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Bellagio, Italy
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Mobile Services Evolution 2008-2018

Chetan Sharma

Summary

Over the last 10 years, the progress made in the global mobile industry has been truly stunning. Mobile device ownership has gone from luxury item to necessity as the feverish rate of adoption has spread mobile technologies into every corner of the world. As we look into the next 10 years, it is certain that the mobile phone will be used for much more than just voice communications. There is an opportunity for private institutions and public enterprises to build the vision of a cohesive mobile-services platform that enables and engages the masses to both fundamentally enhance the quality of their daily existence and to create new opportunities globally. This paper takes a look at the potential evolution of mobile technology and services over the course of the next 10 years, and discusses an M-Services framework for building and deploying diverse mobile services. The paper also examines the challenges and steps that will be needed to achieve this vision.

Introduction

The evolution of mobile services is impacted by several key forces of change. Chief among them are technology innovation and diffusion; consumer behavior; globalization and the elimination of economic borders; and the easing of regulations to promote trade and commerce. This is leading to the emergence of new players, new ecosystem dynamics that drive innovation, and the creation of open and common architectures. Given the availability of handsets that cost less than $20 and the growing demand from the rising middle class, mobile networks are being deployed and consumers are snapping up handsets faster than manufacturers can build them.

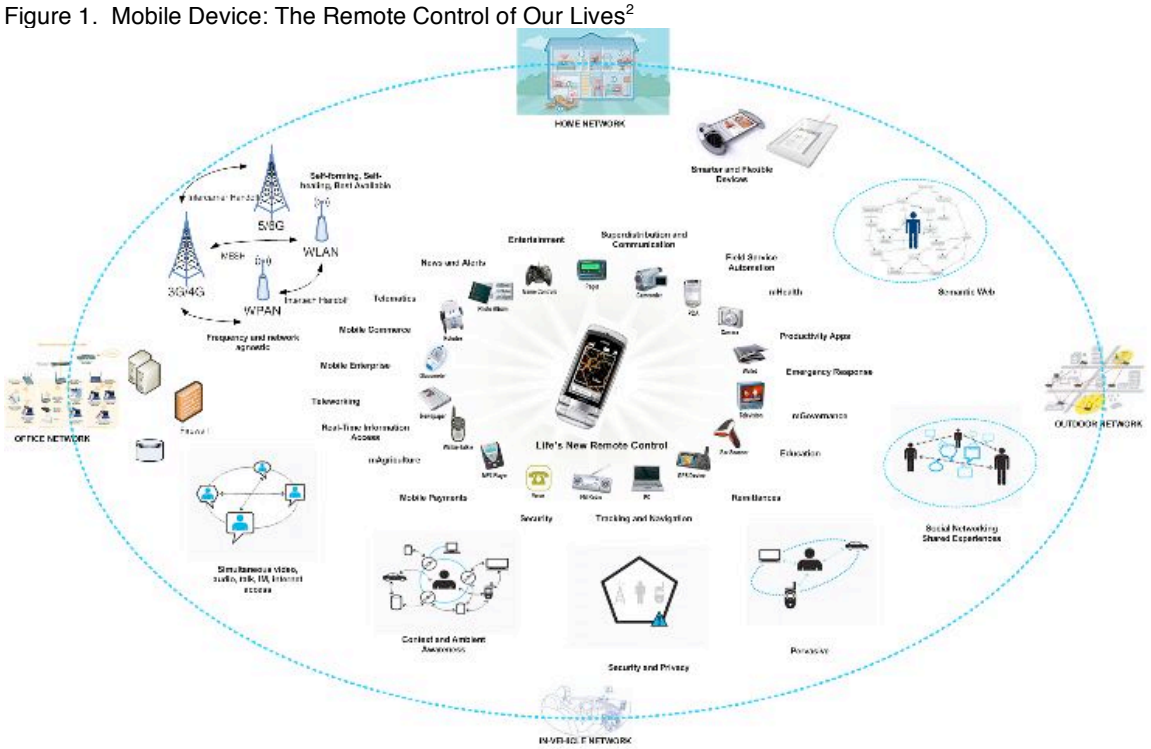
In 1991, Mark Weiser, in his seminal article, "*The Computer of the Twenty-First Century*"[1] described computing as "a world in which humans and computers are seamlessly united." The article opened with "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." As we look forward to the next 10 years of evolution in the mobile industry, two things are certain. First, by 2018, mobile technology will become so ingrained and embedded in our daily lives that, as Weiser suggested, it will be indistinguishable from the mundane. Second, the very definition of a mobile device and mobility will undergo a drastic transformation in the next decade. Instead of just mobile phones having cellular radios and connectivity, there will be hundreds and thousands of different devices, each a unique appliance, that will have wireless connectivity to a network. There will be sensors in the buildings we live in, the clothes we wear, the roadways we commute on, and the vehicles we drive in. Nearly everything of substance will have connectivity. With the evolution in networking technologies, middleware architectures, and mobile devices, we are entering a new era of always-on, real-time-access mobile experience.

