anticipated shifts in public policy and private-sector business models to enable sustainable investments in national broadband networks are slowly but surely materializing.
- Policymakers and operators alike now need to take a wide-ranging view of digital highways' potential, moving beyond the deployment of next-generation national broadband infrastructure to recognize the importance of developing adapted services and applications and actively encouraging usage.
- Only by creating digital communities can the members of the broadband ecosystem accelerate investment and sustain the socioeconomic benefits of next-generation broadband.

THE BENEFITS OF DIGITAL COMMUNITIES

In March 2010, the U.S. Federal Communications Commission (FCC) published *Connecting America: The National Broadband Plan*, an effort to address the fact that only seven of 10 households in the United States use the Internet. Beyond examining infrastructure requirements, the FCC plan recognized that ubiquitous, affordable high-speed broadband was essential in driving national competitiveness: The plan spelled out seven priority areas in which broadband enabled advancements, including education, healthcare, energy and the environment, and civic engagement.¹

The United States is far from alone in its aspirations. Governments around the world are spending billions and setting ambitious targets as they recognize that digital highways—defined as nationwide high-speed broadband enabled by a combination of fixed

as well as wireless networks—are a crucial foundation for many areas of socioeconomic development. Just as actual highways connect people and foster social and commercial activity, digital highways can facilitate the creation of virtual communities in vital areas. When policymakers and telecommunications operators collaborate with leaders in other sectors, such as health and education, they are laying the groundwork for profound improvements—boosting national competitiveness, innovation, economic productivity, and social inclusion.

Accelerating the deployment of digital highways and deriving their full benefits is not a simple task. It requires fundamental changes in vision and action throughout the entire broadband ecosystem. Policymakers and network operators first must look beyond broadband networks and facilitate the development of a host of related services and applications (apps), then actively encourage citizens to use them. There is also a strong need for collaboration among other sector participants, such as

device manufacturers, application developers, and counterparts in adjoining sectors. Finally, the members of the broadband ecosystem must work with their counterparts in adjacent industries—such as healthcare, energy, education, and transportation—to develop the apps that will help those sectors reap broadband’s benefits. Only when all these stakeholders are fully engaged can digital highways reach their full potential and facilitate efficiency, competitiveness, and prosperity in the communities they serve.



THE NEED FOR DIGITAL HIGHWAYS

Widely accessible, high-speed broadband infrastructure is the foundation underlying all these possibilities, and several trends are converging to underscore the need for these digital highways.

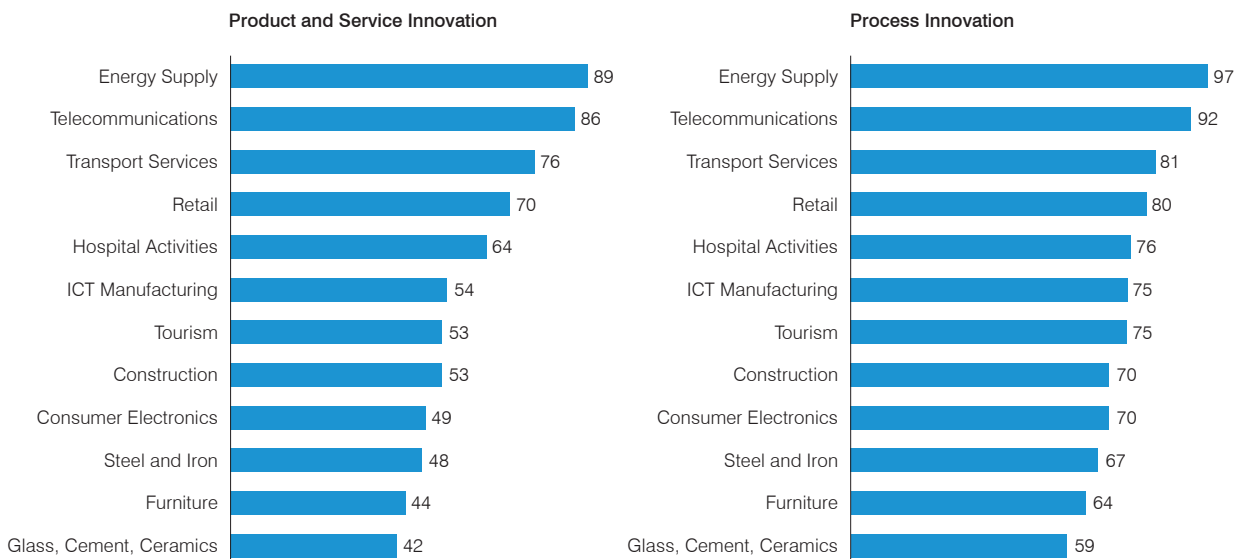
First, the proliferation of information and communications technology (ICT) continues to have a strong impact on socioeconomic growth. Consumers and businesses have recognized ICT as a source of productivity enhancement; as a result, enterprises have invested in the sector, particularly in developed markets, and ICT adoption has increased dramatically. There were 100 million personal computers in 1990 and 1.4 billion in 2010. The number of mobile phone users increased from 10

million to more than 5 billion over the same period, and the number of Internet users surged from 3 million to 2 billion. As adoption of ICT has made exponential gains, so has its role in fostering both product and process innovation across industry sectors (*see Exhibit 1*). All these technologies rely, in one way or another, on broadband. Therefore, countries seeking to better their standard of living and competitiveness consider digital highways to be a national imperative.

