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m-Powering India:

Mobile Communications for Inclusive Growth

Report of the Third Annual
Joint Roundtable on Communications Policy

Richard P. Adler and Mahesh Uppal
Rapporteurs

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The reader should note that this report is written from the perspective of informed observers at the conference. Unless cited to a particular person, none of the comments or ideas contained in this report should be taken as embodying the views or carrying the endorsement of any specific participant at the conference.

Foreword

In the field of communications, it is widely appreciated that the spread of mobile phones in India is one of the world's great developments. While mostly in the urban areas, the nearly 300 million mobiles will increase to a half billion by 2010, and penetrate more widely to the rural areas as well. Spurred by cheap handsets, prepaid cards, low-cost service options, a policy of Calling Party Pays, and innovative customer services, India is adding over eight million subscribers a month. One operator alone has sold one million mobiles a month since offering a handset for as low as 777 Indian rupees or US$20.

The transformational nature of this phenomenon is the subject of this report of the Third Annual Joint Roundtable on Communications Policy convened jointly by Aspen Institute India and the Communications and Society Program of the Aspen Institute (U.S.) in February, 2008. The roundtable of 28 Indian and American leaders and experts from government, communications industries and academia focused on how to propel India forward via the mobile revolution by a more inclusive expansion strategy.

Nripendra Misra, Chairman of the Telecom Regulatory Authority of India (TRAI), keynoted the conference by outlining the state of the mobile industry in India, a cellular market with an annual compounded growth rate of 42 percent since 2002, and an expectation to reach 500 million subscribers by 2010. Chairman Misra stressed the need to expand the rural coverage in India to reach its goals. "India is still, unfortunately, on the wrong side of the digital divide, which prevents a significant portion of our population from attaining their full potential," he stated.

Although there is a low Average Revenue Per User (ARPU) in India, Chairman Misra expects that to increase from a convergence of services, improved quality of content and the inclusion of more value added services, e.g., SMS text messages, ringtones, Bollywood and cricket related content. Chairman Misra also touched on how nascent mobile commerce would quickly overtake e-commerce in India. The TRAI Chairman's complete remarks are included in the Appendix.

The report details some successful and low cost mobile projects in rural India which have positively impacted their communities in both social and economic ways. One such innovative solution described is the Candlebox—a low cost, low power "webtop" device that uses mobile technology to provide wireless Internet access for various services including email, social networking, e-commerce and distance learning. This device is being developed by one of the sponsors, Qualcomm, in conjunction with NIIT, the largest private educator in India, as a result of a discussion at the 2007 Aspen Joint Conference regarding access for learning technologies in India's rural areas.

Aspen roundtable participants discussed developments, context, and policy over the two day meeting in Kovalam, Kerala, India. The group then presented its recommendations to senior government officials in New Delhi: Montek Singh Ahluwalia, Deputy Chairman Planning Commission; MM Nambiar, Special Secretary, and senior staff members, Department of Information Technology; and Nikhil Kumar, Chairman, and ten members of the Parliamentary Committee on Information Technology.

Recommendations

The group recommended mobile reform in four main areas: infrastructure, m-currency, hybrid services and light touch regulation.

Infrastructure. First, the group recommended that all carriers should be granted easy access to essential infrastructure at a fair price. This would also allow carriers to expand coverage to rural areas as well as provide additional revenue to backbone network operators. The group also pushed for active (in addition to passive) sharing of network infrastructure and the use of the 700 MHz spectrum for wireless broadband communications. When the group met Dr. Montek Singh Ahluwalia in Delhi, they pointed out that this was one of the recommendations that TRAI had previously made to the Department of Telecommunications (DoT). Within two weeks of this sharing of this list with Dr. Ahluwalia, the DoT approved TRAI's recommendation to allow service providers to share active infrastructure components.

M-currency. The Roundtable suggested that a standardized m-currency would enable m-commerce to take place in a secure and seamless

way. The groups suggested to form a consortium that would support an m-currency payment mechanism, similar to the M-PESA scheme in Kenya or G-CASH in the Phillipines (both outlined in the report) in order to promote m-commerce.

Hybrid Services. To improve the success of m-commerce in India, the group recommended introducing "hybrid" services, which are applications involving new technology and content but delivered by a trusted human interface. An example is the United Villages model which expanded beyond simple data access to providing access to jobs and marital databases as well as an online e-shop. United Villages provides a network of bandhus (friends)—a friendly face to conduct the online transactions on behalf of the end user for the services they require. The group also recommended delivering "e-government services" via "m-government" applications as more users in India have mobile access.

Encouraging Light-Touch Regulation. The final recommendation from the Roundtable called on the government to continue to refrain from regulation in instances where it would result in reducing competition and stifling innovation.

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Mobile Phones: A Global Revolution

Nripendra Misra, Chairman of the Telecom Regulatory Authority of India (TRAI), opened the 2008 Joint Roundtable on "The Future of Indian Mobile" by describing the astonishing growth of mobile phone service in India:

> Today, India is the world's fastest growing cellular phone market. This past month, we added 8 million subscribers. Our current telephone subscriber base stands at 273 million, with an annual compounded growth rate of 42 percent since 2002. The number of cellular phone subscriptions has tripled over the past year and is 233 million at present [December 2007]. India looks set to achieving the stated target of 500 million telephone subscribers by the end of 2010.
>
> Financially too, the telecom sector in India has shown positive results. Gross revenues for the sector have grown at a compounded annual rate of 21 percent since 2002 and currently stand at US$20 billion. This accounts for about two percent of the national GDP [gross domestic product]. Further, the sector has attracted significant domestic and international investment. The four largest service providers have a combined market capitalization in the range of US$50 billion, which is on par with the capital investment in the industry.

Shortly after the Roundtable concluded, India reached another landmark. In March 2008, the country added another 10.16 million mobile subscribers, bringing the total to 261 million. This meant that India had surpassed the United States (with an estimated 257 million mobile sub-

scribers) to become the second largest mobile market in the world, trailing only China.[1]

The mobile revolution that is taking place in India is part of a larger global phenomenon. Sometime before the end of 2007, the worldwide penetration of mobile phones in use passed 50 percent—that is, there is now more than one mobile phone line for every two people on the planet.[2] Use of mobile phones has already eclipsed use of conventional "fixed" telephones which in more than a century never exceeded a global penetration of 20 percent. In 2001—less than two decades since the mobile phone's introduction—mobile phone penetration globally equaled and then rapidly surpassed that of fixed telephone service (which has actually begun to decline as subscribers switch from fixed to mobile lines as their only phone service). Mobile phones now reach more than twice as many people as fixed telephone lines.

India had become the second largest mobile market in the world, trailing only China.

The number of mobile phone users also has surpassed the number of people with personal computers and Internet access, globally as well as in India, which currently has about 30 million PC-based Internet users.[3] These statistics show that for much of the world, and especially for developing countries such as India, the mobile phone is truly bringing access to modern electronic communications to a mass audience. Although voice calls are the initial focus of many mobile users, the technology can be a platform for access to a wide range of data services as well. (For a description of a hybrid approach that uses low-cost wireless technology to provide PC-like Internet access, see "Qualcomm's Candlebox" on page 21.)

There seems to be no upper limit to the penetration of mobile phones. Some 30 countries in the world now have more mobile phone subscriptions than people. As of 2007, for example, Europe as a whole had a penetration rate of 103 percent (that is, there were 103 mobile phone subscriptions for every 100 Europeans). Luxembourg had a penetration rate of 158 percent, followed by Lithuania (127 percent) and Italy (126 percent).[4] In December 2007, the penetration rate in Hong Kong reached 152 percent.[5] (The mobile phone penetration rate in the

United States at the end of 2007 was 85 percent, which puts the United States somewhere in the middle among developed countries.)

The Significance of Mobile Phones

Beyond their impressive numbers, why are mobile phones important? These devices have several distinctive characteristics that help to explain their impact:

- ***They are personal.*** Unlike conventional "landline" telephones, which are confined to a fixed location, mobile phones typically are associated with an individual. Thus, communications and other services that mobile phones provide can be targeted to specific individuals rather than entire households.[6]

Some 30 countries in the world now have more mobile phone subscriptions than people.

- ***They are portable.*** These lightweight, wireless, battery operated devices can be carried wherever users wish to take them. With the addition of Global Positioning System (GPS) capabilities, mobile phones can be "location aware"—that is, their location can be continuously tracked, offering the potential for development of a variety of novel applications (as well as raising potential concerns about privacy).

- ***They are digital.*** Recent generations of mobile phones are based on digital technologies that continue to become steadily smaller, less expensive, and more powerful. In addition to providing simple voice communications, virtually all mobile phones sold today also can support "value added" features such as text messaging and downloadable ringtones. More sophisticated applications that currently are available only on advanced (and relatively expensive) handsets eventually will appear on less expensive phones. Today's typical "smart phones" have approximately the same computing power as the personal computer of a decade ago; within a few years, even low-end mobile phones will provide computing power that is equivalent to the current gen-

eration of personal computers. The mobile phone has the potential to be a "platform" that can provide mass access to a wide range of socially and economically beneficial services.

- ***They are connected.*** Mobile phones exhibit so-called "network effects"—that is, their value grows as the number of other people with such phones increases. Moreover, just as mobile handsets benefit from the steady improvement in the performance of digital technology, so do the wireless networks that these phones use. Each succeeding generation of network technology is substantially faster and more powerful than the preceding generation. The third-generation (3G) networks that are being introduced around the world offer the ability to transmit live video (mobile TV) as well as to carry voice and data. According to TRAI Chairman Misra, nearly 58 million subscribers in India (almost 25 percent of total subscribers) already access the Internet via 2G networks, using their mobile handsets. The 3G networks, which should be introduced soon, will provide much better service, and the 4G next generation networks, which are already on the drawing board, will be even faster and more powerful.

- ***They are affordable.*** As a result of innovations such as prepaid plans, plans with bundled handsets, and ultra low-cost handsets (discussed below), the cost of ownership for a mobile phone is so low that it is within the means of a large portion of the Indian population.