Mobile Device: The Remote Control of Our Lives

While we have come to know the mobile phone as a communications device, its role in our daily lives has been expanding. Mobile devices have become essential tools to help us navigate through our days, whether we are checking emails, paying for tickets, sending money transfers, taking pictures of our kids, watching the World Cup live, checking commodity prices, or offering emergency response to mHealth (mobile health). As figure 1 shows, and as we alluded to earlier, it is not just the traditional phones that have cellular connection these days. We are slowly but surely moving into an era when a majority of electronic devices, from small tags to giant billboards, will have a communication channel with which both machines and humans can interact. Basic functions (such as camera, messaging, GPS, wallet, camcorder, gaming controls, rolodex, glucometer, scanner, and context awareness) can be used to build a

multitude of applications and services that are customized to specific demographics and regions and go far beyond the downloading of ringtones.

Figure 1. Mobile Device: The Remote Control of Our Lives[2]



Already, in 2008, gigabyte mobile devices are available that can process data at one to two mbps. By 2018, devices will take different shapes and forms, becoming foldable, extendable, and flexible, thanks to new display and projection technologies that are just starting to get out of labs. Chips will be everywhere: in sensors, processors, communication interfaces, and storage. The portable device will connect to all of these to gather information, process it, and present it to the user. Also, we will become more accustomed to interacting with the devices via touch, stylus, gesture, and voice.

While the network and device play a crucial role, the real intelligence will lie in the software that ties the middleware and the two end points. Sensors embedded in our infrastructure (roads, buildings, cars, homes, bridges, oceans, etc.) will alert us of impending troubles and changes in the environment. Mobile technology will make health-care service more accessible and will help farmers in planning and selling their crops, all with just the touch of a finger. We will use devices to control security panels in our houses, instantly communicate with experts on topics of interest, and engage in payment, banking, and remittance. The applications and services that will emerge over the course of the next 10 years will bring basic services like health care, enterprise services, and emergency response to the mass market in a much more efficient manner.

Mobile Technology Evolution 2008 – 2018

To see where we are heading, it is worthwhile to take note of the journey of the last 10 years and acknowledge what we have accomplished in such a short period of time. In 1998, the global mobile penetration was around 5 percent. We will be crossing the 50 percent mark in 2008 and we expect to have almost the same number of mobile subscriptions as citizens by 2018.[3] The table below summarizes the key performance metrics from 1998, 2008, and 2018.