Another critical need for digital highways stems from changing consumer behavior. Around the globe, people are coming to expect constant immersion in the digital world—to be able to fulfill their need for communica-

Exhibit 1
ICT Enables Innovation in All Industry Sectors

PERCENTAGE OF INNOVATION ACTIVITY ENABLED BY ICT, BY INDUSTRY (2006–2009)



Note: The methodology and metrics used to assess both innovation and ICT contribution were defined by the e-Business W@tch study "ICT and e-Business for an Innovative and Sustainable Economy."
Source: e-Business W@tch, 2010

tion, information, and entertainment anywhere, at any time. What is more, they are not just consuming content but also creating it; this change, plus the increasing digitization of enterprise and government services, has led to an explosion of digital content. An International Data Corporation (IDC) study estimated that the total digital content created in 2010 would reach 1.2 zettabytes—that's 1.2 with 21 zeros, the equivalent of 75 billion fully loaded 16-gigabyte Apple iPads.² By 2020, IDC estimates, digital content will have grown another 30-fold, to 35 zettabytes. Facing steep costs, enterprises are turning increasingly to cloud computing. IDC forecasts that the amount of data on the cloud will reach 15 percent of the digital data universe, or 5 zettabytes. Already, major technology companies such as

Microsoft, Google, and Amazon offer cloud services. The transmission of so much data will put additional strain on broadband networks.

Indeed, this proliferation of data has had a profound impact on the telecom industry: a recent study by Ericsson highlighted the landmark moment in December 2009 when total mobile data surpassed voice traffic.³ Data use will only continue to rise as smartphones become more common, because smartphone users consume as much as 15 times more bandwidth than users of regular phones. Although successive generations of wireless technologies have improved the efficiency of the wireless spectrum, it is not sufficient to handle the data explosion: Mobile operators will need to turn to fixed broadband

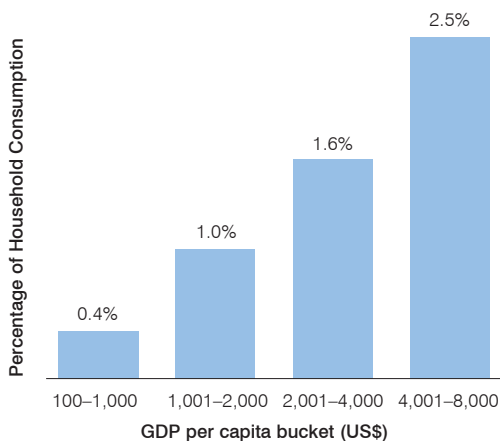
networks to support their operations as smartphones' popularity continues to surge.

Governments represent another source of network demand as they increasingly move toward e-government solutions to serve their citizens. The United Nations' e-Government Survey estimates that only 2 percent of countries today do not have an e-government website.⁴

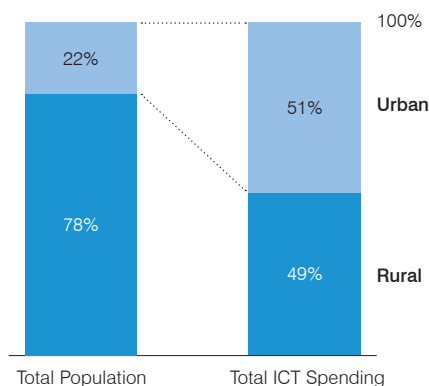
Emerging economies are also spawning demand for digital highways. In many growing economies, consumers are increasing their expenditures on ICT, creating demand for high-speed networks to handle surges in data traffic (*see Exhibit 2*). Emerging economies also see rapid growth in their urban centers: urban

Exhibit 2
ICT Consumption Patterns in Emerging Markets Are Changing

ICT CONSUMPTION BY GDP BUCKETS, 2009
(PERCENTAGE OF TOTAL HOUSEHOLD CONSUMPTION)



EFFECT OF URBANIZATION: INDIAN ICT SPEND, 2009



Source: World Bank, 2010; World Resources Institute, 2007; Booz & Company analysis

populations in emerging markets grew 3.4 percent between 1975 and 2005, compared with growth of 0.8 percent in developed countries over that same period. Such urbanization is usually accompanied by a host of challenges—such as traffic congestion and pollution—that require ICT solutions, such as intelligent public transport systems. Further, emerging economies are investing in e-govern-

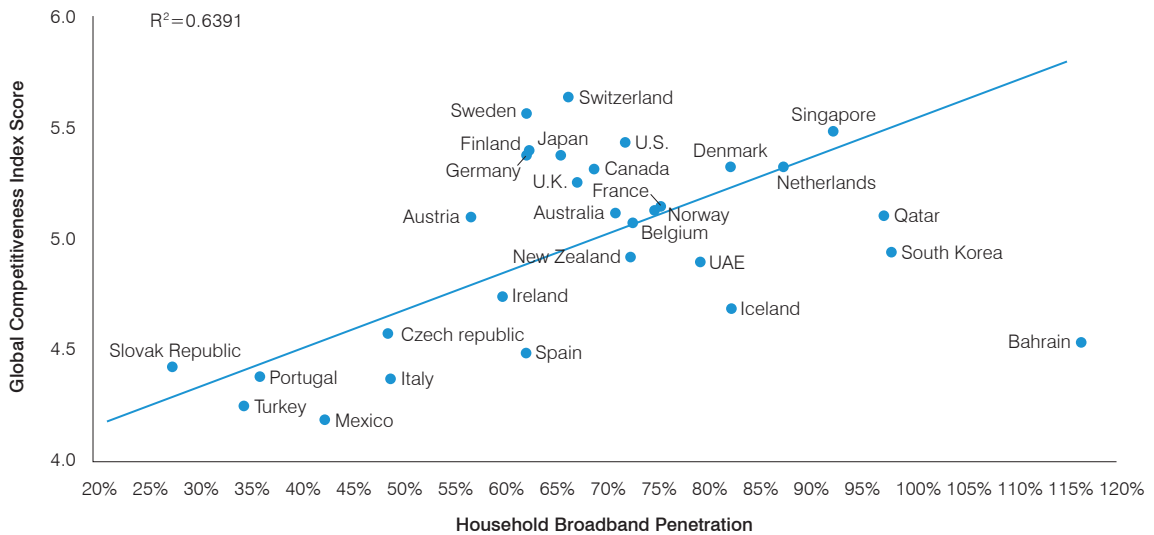
ment platforms that require universal and affordable accessibility to be successful.

The proliferation of content and data usage from governments, businesses, and consumers, as well as the growing needs of both emerging and mature markets, underscore how crucial it is for countries to keep building their digital highways. The

countries that embrace the need for affordable and ubiquitous national networks have proven to be more competitive in the global arena, according to the World Economic Forum's Global Competitiveness Index (*see Exhibit 3*). The message is clear: Digital highways are an imperative for all nations, developed or emerging.