Although many sophisticated mobile applications are being created and initially deployed in the developed world, much innovation also is taking place in the less-developed world. In fact, no single part of the world has a monopoly on innovation in this area. A recent Aspen Institute report described some of the creative ways in which mobile phones are being used globally:

> In India, worshippers send text prayers to the temple of a Hindu god. In China, coupons received on cell phones are redeemable at McDonald's. In Singapore, drivers can pay tolls and buy tickets with a mobile

> device. In South Korea, an online dating service sends a text message when a person matching your profile is nearby. In Los Angeles, high school students flirt, make dates, and carry on courtship rituals in electronic form. People in 22 countries cast 680 million text-message votes for contestants during the most recent season of "American Idol." In Bangladesh, farmers use mobile devices to learn the true market value of their produce. … In Stockholm, customers use mobile phones to find nearby restaurants. A British mobile carrier lets subscribers point their cell phones to the sky to identify constellations….
>
> In the United States, MasterCard announced a new service through which customers can call a phone number, state their coordinates, and receive a text message directing them to the nearest automatic teller machine.[7]

The Emergence of Mobile Phones: Lessons from India (and Elsewhere)

Although the growth of mobile telephony is a truly global story, there are important regional differences in how the technology has evolved in different countries. Kas Kalba, President of Kalba International (an international telecommunications consulting firm), described some of the findings from his research on the global diffusion of mobile phones. Kalba found, for example, that even though "the world as a whole is rapidly adopting mobile phones," there is a "baffling degree of variation in how they have been adopted in different parts of the world." One striking difference between the adoption patterns in more affluent developed countries relative to less affluent developing countries is that in the latter—particularly in rural areas—mobile phones initially are being acquired not by individuals but by households, many of which have never had a conventional landline. In many poor rural communities, Kalba noted, mobile phones are kept in the home and are used by all members of a household, mainly for emergency calls. Only on weekends or on special occasions will a young person get permission to take the phone out of the house.

Thus, average household size can be an important determinant of the rate at which mobile phone penetration grows. In a recent paper, Kalba suggested that one reason that China, initially at least, adopted mobile phones more rapidly and broadly than India could be the fact that households in China (which average 3.4 persons) are significantly smaller than those in India (which average 5.3 persons).[8] With a higher portion of their members holding jobs in the cash economy, smaller households are likely to have more disposable income for mobile phones than larger households.

In India, as in other developing countries, rural residents often regard mobile phones as valuable resources to be shared by family members and even by close friends, rather than purely personal devices. A study by LIRNE*asia* found that in approximately 80 percent of Indian households at the bottom of the pyramid in which one member owns a mobile phone, that phone is shared with other family members; in nearly half of these households, the phone sometimes is shared with non-family members, usually at no cost to the user.

In Bangladesh, the Village Phone Program (VPP) pioneered an innovative technology-sharing strategy to bring mobile phones to remote, rural villages that previously lacked phone service. The program is sponsored by Grameenphone (associated with the Grameen Bank), which is the largest mobile phone operator in Bangladesh. VPP provided loans to poor village residents (mostly women) to purchase a mobile phone and then trained them in mobile phone use. The phone was then made available to other village residents, who pay a per-minute charge to use it. Since the VPP started in 1997, it has attracted more than 260,000 participants in some 50,000 villages throughout Bangladesh. According to Kamal Quadir, CEO of CellBazaar in Bangladesh, the mobile phones used by VPP participants historically have generated the highest average revenue per user (ARPU) of all Grameenphone customers. Although VPP phones made up just 2 percent of the company's subscribers, they generated 17 percent of its revenue. These figures demonstrate that each VPP phone served the communications needs of many people. (This successful program has been replicated in several other countries, including Uganda and Rwanda, although it may be reaching the end of its useful life.)[9]

Col. R. S. Perhar (Ret), chief operating officer (COO) of Tulip IT Services Ltd., explained that adoption of mobile phones in developing

countries typically starts in urban areas; then it moves to larger villages, where mobile phones are first acquired by members of "trading communities" who need to do business with suppliers or customers who are based in cities and are already using phones; then mobile phone use spreads to the broader rural population. Adoption of mobile phones typically follows this flow of people and business transactions.

A 2007 survey of residents of five Asian countries—India, Pakistan, Sri Lanka, the Philippines, and Thailand—conducted by LIRNE*asia* provides additional perspective on "teleuse at the bottom of the pyramid" in those countries.[10] According to LIRNE*asia* executive director Rohan Samarajiva, the survey found that only a minority of residents—particularly those in the least affluent segments—had a mobile phone, but a large majority of people at all economic levels had access to a telephone and had used it. As Table 1 indicates, in all of the countries surveyed, more than 90 percent of respondents indicated that they "had used a phone sometime in the preceding three months" (in India, the percentage was 94 percent). This finding contradicts the frequently quoted claim that "half the world's population has never made a phone call," which Samarajiva characterized as an outdated claim that seems to have been "frozen in time."

Table 1: Cell Phone Use in Asia

	South Asia			Southeast Asia	
	Pakistan	India	Sri Lanka	Philippines	Thailand
Percentage of respondents who have used a phone in the past 3 months	98	94	92	93	95

Source: Ayesha Zainudeen, Nirmali Sivapragasam, Harsha de Silva, Tahani Iqbal, and Dimuthu Ratnadiwakara, "Teleuse at the Bottom of the Pyramid: Findings from a Five-Country Study" (Sri Lanka: LIRNE*asia*, November 2007).

Kas Kalba also pointed out that "[adoption] patterns can change" and that early usage patterns of new technologies are not necessarily good predictors of future use.[11] Since 2005, for example, India—which initially lagged behind China—has experienced "a surge in new mobile subscribers and is now adding them in larger numbers [each month] than China." In fact, as TRAI Chairman Misra pointed out, India has become the "world's fastest growing cellular phone market."

What has changed? An important factor in the acceleration of mobile adoption in India has been the introduction of prepaid accounts, which allow users—often with very modest incomes—to pay relatively small amounts (in some cases, as little as US$0.20) in advance to keep their mobile service active. Today, in fact, more than 90 percent of Indian mobile subscribers have prepaid plans.

ARPU for India as a whole is now below INR 240 (US$6.00) per month—one of the lowest rates in the world. (In countries such as Japan and the United States, ARPU typically is in the range of US$50 per month.) The rapid growth in mobile subscribers in India has been accompanied by a steady decline in ARPU for these customers—a trend that is likely to continue as future growth is increasingly propelled by the extension of mobile service to the country's poor, rural residents.

Several other factors have helped expand mobile usage by reducing costs. India has implemented a policy of "calling party pays" (CPP), which means that all incoming calls to mobile phones are free to the person receiving the call. CPP helps lower the costs of mobile phone ownership for users who make few outgoing calls. Whereas affluent urban users in India—as in other countries—have quickly gotten used to making frequent mobile calls and sending multiple text messages on a daily basis, the use of mobile phones among poorer rural residents is still restricted to business-related and emergency calls.

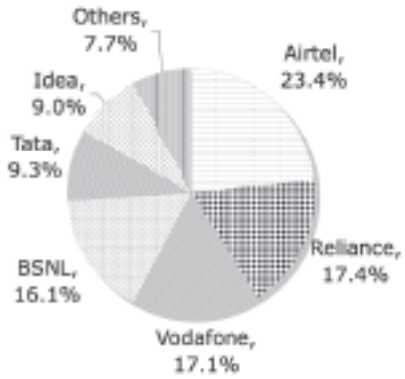
Another factor that is stimulating growth is the availability of "ultra low-cost handsets" (ULCHs) that reduce the barrier to mobile phone ownership. According to Sukanta Dey, president of emerging business for Tata Teleservices Ltd., more than a quarter of all handsets sold in India are second-hand. At the same time, manufacturers who are focused on emerging markets have been working on developing less expensive (< INR 1000) handsets. In 2007, for example, Reliance Telecom introduced a line of low-cost handsets that included a phone with a monochrome screen priced at INR 777 (US$19.20) and a handset with a color screen at INR 999 (US$24.70). Reliance reportedly sold 1 million of these inexpensive phones within a month of their introduction.

The impact of lower costs is being felt beyond India. Kamal Quadir of CellBazaar pointed out that Grameen's Village Phone Program, which has been highly successful in expanding the use of mobile phones in rural Bangladesh, is "now dying." The cost of a mobile phone has decreased so much that even poor villagers can buy their own phones and no longer need to use a shared phone. The VPP has played a valuable role in exposing many rural residents to the benefits of access to a telephone, which has undoubtedly helped to accelerate the adoption of mobile phones in Bangladesh, but its usefulness may be nearing its end.

Several Roundtable participants pointed out that low ARPUs and low handset costs do not necessarily mean low profitability for telecommunications companies. According to LIRNE*asia*'s Rohan Samarajiva, ARPU for Hutchison Telecommunications Lanka, a pure "bottom of the pyramid" mobile operator in Sri Lanka, is approximately US$3.00 per month, but its profits (before interest, taxes, depreciation, and amortization, or EBITDA) are approximately 50 percent of revenue.[12] India's largest mobile operator, Bharti Airtel, which has approximately 24 percent of India's subscribers, earned profits of INR 40.6 billion in 2007 on revenues of INR 184.2 billion—double its 2006 profits of INR 20.3 billion on revenues of INR 116.6 billion.[13]

Nonetheless, if India's mobile phone industry is to continue to grow, it will do so by reaching even more marginal users, which will certainly mean further reductions in ARPU. It remains to be seen whether higher volumes, lower costs, or other efficiencies will continue to mitigate the strain on profits resulting from decreasing ARPUs.

FIGURE 1
Mobile Operators in India



There are approximately one dozen mobile phone network operators in India. The top four national carriers—Airtel, Reliance, Vodafone, and Bharat Sanchar Nigam Limited (BSNL is the incumbent government-owned carrier)—account for approximately three-fourths of all subscribers, and the six largest carriers account for more than 90 percent of subscribers. Other, smaller carriers operate in specific regions of the country.

The Urban-Rural Divide

National mobile phone penetration statistics mask sharp differences between different regions. The starkest divide is between mobile usage in India's cities, which has been growing rapidly, and in the country's rural areas, where growth has been much slower. The disparity between urban and rural "teledensity" (the number of phones—the great majority of which are mobiles—per 100 users) has been increasing steadily—from a gap of about 14 times in 1998 to a gap of more than 22 times in 2007. On the other hand, rural teledensity today is approaching the level where urban teledensity was a decade earlier. The question now is whether the strategies and policies that fueled the growth of mobile communications in urban areas will be sufficient to drive growth in India's rural areas, which account for approximately two-thirds of the country's population.