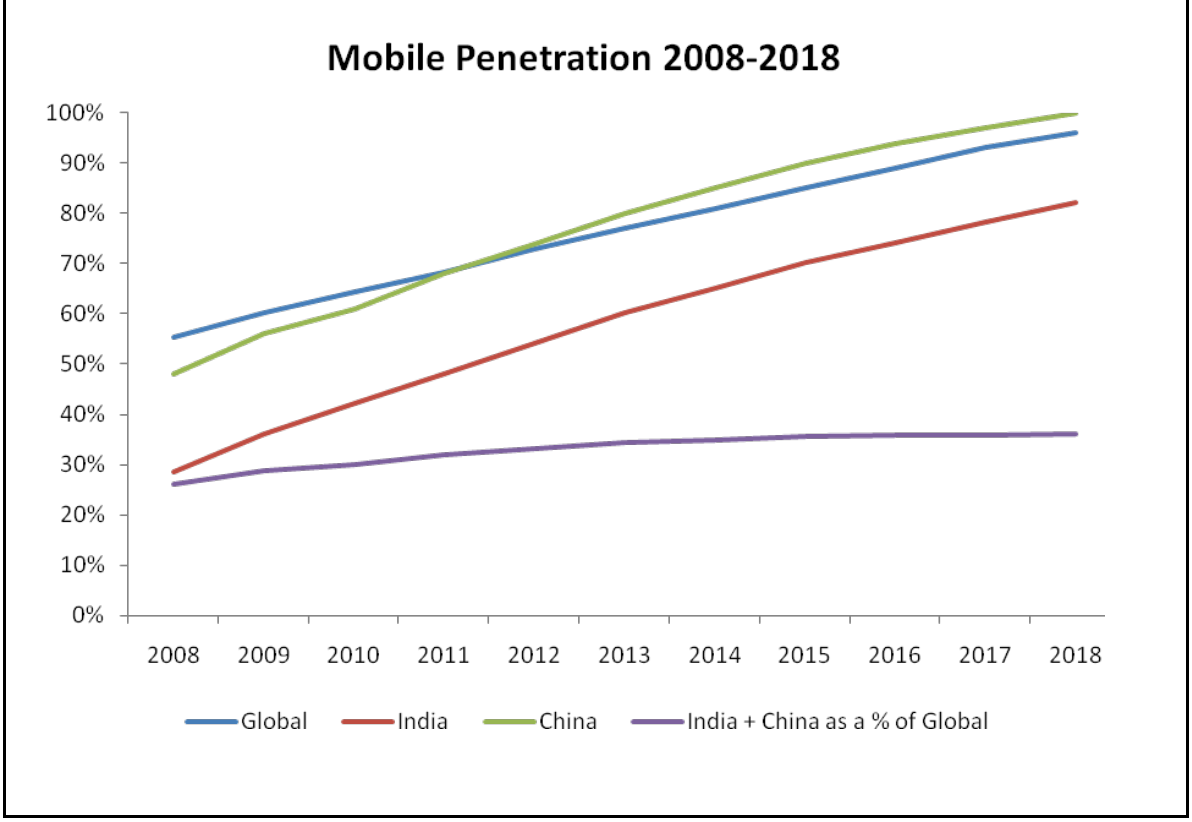
Table 1. Mobile Evolution 1998-2018[4]

	1998	**2008 (estimated)**	**2018 (estimated)[5]**
Mobile Penetration			
Global	5 percent	55 percent	96 percent
China	2 percent	48 percent	100 percent

	1998	2008 (estimated)	2018 (estimated)[5]
India	< 1 percent	28 percent	82 percent
High GDP per capita nations/total mobile subscriber base	75 percent	24 percent	15 percent
China + India/total mobile subscriber base	8 percent	26 percent	36 percent
Mobile data services revenues as percent	4 percent	19 percent	40 percent
Main data applications	SMS	SMS, browsing, search, video, music, navigation, enterprise	
Networks	primarily 1G and 2G	mostly 2.5G and 3G	mostly 5G and 6G
3G+ penetration	0 percent	18 percent	90 percent
Network speeds	< 50kbps	up to 2Mbps	up to 1Gbps
Device ASP	$200	$130	< $20
Smartphone penetration	< 1 percent	10 percent	40 percent
Average battery life	2 hours	2.5 hours	24 hours

As indicated in Table 1 and in Figure 2, global mobile penetration grew tenfold in the last 10 years, and is likely to reach almost 100 percent by 2018. China and India will account for the most number of subscribers and will add a total of 1.6 billion new subscribers in the next decade. Also, there will be a significant shift in mobile revenues from voice to data, the likes of which we have already seen in Japan, with similar trends starting to emerge in Western Europe, Korea, and North America. Flat-rate pricing that is inevitable in every territory will foster the growth and usage of new mobile applications for which consumers won't have to worry about usage-based tariffs. Newer business models, including mobile advertising, will also help lower the cost of mobile data services to users and will encourage innovation and usage.