Exhibit 3
Competitiveness Is Correlated with Broadband Penetration

COMPETITIVENESS VS. BROADBAND PENETRATION, 2010



Note: "Global competitiveness" is defined as the set of institutions, policies, and factors that determine the level of productivity of a country.
Source: World Economic Forum, 2010; Booz & Company analysis

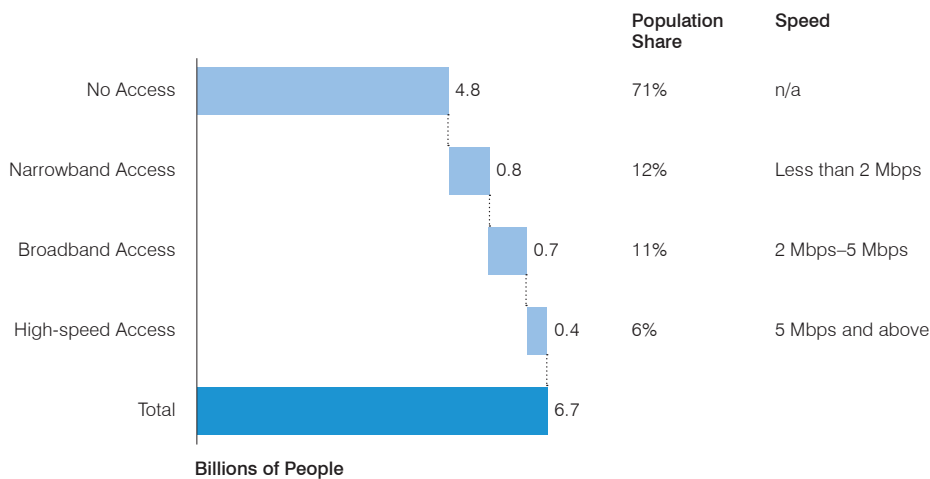
THE STATE OF DIGITAL HIGHWAYS

Despite digital highways' socioeconomic impact and their importance as the foundation for digital communities, more than 83 percent of the world's population lacks connection to a broadband network (see Exhibit 4). High-speed broadband is avail-

able to just 6.2 percent of the global population. Notwithstanding the best efforts of governments and the private sector, the broadband digital divide persists as a significant challenge to inclusive and sustainable development, especially in emerging economies.

Exhibit 4
High-speed Broadband Is Accessible to Only a Limited Part of the Global Population

GLOBAL ACCESS TO BROADBAND, 2010



Source: Akamai Technologies, first quarter 2010; Booz & Company analysis

These gloomy statistics, however, fail to show the progress that countries *have* made in recent years (see *Exhibit 5*). Policymakers and network operators are making major strides in accelerating the availability of national broadband networks.

Policymakers

In both developed and developing

markets, policymakers are considering the establishment of digital highways to be a national imperative, and they are introducing regulations and policy to ensure their rapid deployment.

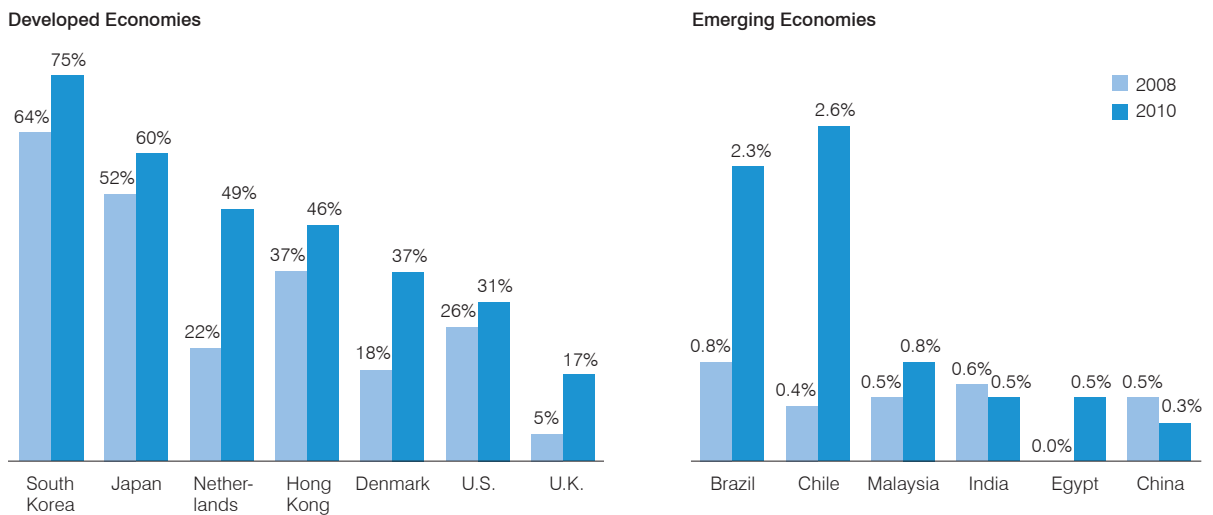
In July 2010, for example, the Finnish government formally declared broadband to be a legal right and vowed to deliver high-speed access (100 Mbps)

to every household in Finland by 2015.⁵ The French assembly declared broadband to be a basic human right in 2009,⁶ and Spain is proposing to give the same designation to broadband starting in 2011.⁷

In some countries, policymakers are establishing comprehensive broadband policies. In the United States,

Exhibit 5
Adoption of Digital Highways Is Picking Up

PERCENTAGE OF CONNECTIONS FASTER THAN 5 MBPS



Source: Akamai Technologies, 2010; Booz & Company analysis

the FCC's *Connecting America* plan outlines initiatives to improve high-speed broadband adoption across sectors and industries, proposing a US\$9 billion fund to accelerate broadband deployment.⁸ The U.K. government has committed £850 million (US\$1.4 billion) to its broadband plan,⁹ and Brazil has committed \$7.3 billion over the next five years.¹⁰ Emerging economies are also stepping up their plans: Estonia said it will spend \$500 million for a national broadband network,¹¹ and India has begun setting its national broadband plan.¹²