A December 2007 news story illustrates both the high level of interest in mobile phones among rural residents and the barriers that still must be overcome to provide adequate mobile service to the entire country. According to a CNN story, 40 residents of the village of Kajrai (population 700) in the state of Madhya Pradesh have acquired mobile phones. Although the village has wireless service, it does not have electricity. As a result, the residents of the village must travel almost 20 kilometers every day to get their phones charged. One resident of the village commented that "we have been living here for more than 50 years. All of us are Harijans, but we don't have electricity, there are no roads, and many people fall ill during the monsoons."[14]

To highlight the magnitude of the policy challenge in bringing mobile services to the entire country, General S.S. Mehta, Director General of the Confederation of Indian Industry (CII), compared the situation in telecommunications in India today to that of aviation. The scope of civil aviation is changing dramatically in both China and India. Mehta noted that between them, the two countries are building 200 new airports that will vastly expand airline service and increase the number of passengers. This change is largely the result of the introduction of a "blue skies" policy that is changing the way in which airlines are regulated. Is a similar change required in telecommunications policy if India is to reach its goal of 750 million subscribers by 2012?

Mobile Phones and Economic Growth

One assumption is that connecting people who have lived in isolation to the larger world is a good thing. The spread of mobile phones appears to be both inevitable and a phenomenon that can improve people's lives by increasing their ability to communicate and thereby expanding their horizons. There also is evidence that expanding access to mobile telephones can stimulate economic growth—particularly in the developing world, which has largely lacked modern communications capabilities. Using data from Africa, for example, economist Leonard Waverman has estimated that an extra 10 mobile phones per 100 residents in a developing country can lead to approximately one-half point of additional growth in GDP per person.[15]

An anecdote from India that has been widely used to illustrate the economic benefits of expanded communications concerns the fishermen of Kerala state, who were reportedly able to increase their income as a result of adopting mobile phones. Until recently, this story remained purely anecdotal. A published study by Harvard economist Robert Jensen provides specific quantitative evidence, however, for the economic benefits of mobile phone adoption.[16] In early 1997, just before the introduction of mobile phone service in this state in southwestern India, Jensen conducted a survey of prices that were being paid to fishermen for their sardine catch at 15 different beach markets along the Kerala coast. Although these markets were not far apart, there was no easy way for them to communicate with each other. As a result, Jensen found that there was a wide variation in the prices fishermen received for their catches, mainly because some markets had an excess of buyers (which drove prices up) while others had an excess of sellers (which drove prices down—in some cases to zero, when there were no buyers at all). Because the fishermen had no way to know in advance where the buyers were or what they were willing to pay, the market for fish was highly inefficient.

When mobile phone service was introduced in Kerala in 1997, the location of base towers along the coast provided phone service 20 to 25 kilometers out to sea—a distance within which most fishing activity took place. By 2001, more than 60 percent of the fishermen and almost all of the buyers were using mobile phones to coordinate sales. The results were significant, according to Jensen: "Price dispersion was dramatically reduced…waste, averaging 5–8 percent of daily catch before mobile phones, was completely eliminated…[and] fishermen's profits increased on average by 8 percent while the consumer price declined by 4 percent."[17] Jensen notes that, in contrast to government- or foundation-funded demonstration projects that often end when their funding stops, this type of gain is likely to be sustained over time because providing the service is profitable for the mobile phone operators, and the costs of the service are borne by individuals, who do so because it contributes to their personal welfare.

Benefits of Mobile Phones for Rural Residents

A 2006 report sponsored by Nokia identified several potential social and economic benefits of the adoption of mobile phones by poor, rural residents of India.[17] These benefits include the following:

- Increased credibility and credit-worthiness, based on greater "locatability" and "contactability"
- Increased sense of autonomy
- Easier maintenance of long-distance business ties
- Decreased dependency on proximal, local relationships
- Better access to market information
- Better coordination of travel and transport
- Increased remunerative workdays
- Strengthened business networks
- Access to new clientele

Mobile Value-Added Services and Convergence

Mobile phones can do many more things than simply support ordinary voice calls. In India, value-added services (VAS)—all applications other than voice—currently account for approximately 7 percent of wireless revenues. The total VAS market in India in 2007 was approximately US$900 million, up from US$678 million in 2006.[18]

As in many other countries, the leading VAS applications in India are short message service (SMS)-based text messaging (which accounts for more than 55 percent of VAS revenues) and downloadable ringtones. According to a recent report, the current "killer applications" for VAS in India are Bollywood-related content and cricket results. One of the most popular applications in India (much as in the United States) has been voting via SMS for finalists on the TV show *Indian Idol*. In September 2007, the show's two finalists drew more than 70 million SMS votes, generating revenues of INR 21 crore (US$5.2 million).

The number of SMS messages sent in India is expected to grow from 59 billion messages in 2006 to 180 billion in 2010.[19] Although the vast majority of text messages are exchanged between individuals, several new informational and other services that use text messaging (such as

the voting discussed above) have been introduced in India in recent years. These services suggest the increasingly broad range of applications that mobile phones can provide.

In October 2007, for example, Google India launched a service that allows mobile phone users to retrieve business listings, movie show times, weather reports, dictionary definitions, and other kinds of information through SMS. Another novel use for text messaging, according to an article in *The Hindustan Times*, is "microblogging:"

> At 21, Ludhiana management student Harjinder Singh already has a mega project in hand, albeit in a micro medium. His 160-character blog posts, punched out on his Nokia handset, instantaneously reach 57,659 Sikhs across India all at the cost of a single SMS. "I aim to arouse the pride of young Sikhs through my writings," says Singh, who started blogging on his phone last May. "Many of my Sikh readers voted for Ludhiana's Ishmeet Singh in Star Plus's Voice of India and contributed to his victory," he adds. Singh has hired two people to get him cell numbers of 200,000 Sikhs, because he wants to reach "one in ten Sikhs soon."
>
> In Delhi, Lalchung Siem, a 33-year-old Food Corporation of India employee, whips out his phone several times a day to blog in Hmar, a tribal language spoken by a small group of people in India. His posts are sent free to 6,106 readers in the North-East by SMSGupShup, a microblogging platform. "Recently, I got an SOS call after two boys fell in a river in Saidan village, Manipur. I flashed the SMS on my blog, and within minutes, a hundred people reached the spot, and managed to rescue one of the boys," he says.[20]

SMS-based services also are providing valuable health and agricultural information. A texting service that provides information and advice about HIV/AIDS was launched in 2006 by the Heroes Project sponsored by the Richard Gere Foundation India Trust, Parmeshwar Godrej, and the Bill and Melinda Gates Foundation. Using the Specific Query Response

(SQR) system, users can submit questions about HIV/AIDS to the Star Care service and get a personalized response from a trained medical counselor via SMS within 24 hours. The project was reported to have received more than 25,000 queries in its first month of operation.[21]

An interactive service called Almost All Questions Answered (aAQUA), created by the Developmental Informatics Lab at IIT Bombay, is providing farmers in the state of Maharashtra (and elsewhere in India) with advice on a broad range of agricultural topics, ranging from better farming methods to marketing strategies. Farmers can register for the service at no charge and submit questions in English, Hindi, or Marathi via a Web site or via SMS. Experts at agricultural universities respond to the questions.[22]

From Wired to Unwired

Another project that is providing useful information to farmers illustrates the potential of mobile communications. The Warana Wired Village service was designed to support a large rural sugarcane cooperative in the state of Maharashtra. Since the service was launched in 1998, it has provided information to 40,000 sugarcane farmers via Internet-connected PC-based kiosks located in 56 villages.[23] In 2006, a team of researchers visiting Warana reported:

> It is indeed amazing that these kiosks are still running eight years after their original installation [since] it is rare that you see rural computing projects running for this long. That said, the PCs were running into many issues due to the rugged rural conditions, and maintenance costs were shooting up steadily. Power is a huge issue in these rural places, and they had UPS backups that would help with it. It costs money to replace them that also added to the maintenance costs.[24]

To address these problems, a team from Microsoft Research India developed a new system that replaced the PC-based kiosks with SMS-enabled mobile phones. The team demonstrated that all of the information that was being provided by PCs could be successfully delivered

via SMS and that replacing all of the kiosks with mobile phones could produce annual savings of more than INR 1 million (US$22,000), primarily from lower maintenance costs. Another advantage of the mobile phone-based system is that users are no longer tethered to a limited number of kiosks but can access the information they need from any location with mobile phone service. Now farmers can get their questions answered while they are on the way to market or even when they are working in their fields. Whereas the kiosks reduced the time required for the farmers to get important information from two weeks to two days, the mobile phone-based system has made information retrieval virtually instantaneous.

As noted above, Indian fishermen are among the groups that have been shown to benefit from the introduction of mobile phones. Building on this evidence, an application called Fisher Friend is now being piloted in Tamil Nadu. A joint project of Qualcomm India, TATA Indicom, Astute, and MSSRF, Fisher Friend is delivering information on current market prices, along with data on wave height and weather forecasts, to fishermen at sea via mobile phones.

In at least one case, mobile phones have been deployed on a large scale to improve information collection. In 2007, the Orissa Animal Husbandry and Veterinary Department introduced an SMS-based reporting system to track livestock health and breeding services in the state. Replacing the previous paper-based system with electronic communications enabled the department to dramatically reduce the time required to collect reports from the field and its response time to reported problems. Approximately 10,000 local field staff are using the SMS-based system to submit reports on topics such as the health of the state's 28 million cattle on a weekly basis; these reports can be quickly compiled to provide reports on a statewide basis. During a recent outbreak of bird flu in the neighboring state of West Bengal, the department was able to monitor the status of about 1 million poultry birds in the villages bordering West Bengal on daily basis; the department credited this system with helping to keep the outbreak from spreading into Orissa.[25]

Another pioneering public health application that is using mobile phones is the Tamil Nadu Health Watch—a disease surveillance system

introduced after the tsunami of 2004 devastated portions of this region. The system provides instant links between Primary Health Centers in four districts to enable health experts and program managers to coordinate activities more effectively and allocate resources more efficiently. The use of mobile phones allows health workers, even in remote areas, to immediately report disease incidence data to health officials, speeding up their ability to respond.