Figure 2. Mobile Subscriber Penetration 2008-2018[6]



Mobile Ecosystem Dynamics

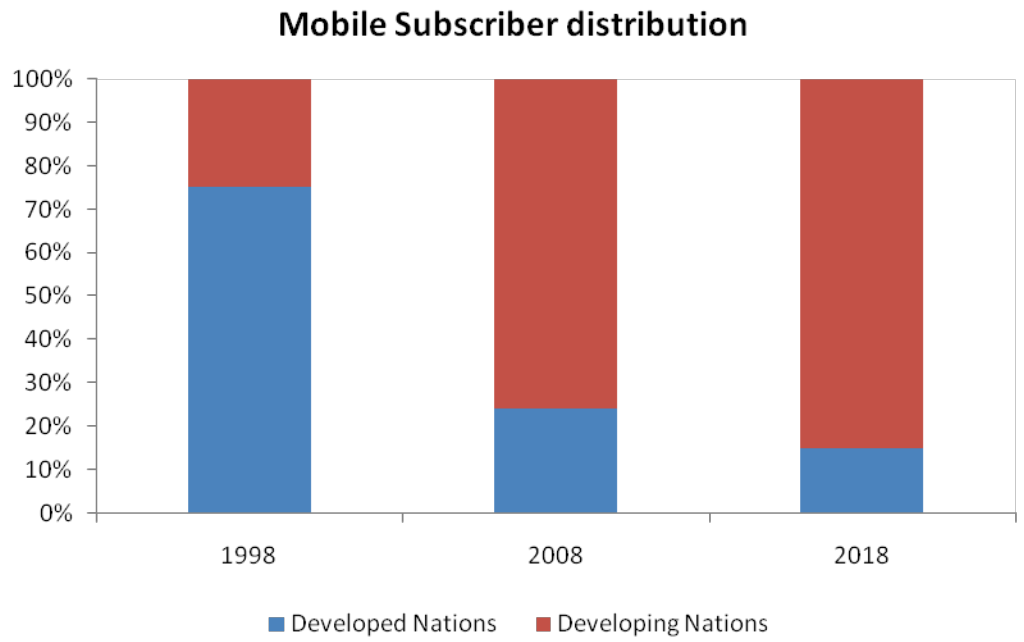
Traditionally, the mobile ecosystem has been dominated and controlled by mobile operators in nearly every country. However, as we move into a data-centric landscape where data services will account for more than 40 percent of data revenues on a global basis, newer players are emerging and newer alliances are being formed. Google, for example, has entered into the mobile OS business. Along with Sprint, Clearwire and a number of cable providers have invested in a WiMAX initiative in the United States. Similarly, the convergence of cable, Internet, and mobile technologies and the desire to offer bundled and integrated services will lead to a different-looking ecosystem than today.

Globalization is forcing operators, who were once comfortable on their home turfs, to invest in emerging markets to capture value and future growth. From an infrastructure perspective, the investment has clearly been shifting from the developed world to the developing nations as they plan to expand coverage and bring new subscribers onboard. Finally, there is a strong movement towards opening up access to the ecosystem so that the developers can offer applications and services on the mobile platform just like they do online. Such efforts will lead to more innovation and better services for the consumer, including entertainment, enterprise services, and public safety.

Deployment and Adoption of Mobile Technology in the Developing World[7]

The telecom growth in the developing countries over the past five years has been tremendous. In 1998, India and China had less than 1 million and 25 million mobile subscribers respectively. In early 2008, both countries are adding 8 million to 10 million subscribers per month (compared to the United States, where the growth is around 1.6 million subscribers per month, or Japan, where the corresponding figure is less than 1 million).[8] In fact, the majority of the growth over the next 10 years is going to come from the developing world. In 1998, the developed nations accounted for more than 76 percent of mobile subscribers worldwide. In 2008, this number will drop to 24 percent and by 2018, only 19 percent of the mobile subscribers will come from today's developed nations (figure 3).

Figure 3. Mobile Subscriber Distribution 1998-2018[9]



The continued expansion of subscriber base and services will require enormous infrastructure investments. The accessibility of mobile services is going to be a key driver for the future success of the developing nations. Better health services using mobile technology will be essential to serve the aging and remote geographies. Emergencies, whether natural or man-inflicted, will demand new and better communication tools and infrastructure. In addition, the rising travel costs

will mean the need for better distribution of information, commerce, education, and communications. Within the telecom realm, mobile technology is the most important growth sector in the developing nations, where mobile penetration is many times the penetration of desktops and of fixed-line Internet capability.