Policy initiatives have not been limited to infrastructure; some policymakers are investing in demand stimulation. Korea has put \$65 million into a smart grid pilot on Jeju Island, operating a fully integrated smart grid for 600 households.¹³ In the United States, the government has committed as much as \$11 billion as part of its American Recovery and Reinvestment Act (ARRA) to develop smart grids.¹⁴

Additionally, regulators are becoming more involved, encouraging rules to foster cooperation that would facilitate the build-out of national networks. The European Commission, for example, recently articulated regulatory recommendations to encourage partnerships among operators that will use next-generation fiber networks.¹⁵

Network Operators

Along with policymakers, network operators are the dominant stakeholders in the sector, and they are playing an increasingly active role in the development of digital highways by adopting new business models that separate their network assets from services. These multilayer business models allow operators to reduce their focus, investment, and dependency on traditional revenue streams and instead position themselves to scale next-generation networks and related apps and services. Often, policymakers and network operators work together to forge solutions beneficial to them both.

For example, the Telstra Corporation, the incumbent operator in Australia, recently followed operators in Singapore and New Zealand in adopting a multilayer network. Telstra will separate its wholesale and retail businesses and progressively decommission its copper network as the government-backed national broadband network rolls out. This was a difficult deal, as it upends the operator's entire approach to doing business; it required protracted negotiations, including, at one point, the position that the government would build an A\$43 billion (US\$44.5 billion) network without Telstra. Ultimately, the operator agreed to accept A\$11 billion (US\$11.4 billion) from the Australian government as an incentive to de-layer its services.

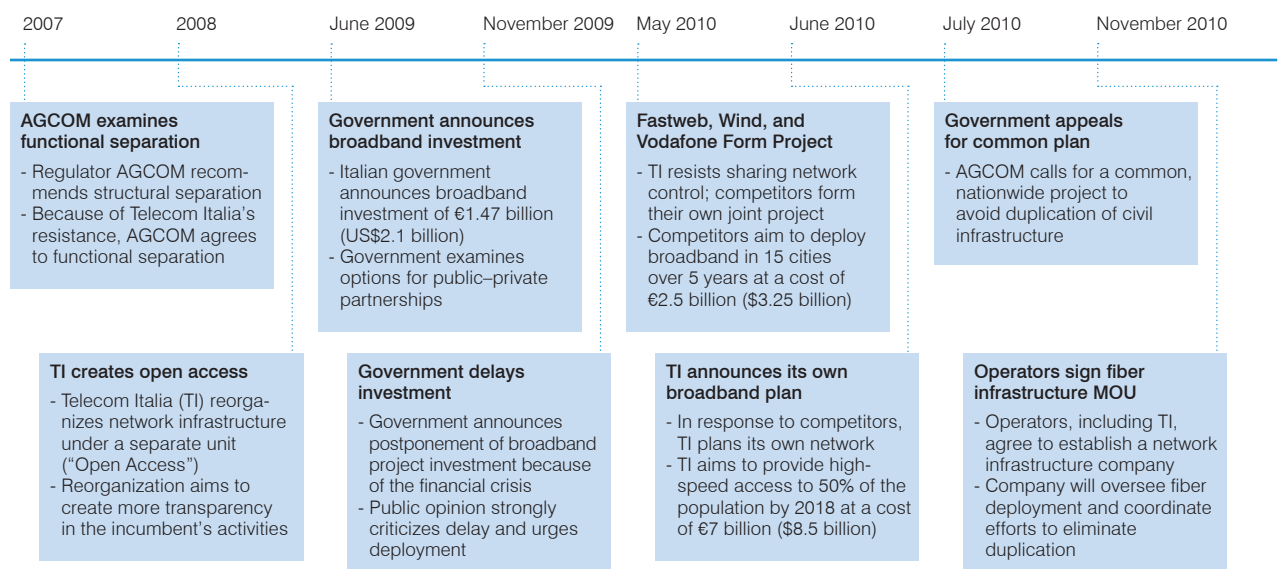
In 2007, Italy's telecommunications regulator, AGCOM, began seeking ways to boost the country's low broadband penetration rates. After lengthy negotiations, Italy's incumbent operator—Telecom Italia—

agreed to de-layer its networks by undergoing a functional separation to establish a new open-access entity, from which all operators would acquire wholesale services. Investment in fiber networks in the country still remained limited, however, until the Italian government announced a €1.5

billion (US\$2.1 billion) injection into a fiber company in early 2009 to accelerate the deployment of next-generation infrastructure. That plan stalled until November 2010, when the Italian government worked with operators to forge a plan that would create an infrastructure company run

by representatives from major operators and the ministry of telecommunications (*see Exhibit 6*). Italy's model reflects similar evolutions in Australia and Singapore, where the incumbent was reluctant at first to be a part of the broadband company, but eventually joined in a national effort.

Exhibit 6
Italy's National Broadband Network History



Source: Booz & Company



BUILDING COMMUNITIES AROUND DIGITAL HIGHWAYS

With national broadband networks around the world on track for continued deployment, participants in the broadband sector are recognizing that the true value of digital highways does not reside in their construction alone. If broadband represents a digital highway, then the apps that are enabled by broadband are the communities that will grow alongside it—and they are critical to realizing the maximum socioeconomic benefits from broadband. Policymakers, operators, device manufacturers, and application developers are unlocking the true potential of digital highways by facilitating the creation of apps that deliver better services and boost national competitiveness. The possibilities enabled by broadband include, but are not limited to:

- *Enabling smart governments:* ICT today is playing a key role in helping governments maintain public service standards while they struggle with budget deficits and attempt to curb national spending. A study by the European Union revealed that European taxpayers could save more than €15 billion (US\$20 billion) if their governments were to switch to electronic invoicing systems.¹⁶

- *Enabling healthcare:* The number of citizens over the age of 60 is likely to double in developed countries over the next three decades. ICT is playing a vital role in enhancing the quality and reducing the cost of healthcare in these economies through apps such as electronic health records and e-health services. iData Research forecasts that the U.S. patient monitoring market, including home tele-health and hospital wireless telemetry monitoring segments, will reach nearly \$4 billion by 2017.¹⁷

- *Enabling sustainability:* The adoption of green ICT apps could result in a 15 percent reduction of global emissions, or 7.8 gigatons of CO₂, by 2020, according to a Smart 2020 study.¹⁸ These apps include elements such as smart grids, which received \$3.4 billion in stimulus funding in 2009 in the United States.