Other projects have used the capabilities of mobile phones in innovative ways to promote health. New Delhi-based ZMQ Software, with support from the Delhi State AIDS Control Society, developed four free downloadable games for mobile phones that are designed to increase awareness of HIV/AIDS.[26] One game, "Safety Cricket," uses a sports theme to teach awareness of the specific causes of HIV/AIDS. The games, released on World AIDS Day in 2005, were downloaded more than 10 million times over the following 15 months.

New capabilities are expanding the range of applications for mobile phones even further. According to a recent report on the future of VAS in India, the next generation of SMS will offer features such as customized text colors, "emoticons," scheduled SMS, SMS to e-mail, and graphic and multimedia attachments. Group messaging services will enable users to create a group and send an SMS to all members at a reduced cost.[27]

Whereas using text-based SMS services requires the ability to read, voice SMS does not. Several Indian operators—including Bharti, BPL, Aircell, Idea, MTNL, and Reliance—have introduced voice SMS services that offer most of the benefits of conventional SMS without the need to type or read text. A new service that is likely to be introduced in India in the near future is mobile TV, which will provide live television programming on a suitably equipped handset (which currently costs approximately INR 30,000, or about US$740, and requires access to a high-speed 3G wireless network). A market research report predicted that 12 million Indian subscribers (approximately 5–6 percent of all subscribers) would sign up for a mobile TV service in its first year of operation, generating first-year revenues of up to INR 1,440 crore (US$360 million).[28]

As the reach of mobile communications continues to grow, many new services—including services specifically tailored to the needs of India's rural residents—are likely to appear. In spring 2008, for example, Bharti Airtel and the Indian Farmers Fertilizer Cooperative (IFFCO) announced the launch of a new joint venture that will offer low-cost handsets bundled with a set of services designed to help farmers. The services include five free voice messages each day that provide updates on topics such as market prices, farming techniques, weather forecasts, rural health initiatives, and fertilizer availability. A dedicated help line manned by experts will provide answers to users' questions.[29]

The mobile phone-based system has made information retrieval virtually instantaneous.

As these examples suggest, the mobile phone has become a platform for an ever-expanding range of uses. TRAI Chairman Nripendra Misra noted that an overarching issue in the minds of regulators is the "convergence" of services that is being driven largely by the growth and evolution of mobile phones. India, like many other countries, is already anticipating the introduction of a high-speed digital "next generation network" (NGN) that will further blur the distinction between mobile telephony and the Internet, as well as the distinction between the types of content that historically have been provided through telephones, computers, and broadcast media such as radio and television. Although such convergence offers exciting prospects for the people of India, Misra noted, it also poses formidable challenges to regulators attempting to keep up with the rapid changes in technology and the ways in which they alter the competitive landscape. As mobile phones become increasingly pervasive and powerful, further unanticipated uses are likely to emerge, posing additional challenges to regulators.

Qualcomm's Candlebox

At the 2008 Aspen Joint Roundtable, Kanwalinder Singh of Qualcomm India, presented the prototype of a newly developed product that was inspired by the discussions at the 2007 Roundtable that focused on educating India's knowledge workforce. During the 2007 discussions, participants agreed that innovative use of technology will have to be part of the solution to the challenge of reaching the millions of Indians—particularly those living in the country's rural areas—who lack access to high-quality education.

As mobile phone handsets have become more powerful and more capable, they have begun to resemble "mobile computers." Their functionality has been limited, however, by the small size of the keyboards and screens typically required by mobile devices. Qualcomm's Candlebox is intended to overcome these limitations.

The Candlebox is a small, inexpensive desktop device that uses the technology developed for mobile handsets to provide wireless Internet access. To enhance usability, the Candlebox is designed to be used with peripherals such as a keyboard, a mouse, and an external display. The device can be attached to a conventional TV set or a computer monitor and will work with several different high-speed wireless network protocols that are being introduced (e.g., High-Speed Downlink Packet Access [HSDPA], High-Speed Uplink Packet Access [HSUPA], or EV-DO).

The Candlebox can provide access to any Web-enabled service, including e-mail, search, social networking, instant messaging, e-commerce, e-banking, and distance learning. The device has several features—low cost, low power consumption, rugged design (no moving parts), and simplified connectivity—that should make it an attractive option for poor, rural residents. In fact, this "Web top" device is an example of a "convergence" device that further blurs the line between conventional "wired," PC-based Internet access and wireless mobile access.

The Candlebox platform is being developed by Qualcomm in collaboration with India's National Institute of Information Technology (NIIT), the largest private educator in India, who would be the first customer for the box. The precommercial product is expected to be ready before the end of 2008. Using this platform, companies can develop commercial versions with features and form factors that serve specific market needs.

The Future of Indian Mobile

Participants in the 2008 Roundtable were confident that India would reach the projected target of 500 million phone subscribers by 2010. By that time, 3G networks should be widely deployed, providing high-speed service to much of the country, and even higher-speed 4G networks should be on the way. Yet questions remain about how that number of subscribers will be reached: Will most subscribers still be in urban areas, many with multiple phones or other wireless devices to serve multiple functions, while rural areas still lag behind? Will the mobile revolution have truly reached the country's rural areas by 2010, connecting its residents to the wider world?

What about the more distant future? By 2020, say, will use of mobile phones be close to universal? If so, will this technology narrow the wide gap between India's increasingly prosperous cities and the poor rural villages that still contain a majority of the country's population? Will the technology help to deliver the benefits of education and healthcare and responsive, efficient government services to the entire country? Can it stimulate the economy in ways that bring prosperity to all?

With these challenges in mind, the Roundtable participants turned to a consideration of what actions are needed to ensure that the technology will continue to spread rapidly, particularly to areas that still lack mobile service, and that the technology will develop in ways that will benefit the Indian people. The participants agreed that models that have worked in affluent countries or in the urban centers of India are not likely to be sufficient to serve all of the country's population.

In exploring the potential of the technology to benefit the people of India, the discussion focused on two categories of mobile applications: *m-government*, which would provide direct citizen access to key government services, and *m-commerce*, which would enable users to use a mobile device to conduct a variety of financial transactions.

From e-Gov to m-Gov

One area in which mobile technology can have a large impact is the provision of government services. Digitizing important government information and providing electronic access to services for citizens has the potential to make access to government more democratic and transparent, as well as increasing efficiency.

Participants at the first Aspen Joint Roundtable in 2006, which focused broadly on the potential of information and communications technology (ICT) to catalyze "inclusive and sustained growth," discussed several projects designed to provide streamlined access to government records and other services. Among the most prominent and successful of these so-called "e-government initiatives" are the following:

- ***Bhoomi***—Introduced in 2001 in the state of Karnataka, this service provides quick online access to more than 20 million rural land records that are vital for many purposes, including obtaining bank loans and settling land disputes. Getting access to these records used to be time-consuming (requiring up to 30 days) and often tempted people to bribe officials. Thanks to the new system, the state's 6.7 million farmers can now quickly get copies of their records for a fee of INR 15 (US$0.37) from government-operated kiosks located in 177 villages in the state.

As mobile phones become increasingly pervasive and powerful, further unanticipated uses are likely to emerge, posing additional challenges to regulators.

- ***eSeva***—This online service in the state of Andhra Pradesh integrates more than 150 different government services in a single system. Users can obtain information, file forms, and make tax and utility bill payments through more than 200 eSeva centers that are open from 8:00 a.m. to 8:00 p.m. every working day and from 9:00 a.m. to 3:00 p.m. on holidays.

- ***Akshaya***—The goal of this educational project of the state of Kerala is to provide training in basic computer literacy skills to at least one member of every household in the state. Since it was launched in 2002, the project has reached 3.6 million households through community technology centers located in more than 400 villages.

Although these projects have produced some impressive results, they have not been broadly replicated, and they have been slow to expand beyond the regions where they were originally introduced. According to a participant in the 2006 Roundtable, although "these are great examples of what is possible, India is becoming famous for being a graveyard of successful pilots. The issue is scalability. We are doing great work, but somehow these have not managed to scale."[30]

One reason for the lack of scalability may be the cost and complexity of computers and the Internet connection required to access e-government services. As the Warana Wired Village project (described on page 17) demonstrates, maintaining the equipment required for PC-based projects in rural areas where the support infrastructure is not well developed can be difficult and expensive. Mobile technology, including hybrid devices such as Qualcomm's Candlebox, may offer a more cost-effective platform for delivering government services to a mass population. There already are more than eight times as many mobile phone customers as PC-based Internet users in India (261 million versus 30 million). Moreover, whereas the number of mobile subscribers is expected to reach nearly half the Indian population by 2010, PC-based Internet penetration will take much longer to reach this level—if it ever does.

Providing access to government records and other government services on mobile devices will offer its own challenges in terms of issues such as usability, reliability, privacy, and security. Moreover, the same inertial forces that have slowed the growth of e-government will be as strong if not stronger in the case of m-government applications, which have an even greater potential to disrupt traditional ways of delivering government services. Nevertheless, the potential for government to connect directly with its citizens makes mobile technology extremely attractive.

The Promise and Problems of m-Commerce

One of the most promising value-added services for mobile phones is *m-commerce*—the ability to make purchases or conduct financial transactions by using a mobile phone. M-commerce could be particularly important in India, where only a small fraction of the population currently has either a bank account or a credit card.

Several Indian banks have introduced "mobile banking" services for their customers. For example, ICICI Bank, ABN Amro, and Barclay's India

have launched mobile services that allow customers to check their account balances, pay bills, and transfer funds. Similarly, Airtel has partnered with several Indian banks and VISA to provide mobile bill payment, money transfer, and prepaid phone recharge service. Movie tickets and tickets for sports events can now be purchased using mobile phones, and the Indian Railway system has announced plans for a scheme to allow passengers to make reservations for rail travel through their mobile phones.[31]

Reserve Bank of India Guidelines for Mobile Banking

In June 2008, the Reserve Bank of India, the country's central bank, issued a set of draft guidelines designed to provide a framework for mobile banking services. According to the guidelines, "the long-term goal of mobile payment framework in India would be to enable funds transfer from [an] account in one bank to any other account in the same or any other bank on a real time basis, irrespective of the mobile network a customer has subscribed to."