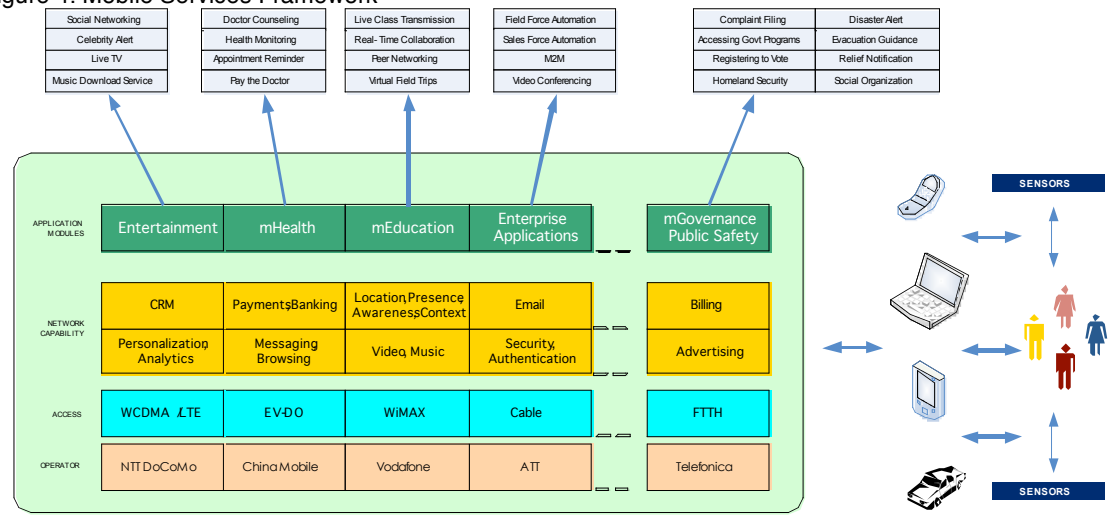
Mobile Services Platform

As we mentioned earlier, the middleware platform is key to building new innovative services in the mobile ecosystem. In this section, we will discuss a high-level framework that can form the basis of developing new applications and services.

The Building Blocks

The best way to think of the long-term mobile services platform is to envision a modular and decentralized framework that enables plug and play and integration through software-as-a-service (SAAS) architecture, where each module is available on demand (as opposed to being available through a tedious integration effort, with a single operator, multiple operators, or other service providers). As shown in Figure 4, a mobile services framework is built on an operator network (which in addition to mobile capability might also have fixed online and cable networks). This could be built on different access technologies from mobile standards such as WCDMA, LTE, EV-DO, WiMAX, 802.11x, and WPAN, to fixed-access networks such as cable, DSL, FTTH, or WiMAX. On top of the access layer is the service enablement layer—a set of network features that help build applications and services modules on top.

Figure 4. Mobile Services Framework[10]



The service-enablement layer will have the most fundamental capabilities such as messaging and browsing; security and authentication; payment, banking, and billing; personalization and CRM; video and music streaming; and location, presence and awareness. Using these capabilities, operators, third parties and other service providers can then build application modules that can either be operator specific or can run independent of the operator. In an ideal world, the capabilities of the network will be abstracted from the access network so that applications can take advantage of these features without complex integration that requires months of work.