In developing countries, in particular, national broadband networks offer a helping hand up the socioeconomic ladder by enabling a few critical areas:

- *Enabling basic services:* Access to primary services such as healthcare

and education is a challenge for most rural citizens in developing markets; ICT allows governments and non-governmental organizations (NGOs) to broaden their provision of these vital services. A number of nonprofit organizations are using mobile networks to deliver mobile health (m-health) services, such as patient data collection and the dissemination of health information, to poor, rural populations throughout Africa. Similarly, in education, nonprofit organizations and operators can collaborate to offer lessons, study tips, and quizzes via mobile devices.

- **Enabling livelihoods:** Almost one-fourth of the world's population lives below the poverty line, on less than \$1.25 per day. ICT can help governments and international nonprofit organizations improve the purchasing power of low-income

groups. In the agriculture sector, for example, farmers can obtain instant weather information and market prices for their crops on their mobile phones—which could help them harvest at the right time and sell products for an appropriate price. This service also reduces reliance on middlemen and overall market information asymmetry.

At this stage, most countries are still focusing on the deployment of broadband itself and are just beginning to explore the possibilities that will arise when broadband becomes ubiquitous and affordable. For example, only 1.5 percent of facilities belonging to the American Hospital Association have comprehensive e-health systems, and smart meter penetration in the United States was estimated at only 6 percent in 2009. Even in the public sector, with its wide range of e-government

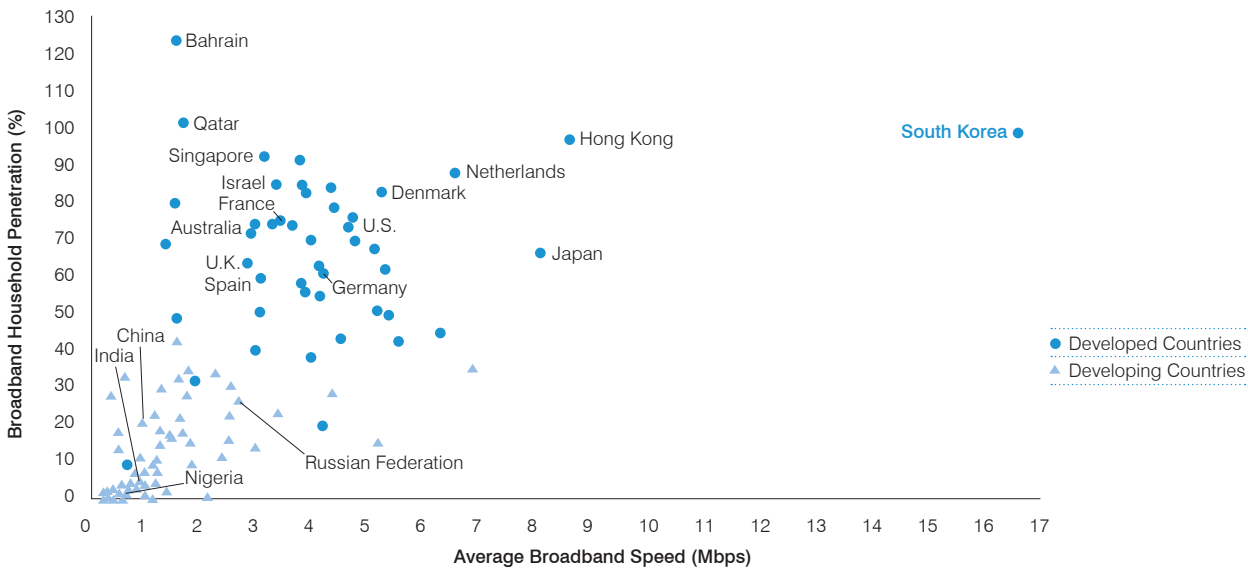
initiatives, adoption has been slow: for example, in the European Union, only 30 percent of individuals ages 16 to 74 were using the Internet to interact with public authorities, as of 2009.

But a few countries have already begun to envision the communities that could spring up around the digital highway; some have even begun to reap the benefits of building such communities. These countries show what is possible when members of the broadband ecosystem collaborate both with each other and with adjacent sectors to develop the apps that catalyze broadband's potential.

South Korea, for example, is the global leader in both access speeds and the adoption of high-speed broadband services (*see Exhibit 7*). It has achieved this status through a series of sustained efforts over the

Exhibit 7
South Korea: A Digital Highway Champion

BROADBAND HOUSEHOLD PENETRATION VS. AVERAGE SPEEDS, 2010



Note: World Bank's classification is used for defining developed and developing countries; high-income countries (GNI per capita > US\$12,196) are classified as developed; the rest are classified as developing.
Source: World Bank; Akamai Technologies, 2010; Booz & Company analysis

last 15 years, starting with the Korea Information Infrastructure plan in 1995; the plan aimed to connect all households to a broadband network by 2005. Since then, Korea has continued to periodically reassess the availability and quality of its broadband network and set higher aims for itself. In 2009, Korea announced a government-backed initiative to boost average broadband access speeds to 1 Gbps for all its citizens.

In addition to access, policies have focused on apps. As early as 1999, Korea outlined plans to boost information technology (IT) apps and literacy under its Cyber Korea 21 plan; it took further steps in its 2006 e-Korea vision plan, which focused on the promotion of information apps.¹⁹ Recently, the country announced a commitment of more than \$500 million for cloud computing initiatives, with the objective of encouraging local businesses to export cloud services.