Key provisions of the draft guidelines include the following:

- Only banks that are licensed and supervised in India and have a physical presence in India will be permitted to offer mobile payment services to residents of India. They would be expected to ensure compliance with the guidelines.
- Banks should offer mobile-based banking service only to their own customers.
- Banks should have their mobile payments scheme approved by their boards before offering it to their customers. Board approval must document the extent of operational and fraud risk assumed by the bank and the bank's processes and policies designed to mitigate such risk.
- The technology used for mobile payments must be secure and should ensure confidentiality, integrity, authenticity, and nonrepudiability. It should be interoperable across banks and mobile networks.
- If sufficient safeguards are provided, SMS text messaging may be used for "micro payment transactions" of up to INR 1500 (US$35) and for "repetitive utility bill payment transactions" of up to IRN 2500 (US$58).

The full text of the guidelines is available online: www.rbi.org.in/Scripts/bs_viewcontent. aspx?Id=1365.

Applications such as these demonstrate the potential of m-commerce, but they are relevant primarily for urban residents who already have bank accounts and credit cards. The Roundtable participants recognized that several existing barriers will have to be overcome if m-commerce is to emerge as a viable option for the country's entire population. These barriers include the following:

Digitizing important government information and providing electronic access has the potential to make access to government more democratic and transparent….

- ***Lack of awareness.*** Only a few practical m-commerce applications currently exist, although the number has begun to increase. As a result, there is relatively little consumer awareness about the value of m-commerce.

- ***Concerns about security.*** Even more than with Internet-based e-commerce, ordinary users worry about the safety and reliability of conducting business over a wireless connection. As CII's Vikram Tiwathia noted, "Users will engage in m-commerce only if they trust that the transactions made through their devices are secure."

- ***Lack of a simple, standardized payment mechanism.*** There is no equivalent in India of the credit card or ATM to provide an easy way to make payments or transfer funds via a mobile phone. Several countries (such as Japan, but not the United States) have already developed phone-based "mobile wallets," but there is nothing like this in India.

- ***Imbalance between service providers and network operators.*** On the Internet, any provider who conforms to the Net's standards can put an application online without anyone's permission; on mobile networks, providers have to work with private network operators. At present, there are many small service providers who must depend on a relatively few large mobile network operators to reach customers (or, as Sukanta Dey of

Tata Teleservices Ltd. put it, "there are six Goliaths and 600 Davids"). Because of this imbalance, the operators are able to capture the lion's share of the revenues generated by value-added services. In addition, service providers complain that it is difficult to negotiate deals and to arrange for prompt settlements from operators who are focused on attracting more subscribers rather than increasing the revenue per subscriber.

- ***Heterogeneous environment.*** Another challenge for service providers is that they must develop applications for multiple networks and a wide range of devices. According to Vanu Bose, chief executive officer (CEO) of Vanu Inc., whereas there are only two major Web browsers for PCs, in the world of mobile phones there are multiple operating systems with multiple browsers, so the same application can look completely different on different screens. Without standardization, developing m-commerce applications can be prohibitively expensive.

- ***Lack of high speed connections.*** Access to high-speed networks is important to providing "rich" applications. The 3G networks that will deliver higher speeds for mobile connections are on the way but have not yet arrived in India.

Even in the face of these barriers, creating useful m-commerce applications that can serve a wide audience is still possible. Some of the most promising applications are based on the use of SMS text messaging—which is relatively simple, works on most mobile phones, and does not require a high-speed connection.

Kamal Quadir first developed the concept of CellBazaar while he was an MBA student at the Massachusetts Institute of Technology (MIT); he believed so strongly in the concept that he moved to Bangladesh to implement it. When he arrived in Bangladesh, he found a country that had 30 million mobile phone users, compared to just 1 million people with ATM cards. CellBazaar is essentially a mobile phone-based version of craigslist. The service, which was developed in partnership with Grameenphone, connects buyers and sellers in an electronic marketplace over mobile phones. Sellers list items for sale, and buyers can

search the listings for items they want to purchase. Because regulatory approval would be required for any application involving money transfer, the system does not require moving funds electronically.*

Several developing countries have introduced simple, low-cost mobile systems for transferring funds. The G-CASH system, launched in the Phillipines in 2004, is a pioneer in enabling mobile phone users to send remittances, make donations, settle loans, and pay bills with a simple text message. M-PESA, introduced in Kenya in March 2007, also uses SMS to support financial transactions, including depositing and withdrawing money, transferring money to another party, or buying prepaid airtime. (The system also is used by travelers, who can deposit funds in M-PESA before embarking on a trip and withdraw the funds when they reach their destination to reduce the risk of being robbed in transit.) According to Neil Gough, international policy director for Vodafone Essar Limited, the M-PESA system was developed jointly by Vodaphone and Safaricom, Ltd., Kenya's largest mobile network operator, and a Kenyan bank.

Anyone with a mobile phone who wishes to use the system can register with one of 1,500 local "agents" (typically small shopkeepers) across the country who also accept and disburse cash payments to M-PESA users. Once a user deposits a sum of money in the system, he or she can send it to any other mobile phone user by entering the recipient's phone number, the amount to be transferred, and a special code number as a text message. After receiving the text message, the recipient can go to any agent to receive the cash. The agent takes a fee for disbursing the cash, but the fee typically is lower than that charged by banks for similar transactions.

As of March 2008, one year after the program's introduction, more than 1.6 million Kenyans (in a country with a total population of 30 million) had set up M-PESA accounts and had used the system to transfer more than US$145 million. At the same time, Safaricom CEO Michael Joseph announced plans to expand the service to India and Tanzania.[32]

* At the 2008 Mobile World Congress that took place in Barcelona immediately after the Aspen Roundtable, it was announced that CellBazaar had won the GSMA Global Mobile Award 2008 in the category of "Best Use of Mobile for Social & Economic Development."

According to *The Economist*, schemes such a G-CASH and M-PESA offer important economic benefits for developing countries:

> There is no need to set up a national network of branches or cash machines. M-banking schemes can be combined with microfinance loans, extending access to credit and enabling users to establish a credit history. Some schemes issue customers with debit cards linked to their m-banking accounts. All this has the potential to give the "unbanked" masses access to financial services, and bring them into the formal economy.[33]

In fact, m-commerce schemes such as these may have the greatest impact in countries such as India, where the great majority of the population lacks access to financial services, rather than in the developed world where bank accounts, ATMs, credit cards, and debit cards are pervasive.

Today, according to Kanwalinder Singh, President of Qualcomm India and SAARC, m-commerce in India is limited largely to SMS-based communications between bank account holders and their banks for purposes such as checking one's account balance. In fact, under current regulation, any type of m-commerce, including money transfer schemes such as M-PESA, must involve a bank.

Hybrid Services

A critical key to the success of m-commerce, particularly in its early stages, is implementation of what were described as "hybrid" services—applications that not only use well-designed technology but also offer content that is truly relevant to and appropriate for the needs of the target audience and make use of a trusted human interface to introduce the new services.

A good example of such hybrid service is the DakNet service provided by United Villages, Inc., a U.S.-based company that was founded by Amir Alexander Hasson. As Hasson explained to the Roundtable participants, his goal was to find a way to bring Internet connectivity to isolated rural villages at very low cost. The DakNet system he created is based on what he calls store-and-forward "drive-by-WiFi." Participating villages are equipped with WiFi-enabled kiosks that local residents can use to send

and receive e-mail, conduct job searches, make travel reservations, and so forth. These kiosks store information from users offline, then link to the outside world via mobile access points (MAPs)—small wireless base stations mounted on buses or motorcycles. When a MAP-equipped vehicle passes through a village, the kiosks connect to it via WiFi and exchange messages in a "burst" mode, uploading outgoing messages and downloading incoming messages. The MAP stores the data it collects until it returns to an urban location where it can connect to the Internet via cellular data networks or WiFi hotspots. Because the buses and motorcycles that carry the MAPs typically follow routes that regularly bring them to the villages, most messages are delivered within 6 hours. DakNet currently is operating in rural areas of Orissa and Rajasthan and has plans to expand to more than 50,000 villages in India by 2011.

In 2007, United Villages introduced an "e-shopping" service based on a printed catalog that features 800 products, including medicines, cosmetics, books, and agricultural products. Orders for items from the catalog are submitted via DakNet and are delivered—usually by the buses that carry MAPs—typically within 36 hours.

According to Hasson, rural villagers under the age of 30 have been very willing to adopt new technology, but older adults have needed more support and encouragement. To overcome this resistance, United Villages created a bandhus ("buddies")— neighbors in the villages who act as intermediaries, introducing and explaining the service, distributing catalogs and taking orders, delivering the items when they arrive, and collecting payment. Although DakNet service is very much a technology-based initiative, it is actually a "hybrid service" that incorporates both people and technology to create value for poor villagers. The key role of the bandhu, Hasson explained, is "to build trust."

United Villages has developed its own "DakNet currency" in the form of prepaid, stored-value cards that are sold in denominations of INR 25, 50, and 100 (US$0.62, 1.25, and 2.50). Participants can use the cards to buy DakNet credits to make purchases from local merchants. Hasson suggested that mobile phone subscribers might use prepaid air time as a form of currency and that prepaid mobile phone accounts could effectively become the first "bank account" for hundreds of millions of Indians (although this development would require a change in regulation or, under current regulation, the participation of one or more banks).

The Role of Regulation

Roundtable participants discussed the relative value of "open" versus "closed" systems. Prasenjit Phukan, senior product manager and mobile product lead for Google India, defined an open system on two levels. From a technology perspective, it is a platform that encourages developers to innovate by using open, standard protocols. From an end-user perspective, an open system allows users to retain control over the level of information they wish to expose across multiple application or service providers in the ecosystem.

Dorothy Attwood, senior vice president of regulatory policy for AT&T, pointed out that a system that is "closed" is not necessarily a bad thing. Especially in the early stages of development, the focus for a network operator is the customer's experience. By controlling the network from end to end, operators can more easily ensure a high quality of service. As a market matures, opening the network to more innovation makes sense. Attwood expects to see many more partnerships develop new applications as the mobile industry matures.