Operators, device manufacturers, and application developers in Korea have

been instrumental in developing the country's digital highway, creating the next-generation apps that boost broadband adoption. For instance, SK Telecom Company—the leading mobile services provider—offers a “digital home” app that allows users to control and monitor home appliances, and a mobile radio-frequency identification (RFID) app that gives users vital information about products before purchase. Korea is also the global leader in online gaming services; more than 30 percent of the population is registered on online multiplayer games.

Device manufacturers such as LG and Samsung have emerged as global market leaders in electronics, partially enabled by successful partnerships with local telecommunications players via which they built devices that allowed for RFID solutions and micropayment tools. None of these manufacturers could have created these devices on their own; their development required extensive collaboration with ICT policymakers;

policymakers in relevant industry sectors, such as finance; sector stakeholders, such as banks and retailers; application developers; and operators, which charge customers to use the apps made possible by these devices.

In combination, these initiatives have resulted in a number of competitive advantages for Korea. Between 2000 and 2007, the country more than tripled the number of patents filed in science and technology. ICT adds more value to enterprise performance in Korea than it does in almost any other OECD country; in public services, Korea has surpassed the United States and the European Union (E.U.) countries to rank highest on the U.N.'s e-Government Development Index since 2008. As a result, Korea has enjoyed one of the highest rates of GDP growth in the last 10 years among OECD countries.

These achievements are not out of reach for other countries—but they will require similar levels of dedicated effort. One way to boost the use

of broadband apps is to generate a better understanding of their effectiveness. Some entities have taken early steps to do so: A study commissioned by the Internet Innovation Alliance shows that broadband is estimated to have generated net consumer benefits of \$32 billion in 2008 in the United States, and higher speeds could continue providing consumers there with greater benefits, adding at least \$6 billion in consumer benefits per year.²⁰ Additionally, new technologies such as smart grids could result in energy consumption savings in the United States of 5 percent in the residential sector and 2.5 percent in the industrial sector. Policymakers, such as the FCC, are also establishing

tools to measure the impact of broadband. The FCC has laid out a number of metrics focused on broadband access and adoption to track progress against its 2020 goals (see Exhibit 8).

Thus far, however, attempts at quantifying the impact of broadband and the apps it enables have been isolated and limited. A standard global approach to understanding and measuring how broadband affects socioeconomic progress will be critical to unlocking its potential.

In the meantime, each member of the broadband ecosystem has a clear role to play in building communities around digital highways.

Policymakers will need to adopt a holistic approach that encourages the development and use of apps. Operators will need to focus on the opportunities generated by this shift in direction and seek out new revenue streams accordingly. And device manufacturers and application developers will need to collaborate with each other as well as with operators on the propositions that will most appeal to users.

Policymakers: Adopting an Ecosystem Perspective

The widespread adoption of broadband apps depends on whether ICT policymakers can take an inclusive, collaborative view of the broadband

Exhibit 8
FCC's Broadband Goals and Performance Dashboard

	2020 Goal	Selected Metric
Focused on Access	- 100 million U.S. homes have affordable access to actual download speeds of at least 100 Mbps, and actual upload speeds of at least 50 Mbps	- Average actual download speeds: Nationwide and by provider - Average actual upload speeds: Nationwide and by provider - Number of households with access to broadband networks with sufficient speed - Minimum price for a broadband subscription: Nationwide and by provider
	- Every American should have affordable access to robust broadband service and the means and skills to subscribe if they so choose	- Percentage of Americans who subscribe to broadband services - Total - Socioeconomic segments - Demographic groups - Percentage of Americans with sufficient digital literacy skills
Focused on Adoption	- To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network	- Percentage of first responders using the nationwide public safety networks
	- To ensure that the U.S. leads in the clean energy economy, all Americans should be able to use broadband to track and manage their real-time energy consumption	- Percentage of American homes that have smart electric meters capable of communicating real-time energy information to consumers

Source: FCC, 2010

A standard global approach to understanding and measuring how broadband affects socioeconomic progress will be critical to unlocking its potential.

ecosystem. Three initiatives for ICT policymakers are clearly necessary.

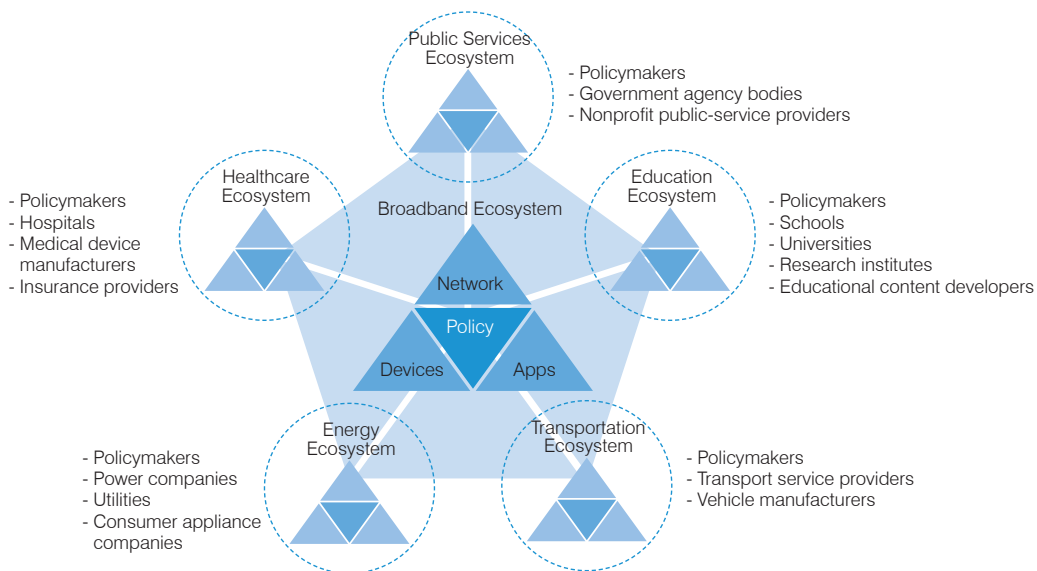
First, they must collaborate with policymakers in adjacent industries—such as healthcare, education, energy, and transportation—to develop sector-specific ICT policies (*see Exhibit 9*). Second, policymakers must stimulate development of apps, such as cloud computing, including selectively investing in the initiatives needed to drive their use. Finally, ICT policymakers need to move beyond simply tracking the availability and adoption

of broadband services and establish tools for a holistic assessment of broadband’s impact. Measuring the contribution of broadband apps to economic and societal progress can make their benefits more tangible, thereby driving more demand and stimulating the creation of even more apps. To accomplish this, policymakers must identify the key metrics that allow for impact assessment, develop methods and tools for monitoring impact, and publish these results. Such metrics could include broadband’s contribution to sector growth,

effectiveness, cost savings and affordability, job creation, and overall quality of life.

The Infocomm Development Authority of Singapore (IDA) is an example of a policymaker that has taken just such a broad view of ICT development. The IDA has developed an array of programs in healthcare, education, financial services, enterprise, and government to support its iN2015 Masterplan, which aims to grow the ICT sector as well as key economic sectors via ICT. Public-

Exhibit 9
An Ecosystem Approach to Building Digital Communities



Source: Booz & Company

service initiatives are already reaping results: Within a span of two years, Singapore climbed 12 places to rank 11th on the U.N.'s e-Government Development Index. Similarly, in the Middle East, policymaker and sector developer ictQATAR has launched ICT2015, a five-year national ICT plan, which aims to develop ICT for government and society through four programs (e-education, e-health, e-government, and e-inclusion). It also fosters economic development through ICT by building a digital content ecosystem for Qatar and driving innovation and entrepreneurship.²¹

Operators: Building New Capabilities for New Opportunities

In the next five years, revenue oppor-

tunities for operators worldwide will continue to shift from those generated on traditional networks (mainly voice-driven) to services enabled by digital highways, such as data services and cloud computing. In 2015, such services could amount to a \$994 billion opportunity for operators (*see Exhibit 10*). Operators that have been slow to invest in broadband, hoping to first get the full return on their investments in traditional services, will need to adapt to this shift to recognize the opportunities afforded by digital highways.

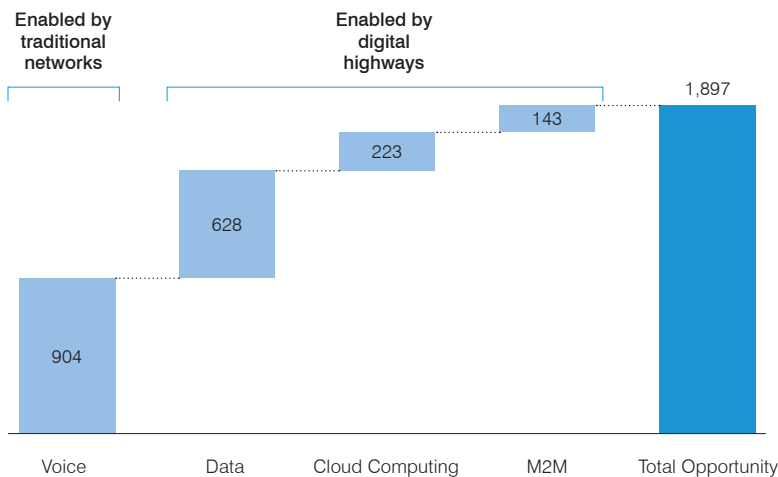
Operators around the world are already shifting their strategies to take advantage of the trend; many have forged partnerships with application

developers or other ecosystem stakeholders. For example, Vodafone Spain has collaborated with Microsoft to offer a suite of enterprise cloud services;²² Vivo in Brazil has built partnerships with Ericsson and NGO Saúde e Alegria to provide isolated communities in the Amazon with access to a range of health and education services.²³ Other operators, such as Orange, are developing capabilities in-house: Orange offers “M2M Connect” solutions for healthcare, transportation, and security businesses that want to monitor their assets in real time.²⁴

Operators are also targeting opportunities in mobile app stores. Some, such as Airtel, are building their

Exhibit 10
New Telecom Revenue Opportunities Are Enabled by Digital Highways

GLOBAL COMMUNICATION MARKET, 2015F (IN US\$ BILLIONS)



Source: ABI Research, 2010; ZTE Corporation, 2010; Booz & Company analysis



own;²⁵ some are collaborating with others to build app stores with a global scale. A group of 24 operators and three device manufacturers recently announced that they are planning to build a wholesale app community.²⁶

However, delivering these solutions and serving these markets requires operators to build a different set of capabilities than those required in providing traditional telecommunication services. Many of these capabilities revolve around working with partners. A recent study from Harvard Business School and Esade Business School found that although partnering on very simple products is overkill, and partnering on extremely complex products is likely to involve too many trade-offs as partners try to reach agreement, projects of moderate complexity—such as apps—benefit from the innovation boost that other companies can provide.²⁷

First and foremost, therefore, operators need to enhance their ability to engage and incentivize large developer communities. Second, they need to build go-to-market partnerships that offer access to

specialized skills. Finally, they need to move away from their traditional focus on network deployment to emphasize services and apps. Operators have traditionally operated closed networks and allowed new apps on a system only after intensive testing; moving to an approach that allows for frequent new services will require operators to significantly scale up their service provisioning and delivery platforms. In addition, operators need to establish open platforms, which allow small application developers to profitably develop apps for operators.

Selling specialist solutions such as smart metering, cloud computing, or machine-to-machine (M2M) communication requires operators to have access to hardware, software, and operational capabilities that may not be available in-house. Establishing partnerships with companies that are familiar with the relevant sectors and that have relationships with sector stakeholders, such as power companies, is critical for operators that want to target these opportunities. Operators are already partnering with large IT and Internet firms such as Microsoft, Google, and

Amazon to resell their cloud services to their current customers; they need to enhance their partnerships in other sectors to capitalize on digital opportunities.

Finally, although apps and services present attractive long-term opportunities for operators, they are unlikely to yield significant revenue immediately. Operators must ensure that short-term thinking does not cloud their vision. Although they will need to continue investing in traditional revenue opportunities, they must be sure that management focus and capital are being directed toward new sources of revenue as well.