There also was a lively debate among the Roundtable participants about what steps—if any—regulators should take to promote the development of mobile services generally and m-commerce in particular. There was general agreement that maintaining openness in these markets is important to allow for innovation, but there was less agreement about how to ensure this openness. Kanwalinder Singh of Qualcomm India argued that many of the technical and consumer trust issues are "on their way to being solved," with no need for outside intervention. He foresaw a "collision of Goliaths," however, as major players from telecommunications and banking clash over control of m-commerce.

Reed Hundt, principal of Charles Ross Partners and former chairman of the Federal Communications Commission, the U.S. counterpart of TRAI, suggested that regulators need to decide whether to allow network operators to move into "adjacent markets" or set up barriers to prevent them from extending their business into other areas (such as m-commerce). Hundt pointed out that the risks of allowing operators to move into adjacent markets—for example, the potential for cross-subsidies (and the difficulty in measuring these subsidies) and concern about creating barriers to entry for innovators—provide "a pretty good argument" for inhibiting operators from such expansion. Dorothy Attwood of AT&T responded by

proposing an alternative: watch carefully how the industry evolves, and act only when there is a demonstration of harm. Such an approach would allow a virtuous cycle of innovation to occur, with regulators intervening only when necessary. For now, Attwood argued, "nothing has been settled enough for the government to step in and set rigid rules."

Participants did reach a broad consensus that given the nascent state of m-commerce in India, regulators should wait until the contours of the industry are more clearly understood before setting rigid rules. As Robert Pepper, senior managing director, global advanced technology policy of Cisco, pointed out, "We don't yet know what the business models will be. Premature regulation could stifle innovation. For now, we should be encouraging experimentation." TRAI Chairman Nripendra Misra agreed, calling for the "least regulatory touch, leaving as much as possible to the market."

One area where regulatory action may be needed is "mobile spam" in the form of unsolicited text messages or mobile e-mail. According to Amir Hasson of United Villages, this issue is even more volatile in the mobile world than on the Internet because bandwidth is costly in time and money. Although industry self-regulation may be preferable to government intervention, such regulation probably would work better for SMS spam (an area in which network operators still have more control) than for e-mail (where no perfect solution has yet been found). Chairman Misra pointed out that TRAI has already banned unsolicited telemarketing calls and SMS to mobile phones, and fines have been levied on some service providers. In 2007, TRAI established a "do not call" (DNC) list, and more than 8 million phone subscribers have registered. Telemarketers are required to check the phone numbers they call against the DNC registry, although the agency has gotten complaints from subscribers on the register who are still getting unwanted calls.

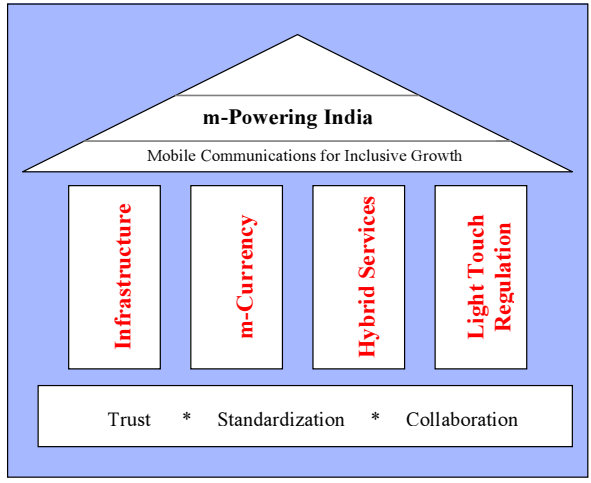
Roundtable participants agreed that having the appropriate regulatory environment will play a key role in facilitating m-commerce. Access to spectrum, for example, is critical to any kind of wireless services and particularly to development of next-generation wireless services. Mobile markets depend on transparent spectrum management, especially allocation and pricing, for their orderly growth. They can be seriously distorted and hurt consumers if spectrum rules are not publicly available or favor a particular technology, company, service, or business model.

Participants argued against premature regulation of the nascent market for mobile services, however. The tendency to treat offenses relating to electronic information and commerce as an entirely new phenomenon requiring new laws or rules should be resisted. Existing law relating to matters such as fraud, libel, and so forth may be sufficient to cover offenses committed through electronic means, although in some cases the laws and regulations may need to be expanded or updated. Finally, holding infrastructure owners responsible for the content of messages carried on mobile networks or the Internet would be unrealistic and unfair. Such actions could discourage innovation, as well as the growth of services of potential value to end users.

Recommendations

The Roundtable participants developed a set of recommendations for policies and other actions intended to accelerate the growth of mobile communications to drive economic growth, encourage greater inclusion of all citizens in society, and improve the performance of government. Specific recommendations fell under four general topics: enhancing and sharing infrastructure, promoting m-commerce, expanding "e-government" to encompass "m-government," and encouraging innovation by avoiding premature or heavy-handed regulation (depicted in Figure 2).

Figure 2
Foundation of Mobile Growth



Enhancing Infrastructure. In terms of infrastructure, the Roundtable participants recognized that further expansion of the user base for mobile communication, particularly to India's underserved rural areas, will involve investing in expanding the reach of wireless networks while ARPU is likely to continue to fall to unprecendent low rates. TRAI Chairman Nripendra Misra noted that reaching the goal of 500 million mobile subscribers will require an additional 300,000 new cell towers. In the face of this major investment, carriers will need to find innovative ways to control costs to continue to operate profitably. The first set of recommendations concerned policies that would help lower costs.

- *Provide nondiscriminatory access to essential backbone at cost-oriented prices to expand rural coverage.*

First, the group recommended that to help expand rural coverage, all carriers should be granted nondiscriminatory access to essential backbone provided at cost-oriented prices. Such a policy would reduce the cost of backhaul, provide more efficient utilization of existing backbone capacity, and provide additional revenue to backbone network operators.

- *Remove restrictions on active wireless infrastructure sharing.*

Although network operators are permitted to share "passive" network components (such as cell towers, conduits, and generators), they have not been permitted to share "active" electronic components (such as routers and amplifiers). Allowing the sharing of active components would also help drive down costs and can be done, the Roundtable participants concluded, in a manner that does not compromise the quality of network service or erode users' privacy in any way.*

- *Allocate 700 MHz band for wireless broadband.*

The third recommendation relating to infrastructure concerned the allocation of the 700 MHz spectrum for wireless broadband communications. Robert Pepper of Cisco reported that despite claims that this band

* After the Roundtable participants met with Dr. Montek Singh Ahluwalia to present the results of their discussions, Dr. Ahluwalia asked for a list of all of the recommendations for changes that had been made by TRAI but had not yet been acted on by the Department of Telecommunications (DoT). Within two weeks, the DoT approved TRAI's recommendation to allow service providers to share active infrastructure components, which could cut carriers' costs by as much as 50 percent.

was already being used by Indian broadcasters, it actually is not being used. (The 700 MHz band has been used by broadcasters in the United States but is being returned to the government for auction as broadcasters switch to all-digital transmission.) Vanu Bose of Vanu Inc. noted that 700 MHz represents an attractive opportunity for India to "get out in front" by setting standards and even developing and building the equipment needed to exploit this band for broadband mobile applications but the country needs to act quickly to take advantage of this opportunity.

TRAI Chairman Misra responded to these suggestions by noting that regulation in India has "followed a path of incentivizing rather than mandating" behavior. Thus, instead of requiring carriers to share their cell towers, the agency recommends that any service provider that shares its facilities with others receives a financial incentive. The Universal Service Obligation Fund, which subsidizes creation of rural infrastructure, requires that towers set up with its support be shared among up to three operators.

More broadly, Misra endorsed the principle that all regulatory decisions should be transparent, predictable, and made in the public domain.

Promoting m-Commerce. The Roundtable participants agreed that the single most useful step that could be taken to promote m-commerce would be creation of an "m-currency" that would be similar to the M-PESA scheme in Kenya or G-CASH in the Philippines.

- *Establish a consortium to develop and support an m-currency payment mechanism for m-commerce.*

To be widely accepted, an m-currency will need to be simple, standardized, branded, and trusted. The best way to develop such a currency would be to establish a broad consortium that includes representatives of the network operators, merchants, application developers, and financial services institutions. Sukanta Dey of Tata Teleservices noted that there are millions of phones in use in India but only about 300,000 VISA credit card terminals in the entire country. The mobile handsets use multiple standards, however, and only about 100 million have advanced (General Packet Radio Service [GPRS]) data capabilities. Most phones are SMS-capable, but although texting can be used for a

relatively simple money transfer system such as M-PESA, it has only limited capabilities to serve as a true "mobile wallet." Several participants pointed out the need for a "middleware" provider to develop a system that can ensure the integrity of mobile transactions.

The participants pointed to the experience of United Villages' DakNet to emphasize the importance of hybrid services that offer locally relevant content and services and provide a friendly human interface along with technology. Only a small fraction of the total population may be ready to adapt new technologies without these enhancements. If mobile communications are to be adopted by the next quarter-billion Indians, many of whom are poor and poorly educated and live in rural villages, the technology will need to be introduced through friendly, trusted channels.

Expanding m-Governance. Given the fact that there are many more mobile users than Internet users, the largest potential for delivering "e-government services" is via "m-government" applications. Over time, in fact, the distinction between the Internet and broadband wireless is likely to blur or disappear, and users eventually will expect to get access to important resources such as government information and services in a variety of modes and on a variety of different platforms.

- *Adapt all e-government applications to run on mobile platforms.*

The government can help to dramatically expand access to its services by adapting current and future e-government applications to run on mobile devices. Health and educational services are of particularly high value to individuals and can help drive broader mobile use. The government also can encourage adoption as both a major supplier of content and a major user of the technology. Because of its size and importance, government can encourage the adoption of standards without having to require them (in keeping with the principle of providing incentives rather than mandates).

In some cases, the government simply needs to be more sophisticated with regard to how it develops electronic services. Robert Pepper of Cisco noted that a Google search for "India Government services" often

will fail to lead to the correct site because content developers often fail to use the right "tags" to optimize the content's visibility to search engines. Educating developers also is important to ensure that their content gets rendered properly by the most commonly used browsers.

Mobile markets depend on transparent spectrum management.

Kas Kalba of Kalba International pointed out that because illiteracy is still widespread in India, it will be important to provide as many services as possible by voice as well as data. Rohan Samarajiva of LIRNE*asia* agreed, noting that SMS use tends to be lower in India than in other countries with higher literacy rates (although the use of SMS versus voice also depends on the relative costs of the two applications).

Encouraging Light-Touch Regulation. In his book of essays about India, *The Elephant, the Tiger, and the Cell Phone*, Shashi Tharoor celebrates the democratization of communications brought about by the introduction of the mobile phone. Tharoor contrasts the current environment, in which mobile phones are available for purchase almost everywhere in the country, with the "bad old days" when there was a waiting list of 20 million people and an eight-year wait to get telephone service. "The key contribution of government" to this turn-about, he explains, is not in anything that it did but in "getting out of the way—in cutting license fees and streamlining tariffs, easing overly complex regulations and restrictions."[34]

The final recommendation from the Roundtable participants called on the government to continue to refrain from premature regulation that could reduce competition and stifle innovation. In many cases, applications that are delivered via a mobile phone are already covered by existing laws in areas such as consumer protection, privacy, and fraud. Reviewing existing laws, however, to determine whether they cover mobile applications and updating them as necessary would be useful. In addition, coordination between regulatory agencies could be useful to avoid conflicts arising from overlapping or unclear jurisdictions. The Roundtable participants also urged the government to work with industry to build the capacity to effectively enforce existing law.

An area in which a new approach could be helpful is to expand monitoring of mobile growth so that it includes metrics for mobile data and broadband use, not simply the absolute number of subscribers (which currently is the sole metric being used to determine things such as allocation of additional spectrum).

Meetings with Government

Immediately after completing their meeting in Kovalam, many of the Roundtable participants traveled to New Delhi to present their recommendations to government representatives. The group held meetings with the following individuals:

- Montek Singh Ahluwalia, Deputy Chairman, Planning Commission
- M Madhavan Nambiar, Special Secretary, and senior staff members, Department of Information Technology
- Nikhil Kumar, Chairman and Member of the Parliamentary Committee on Information Technology.

Montek Singh Ahluwalia

Dr. Ahluwalia was supportive of the Aspen process and made several important interventions in the meeting. In particular, he responded to regulatory issues raised in the presentation.

Dr. Ahluwalia appeared to be in agreement with proposals advocating transparency in spectrum management and the recommendation for fair access to the infrastructure owned by BSNL, the incumbent telecommunications service provider that is owned by the government. He pointed out, however, that BSNL has expressed concern about the concept of sharing its infrastructure and that Parliament had opposed similar proposals made previously. One solution might lie in trying to influence BSNL through the independent members of its board. Dr. Ahluwalia also recalled that the Telecom Commission whose influence has waned in recent years was set up to provide inputs into telecommunications policymaking from outside the parent industry, which was

perceived as opposed to reform. He suggested that the commission could be approached to pursue pending issues with BSNL.

Dr. Ahluwalia requested that a note be sent to him in writing so that he could address concerns about government handling of issues surrounding m-commerce.

Department of Information Technology

In addition to Special Secretary M. Madhavan Nambiar, other members of the Department of Information Technology staff who participated in the meeting were Aruna Sounderrajan, Common Service Centers (CSC); Gulshan Rai, Education and Research Network (ERNET); SP Singh, E-Governance; and Suchitra Pyarelal, director of E-Governance Standards Division, National Informatics Center (NIC).

All regulatory decisions should be transparent, predictable, and made in the public domain.

A discussion with senior managers of the Department of Information Technology followed the presentation of Kovalam meeting recommendations. Mr. Nambiar was interested in the group's recommendations advocating hybrid systems of the kind United Villages was pioneering. He felt such projects had great interest for the government's CSC program, which envisages setting up more than 100,000 CSCs to offer a variety of electronic and other e-government services in rural areas. He and Aruna Sunderrajan noted the group's advocacy of m-governance over e-governance. Mr. SP Singh and Mr. Gulshan Rai spoke of security and standardization issues surrounding m-commerce.

Parliamentary Committee on Information Technology

The final meeting of the Aspen Roundtable took place with the members of the Parliamentary Committee on Information Technology. However, the chairman of the group, Mr. Nikhil Kumar, requested that no report be issued on this session prior to a formal release of the minutes of the meeting by the committee itself.

Key Roundtable Messages and Recommendations

Key Messages:

- Mobile communications can drive growth and significantly enable inclusion and better government.
- Expanding access requires sharing existing infrastructure as well as building new capacity.
- Mass adoption of m-commerce requires development of a trusted m-currency mechanism.
- A mobile platform can multiply access to and impact of e-governance.
- Premature regulation can stifle innovation and usage.

Recommendations:

1. **Enhance infrastructure**
    - Provide nondiscriminatory access to essential backbone at cost-oriented prices to expand rural coverage.
    - Remove restrictions on active wireless infrastructure sharing.
    - Allocate 700 MHz for wireless broadband; 2008 is a unique time and opportunity for India.
    - Spectrum rules should be open, transparent, predictable, and available in public domain.
2. **Promote m-commerce**
    - Development of "m-currency"
        - o Establish a consortium to develop and support an m-currency payment mechanism for m-commerce that is simple, standardized, branded, and trusted.

- Creation of hybrid services
  - o Broad acceptance of m-commerce requires a mix of:
    - Mobile communications,
    - Internet,
    - Locally relevant applications and content,
    - Trusted human interface.

3. Expand m-governance

- m-Governance is key to expanding e-government outreach.
- Mobile users far exceed Internet users.
- Government services on mobiles can catalyze m-commerce growth.
- Adapt all e-government applications to run on mobile platform.
- Example: health and education services on mobile can drive mass adoption.

4. Light-touch regulation

- Premature regulation can stifle innovation and usage.
- Existing law covers most issues such as consumer protection, privacy, fraud, etc.
- Review existing laws to reflect m-commerce specific issues and update as needed.
- Create a formal mechanism to provide coordination between regulatory agencies to avoid conflicts.
- Proactively review rules as technology evolves.
- Avoid technology-specific regulation.
- Set targets for mobile data and mobile broadband usage as well as the number of subscribers.
- Work with industry to build capacity in law enforcement agencies.

Notes

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APPENDIX

The Future of Indian Mobile

Remarks by Nripendra Misra,
Chairman, Telecom Regulatory Authority of India (TRAI)

Presented in Kovalam on February 11, 2008

In the Indian telecommunications sector, things have changed since 1997. Today, India is the world's fastest growing cellular phone market. This past month, we added 8 million telephone subscribers. Our current telephone subscriber base stands at 273 million, with an annual compounded growth rate of 42 percent since 2002. The number of cellular phone subscriptions has tripled over the past year and is 233 million at present. India looks set to achieve the stated target of 500 million telephone subscribers by the end of 2010. Financially as well, the telecom sector in India has shown positive results. Gross revenues for the sector have grown at a compounded annual rate of 21 percent since 2002 and currently stand at US$20 billion. This accounts for about 2 percent of the national gross domestic product (GDP). Furthermore, the sector has attracted significant domestic and international investment. The four largest service providers have a combined market capitalization in the range of US$50 billion, which is on par with the capital investment in the industry.

As the telecom regulator, the Telecom Regulatory Authority of India (TRAI) is watching over one of the most interesting and critical infrastructure fields today. Around the world, governments, international agencies, and academics have recognized telecom as an enabling infrastructure—allowing the people it connects to reach out and communicate, seek business, and grow their knowledge. India remains, unfortunately, on the wrong side of the digital divide, which prevents a significant portion of our population from attaining their full potential. The majority of telephone and Internet subscribers are in urban areas; rural India has a telephony penetration of only 7 percent, which is significantly lower than urban India's penetration of 55 percent. Given that communication is a human need and right and that a strong communications network enables commercial and social ties, we must bridge this divide between urban and rural India. Indeed, there is plenty of evi-

dence to show that telephone penetration has a high correlation with GDP per capita. For example, comparative data shows that if one country has 1 percent higher mobile phone subscription rate than another, its GDP per capita will be about 200 dollars higher. Surveys and studies have repeatedly shown that access to information and communication technologies (ICT) allows at least the benefits of information availability, business opportunities, and social connections that translate into brighter education and economic opportunities. TRAI believes that all Indians should have the opportunity to connect with the world beyond their geographical horizons and is working to ensure that anyone can get a dial tone wherever and whenever they desire.

India is a country with a rich blend of culture, people, and lifestyles that are inherent parts of its identity. The Indian economy has witnessed high growth rates in recent years. India now has one of the fastest-growing economies in the world and has generated unprecedented interest among investors within and outside the country. The inflow of required funds in the telecom sector has accelerated development of new applications and content, and a convergence of technologies creates an environment in which it has been necessary to deliberate on the type of future telecom networks, both in terms of technology and applications. The increasing popularity of Voice over Internet Protocol (VOIP), the availability of free voice chatting, video clips on mobile, and the development of new enterprise applications on mobile handsets has forced us to look at emerging telecom scenarios from a regulatory point of view and from a technology point of view. Rapid technological changes in the ICT sector pose a new challenge to policymakers and regulators.

The fast growth of telecom is resulting in a reduction of average revenue per user (ARPU). Although this phenomenon is expected, operators do not like to see a decline in revenue and will make all efforts to sustain the revenues to support their operations. Customers also are looking for new services, new applications, and value-added content. Hence, networks must be capable of supporting new services and applications at a faster speed and launch new contents. Although new services are welcomed in India, our country is highly price sensitive; therefore, affordability is an important concern. It is with this background that the convergence of services can be leveraged to meet the upcoming

demand of the telecom sector. The next-generation network (NGN) is one of the solutions to support a converged telecom network. The development of a robust IP backbone, the penetration of Internet and broadband, the creation of value-added content, and the flexibility to launch content are some of the natural concerns.

High-speed Internet access is likely to yield economic benefits, better education, better governance, and a knowledge-based society that will help all segments of society, including children, working people, the elderly, and those using broadband exclusively for business. The increasing use of mobile to access the Internet confirms the changing trends. We now have 57.78 million mobile subscribers who access the Internet using a mobile handset. The launch of third-generation (3G) services will provide much higher speeds to access the Internet and support many more applications.