Device Manufacturers and Application Developers: Collaborating to Appeal to Users

Like operators, device manufacturers and application developers should collaborate with other ecosystem players to capitalize on the digital highways opportunity.

In light of consumers' and application providers' growing demand for data services, manufacturers are responding with smartphone devices that capitalize on upcoming digital highways. The number of smartphone

models has increased considerably, as have smartphone sales (see Exhibit 11). Markets such as the United States are already seeing smartphones capture 47 percent of market share in new handset sales.²⁸ Accordingly, the number of players in the market is set to grow rapidly over the coming five years, with electronics players such as Dell, Acer, and Huawei joining the fray.

In terms of contributing to socioeconomic development, device manufacturers can forge partnerships with public- and private-sector players to drive adoption of apps in key sectors

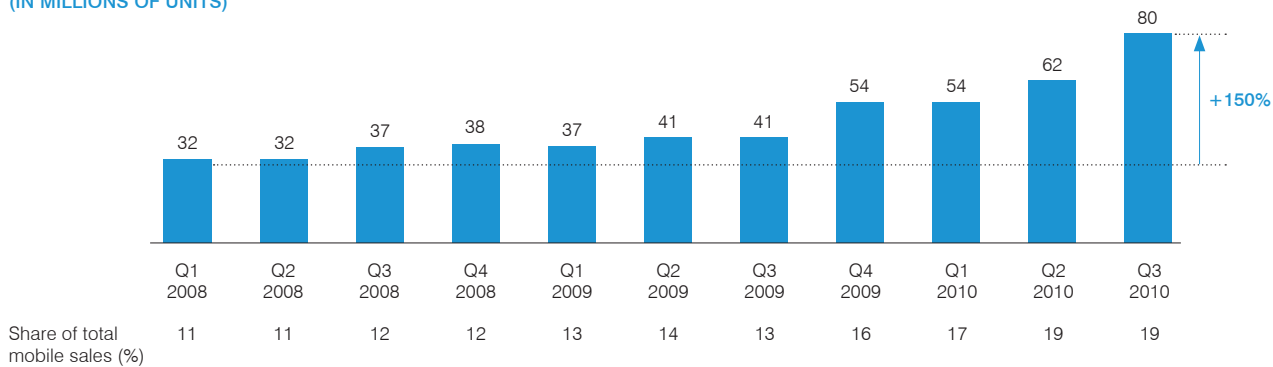
and underpenetrated segments. For example, Nokia has partnered with Vodafone Group Foundation, the Pan-American Health Organization, and the Brazilian Department of Indigenous People's Health to develop MobiSUS, a mobile phone-based program that allows Brazilian healthcare workers operating in remote, challenging environments to collect health data more efficiently, thus improving the delivery of care. The project is being implemented in 18 of 34 special indigenous health districts, where the use of mobile technologies is replacing the current paper-based system. Nokia has provided the handsets,

software, and data-gathering platform for the program, which will be implemented on a national scale in cooperation with the Brazilian Ministry of Health.²⁹

Device manufacturers can also play a central role in nurturing developer communities, which can drive the development and adoption of new broadband apps. Device manufacturers should team up with telecommunications operators, operating system providers, and application developers to enable open platforms and profitably bring new propositions to market.

Exhibit 11
Smartphone Ownership Is on the Rise

GLOBAL SMARTPHONE SALES, Q1 2008–Q3 2010
(IN MILLIONS OF UNITS)



Source: Gartner, 2009; Booz & Company analysis

*Device manufacturers
can forge partnerships
with public- and private-
sector players to drive
adoption of applications
in key sectors and
underpenetrated segments.*

Application developers, too, are playing a key role in broadband adoption. Many are partnering with operators to push apps such as cloud computing; the size of the global cloud computing market was estimated at \$68 billion in 2009 and is set to grow to \$223 billion by 2015.³⁰ Application developers are also getting involved in developing infrastructure; for instance, Google is rolling out trial fiber networks in an initiative called “Think Big with a Gig.”³¹ Other ecosystem players, such as Apple, are encouraging the growth of a broadband application developer community; Apple offers software, technical support, and other resources for application development. Building on the success of its iPhone-focused App Store, it recently launched the Mac App Store to offer desktop applications.

Application developers should encourage the broader use of

successful next-generation services such as cloud computing by scaling them across multiple platforms. In 2009, global spending on ICT services was close to \$4 trillion across hardware, software, services, networks, and human resources; as part of this spending moves to the cloud, application developers can target a market currently dominated by large multinational firms such as Microsoft and IBM. Specifically, there is a clear and increasing need to develop tools for search capabilities, information management and prioritized storage, and security and privacy protection. Targeting this opportunity requires application developers to effectively collaborate with both operators and device manufacturers.

M2M is the second key priority area for application development: it is one of the fastest-growing technology areas, and it offers a strong revenue

opportunity for network operators and technology suppliers thanks to the emergence of end-user devices with M2M features. According to recent studies, the M2M market will increase to approximately \$19 billion in the coming years, with impressive growth from 75 million devices in 2009 to about 225 million devices in 2014.³² The M2M market growth is being fueled in part by the arrival of end-user devices with M2M features, such as Amazon’s Kindle.

M2M devices offer socioeconomic benefits as well. BM Smarter Cities and Cisco Intelligent Urbanisation, for example, are using M2M technologies to deliver intelligent energy management for smart cities. In doing so, IBM and Cisco have had to collaborate with smart meter manufacturers, energy companies, and operators to build and deliver holistic platforms to end-users.



CONCLUSION

U.N. Secretary-General Ban Ki-moon recently said in an address to the Broadband Commission for Digital Development (a global NGO) that broadband has extraordinary potential to enable human progress.³³ A campaign from that commission calls for universal broadband with the slogan “B more.”³⁴

However, to deliver on the promise of broadband and to “B more,” stake-

holders across the ICT ecosystem need to take a holistic approach to its role in society. The future of digital highways rests on a collaborative, committed, and capable ecosystem that not only delivers high-speed broadband but also builds vibrant communities around it. Communities that facilitate stakeholders’ innovation, adoption, and collaboration will realize the extraordinary potential of broadband.

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