The cost of handsets is falling, and many handsets that support advanced applications are within the reach of common people. Technology projections indicate that microprocessors will run 1,000 times faster than the speed at which computations are being done today. That means enormous gains in productivity and efficiency, giving people unimaginable power to access, organize, and transform information. A Confederation of Indian Industry (CII) report states that if connectivity and service innovations are designed appropriately and implemented effectively, they can be a key driver for several socioeconomic gains, including economic growth and employment generation. The important aspect of the CII report is that most of the initiatives proposed are industry driven and do not require any investment by government.

International experience suggests that high-speed accessibility is one of the key factors to drive convergence. The U.K. Office of Communications (OFCOM) acknowledged in an August 2007 report that the availability of broadband in more than 50 percent of households has driven the development of converged services and devices.

The convergence has opened major revenue opportunities for producers of content. Over the first half of 2007, 90 percent of digital content sales by volume came from downloads through computers or a mobile handset. OFCOM observed that increasingly sophisticated devices that typically work using IP platforms are beginning to influ-

ence customer behaviors. High-speed Internet access has fueled bundling of communication services and has become increasingly popular among customers. As the OFCOM study notes, more than 40 percent of households are now using two or more communication services from the same service provider. The consumption of services and multimedia also has increased; OFCOM reports that each person now uses these services more than 7 hours a day. The study also finds that women ages 25 to 34 spend 20 percent more time online than their male counterparts. Children growing up using the Internet will become more accustomed to e-learning at home and at school. As a result, the younger generation will be more likely to regard new digital evolutions as a lifelong process and will expect to have access to online interactive educational resources. This evolution will have a positive impact on skill development and familiarity with technological advancements. Similar growth models need to be created in India as well.

Declining ARPU, combined with the changing scenario, technological advancements, and convergence, will drive future growth, and adjustments in the present business model will need to take place. The type of content being used will change, and the services will change, which will have an impact on the day-to-day life of common people in terms of their activities, behavior, and more noticeably business transactions. Websites such as *Indiamart.com* and *Baazee.com* are examples of the online ventures that see outstanding volumes of e-commerce transactions. Real-time selling and buying on *Baazee.com* enable a person to sell cars, books, stocks, and virtually anything that comes to mind. The Internet has made the whole world a personalized market place. Profits from online trading are garnering a great deal of appreciation as well as opening new markets for further trading within India.

According to projections by McKinsey and Nasscom, e-commerce transactions in India will reach the US$100 billion mark in 2008. Business-to-business (B2B) portals have played a major role in promoting e-commerce. Advancement of telecommunications and computer technologies has made B2B portals an integral part of the economic infrastructure of any business place. B2B portals give an exporter-importer the ability to trade with ease and without preparation of physical order documents. The advantages of having the assistance of a quality B2B portal are manifold and can have positive impacts on productivity and each transaction.

Technological developments have made it possible to offer financial transactions such as ticketing, banking, marketing, auctions, and location-based services through mobile handsets. Such services are popularly known as mobile commerce or m-commerce, a modified version of e-commerce. M-commerce is in the nascent stage in India. Some service providers have introduced applications such as paying post-paid bills, railway reservations, and so forth, and more service providers are in the pipeline for offering m-commerce applications. Mobile commerce can be regarded as the successor of e-commerce. The capability to pay electronically through a secured network is the thought behind e-commerce.

The development of value-added content and applications is another area of concern. At present, value-added service accounts for about 13 percent of total revenue, but this figure is going to change very soon. Increasing convergence and popular IP applications may drastically reduce the revenue potential from plain old telephone service; projections indicate a steep rise in value-added services, however. The content production industry is going to flourish and will be a focal point of attention in times to come.

Moreover, the future is going to see machine-to-machine communications. Networking of censors will become ubiquitous. According to projections, in 2008 approximately 10 billion microprocessors will be sold, embedded in everything from computers to coffee makers. These devices initially will be able to "think" but not "talk"; they will perform specific tasks but cannot communicate. This is likely to change quickly. The cost, size, and power requirements of such wireless devices are falling rapidly. Hence, in years to come, wireless communication will be part of the fabric of everyday life.

The general direction is clear. In the years ahead, new wireless technologies will appear in a plethora of devices, much as computer chips did in the second half of the 20th century. The industry as a whole—including handset manufacturers, software developers, chip developers, application vendors, and so on—will enjoy the prosperity of significant increased revenue potential in coming years.

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Joint Roundtable on Communications Policy

"The Future of Indian Mobile"

Kovalam (Kerala), India
February 7–9, 2008

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Note: Titles and affiliations are as of the date of the conference.

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About the Authors

Richard P. Adler is principal of People & Technology, a research and consulting firm based in California's Silicon Valley. He also is a research affiliate at the Institute for the Future (IFTF) in Palo Alto, California.

Mr. Adler was one of the first staff members of the Aspen Institute Communications and Society Program, where he served as Associate Director under the program's founder, Douglass Cater. He has written several reports based on recent Aspen conferences, including last year's Joint Roundtable, *Minds on Fire: Enhancing India's Knowledge Workforce*, and reports from the Aspen FOCAS conference, *Next Generation Media: The Global Shift* (2006) and *Media and Values* (2007).

His current interests include the intersection of aging and technology and the potential of new healthcare delivery systems. He is the author of *Healthcare Unplugged: The Evolving Role of Wireless Technology* (California Healthcare Foundation, 2007) and is co-editing a book on *Texting 4 Health.*

He has taught communications at Stanford University and UCLA and was a research fellow at the Harvard Graduate School of Education. He holds a BA from Harvard, an MA from the University of California at Berkeley, and an MBA from the McLaren School of Business at the University of San Francisco.

Mahesh Uppal is the Director of Com First (India) Private Ltd., a niche consultancy company based in New Delhi, India, that specializes in policy, regulation, and strategy.

He has 20 years of experience in telecommunications. He advised several national and international corporations on emerging regulatory issues such as spectrum, competition, and industry structure. He also has consulted for international development agencies including the World Bank, the International Telecommunication Union, the United Nations Development Programme, the Canadian International Development Agency, and the International Development Research Centre. He also advised several governments on telecommunications

policy and regulatory issues and worked with civil society organizations in India to build capacity in dealing with consumer issues in a market-driven telecommunications environment.

He was actively involved in the formative years of regulation and competition in India's telecommunications sector. He contributed extensively to the process of creating the Telecommunications Regulatory Authority of India (TRAI), India's first market regulator.

He was educated at St. Stephens College in Delhi, the Indian Institute of Technology in Kanpur, and City University in London. He was part of the research staff at the Indian Institute of Science, Bangalore; Heriot-Watt University, Edinburgh; Cambridge University; and Sussex University at Brighton in United Kingdom.

Previous Reports from the Joint Roundtable on Communications Policy

Minds on Fire: Enhancing India's Knowledge Workforce

Richard P. Adler, rapporteur. This report examines the economic opportunities offered by India, the workforce problems facing all sectors of industry, especially India's burgeoning information technology industry, and some solutions for how to bridge the gap between the number of jobs being created in IT and telecom services sector and the number of available, skilled workers. The report promotes Learning 2.0, or open source learning enabled by the Web, in India and calls for the Indian Government to enter into a pilot project of public private partnerships to encourage the creation of Knowledge Learning Centers in the Special Economic Zones being created throughout the country. The report presents the Roundtable's findings on how innovative ideas and an increased role of technology in human resource development and management have the potential to significantly enhance the pace of building skills and capacity. Moreover, the report envisions the revolutionary potential of constructionist learning, whereby access to the tools of the infosphere could allow a person to follow his or her passion, access free content worldwide, collaborate with others, and break out of a narrow mindset, low expectation or feeling of entrapment in a poor, remote village. ©2007, 72 pages, ISBN: 0-89843-477-7, $12.00.

Connect and Catalyze: Can India Leverage ICT for Inclusive and Sustained Growth?

David Bollier, rapporteur. This report of the inaugural Joint Roundtable on Communications Policy by the Aspen Institute India in partnership with the Aspen Institute Communications and Society Program addresses India's current economic environment, including the challenges the country faces, and lays out the Roundtable's suggested solutions for ICT to be means for India's sustained economic development. The report looks at how the development of a stronger domes-

tic ICT industry becomes the path toward a more sustainable and diversified competition in international markets. Participants widely agreed that India should aggressively develop its own capacities to compete with the ICT sectors of other nations and also focus on bringing ICT to rural India. ©2006, 63 pages, ISBN 0-89843-454-8, $12.00.

About Aspen Institute India

www.aspenindia.org

In collaboration with the Confederation of Indian Industry (CII), the Aspen Institute launched its international partnership with the opening of Aspen Institute India in New Delhi on February 3, 2004. Aspen Institute India is a non-profit organisation dedicated to in-depth discussion of global issues, development of values-based leadership, and a high-level exchange of opinions, information and values.

The Institute focuses on the most important problems and challenges facing Indian society, the business community, and the individual, inviting top industrial, economic, financial, political, social and cultural leaders to discuss these issues in settings that encourage frank and open debate.

Aspen Institute India pursues its objective by organizing value-based leadership seminars, policy programmes, and public activities.

About the Communications and Society Program

www.aspeninstitute.org/c&s

The Communications and Society Program is an active venue for global leaders and experts from a variety of disciplines and backgrounds to exchange and gain new knowledge and insights on the societal impact of advances in digital technology and network communications. The Program also creates a multi-disciplinary space in the communications policy-making world where veteran and emerging decision-makers can explore new concepts, find personal growth and insight, and develop new networks for the betterment of the policy-making process and society.

Ongoing activities of the Communications and Society Program include annual roundtables on journalism and society (e.g., journalism and national security), communications policy in a converged world (e.g., the future of video regulation), the impact of advances in information technology (e.g., "when push comes to pull"), advances in the mailing medium, and diversity and the media. The Program also convenes the Aspen Institute Forum on Communications and Society (FOCAS), in which chief executive-level leaders of business, government and the non-profit sector examine issues relating to the changing media and technology environment, and hosts the Knight Commission on the Information Needs of Communities in a Democracy.

Most conferences utilize the signature Aspen Institute seminar format: approximately 25 leaders from a variety of disciplines and perspectives engaged in roundtable dialogue, moderated with the objective of driving the agenda to specific conclusions and recommendations. In 2007 and 2008, FOCAS emerged as a larger event.

Conference reports and other materials are distributed to key policymakers and opinion leaders within the United States and around the world. They are also available to the public at large through the World Wide Web at *www.aspeninstitute.org/c&s.*