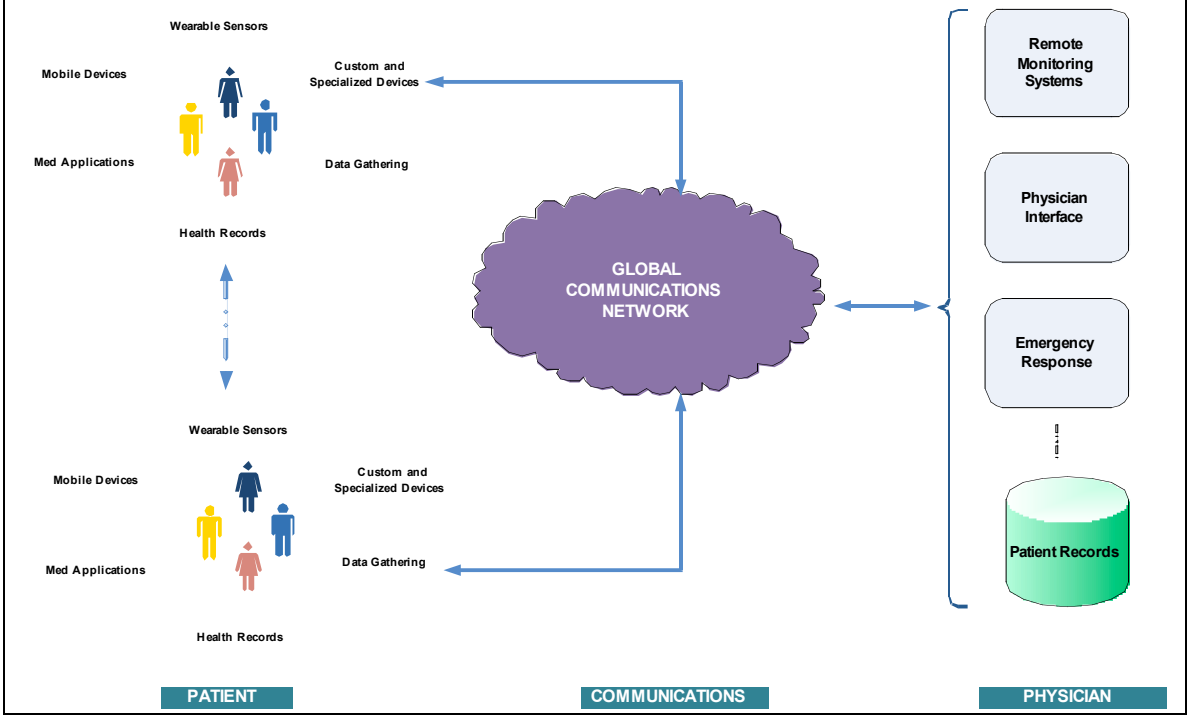
By building modular components at each level and by abstracting and exposing the service-enablement layer to third parties, operators can help build a compelling framework that can accelerate the introduction of new services and applications in a given market.

Let's discuss some of the application and services modules depicted in Figure 4 in more detail.

mHealth

One of the most important areas that mobile technologies are primed to have an impact on in both developing and developed countries is health care. Mobile technology does two things really well: compress time, and compress distance. Thus, it can connect, enable, and empower participants in the health-care ecosystem to reduce costs and errors while increasing productivity, access, and efficiency.

Figure 5. mHealth Services Framework



Mobility will impact the following key areas (figure 5):

- **Remote monitoring systems** - Given the cost of access and administration, there will be significant investment in sensor technology near or on the patient—and investment in the communication infrastructure that connects medical data from sensors and from the patient to the physicians and their staff. This is an especially big market for health-care enthusiasts when it comes to patients who are elderly, impaired, or chronically ill. For example, the German firm Biotronic has developed a phone that communicates with a pacemaker using a close-range radio frequency, then transmits data over a cellular network to the physician in real time.[11,12,13] Remote-care delivery will revolutionize how expertise and drugs are delivered in remote and rural parts of the world. It will also alter the cost structure of equipment and care.
- **Alerting** – The solutions that will scale the most are going to be the ones that are both simple and ubiquitous. The simple alerting capability can help reduce costs and increase efficiency in every country by reducing the number of missed appointments. From proactively monitoring, following up, and reminding patients to adhere to the medication regime[14] to alerting end users in the event of an epidemic or an emergency, messaging and alerting technologies will remain an integrated part of the health-care system.
- **Clinical and administrative data collection and record maintenance** - All of us can relate to the fact that there are countless forms to fill out each time we interact with the health-care system. By automating data collection in the case of trials or patient monitoring and by digitizing the medical records for further processing, significant cost savings will be attained. Enormous computing power and Gbps (gigabits per second) network connections will mean data can be collected[15], analyzed, and understood in real time from almost anywhere on the planet.
- **Globalization of health-care delivery** - In an interconnected world, health-care delivery will be much more decentralized and much more readily distributed. Your local clinic might be responsible for monitoring your vital signs. but the analysis and prognosis might come from a physician thousands of miles away. You might be lying on a bed in Kuala Lumpur, but your surgeon might be in

Stockholm on video conference with experts from Cambridge and Chennai. Real-time translation capability would mean language differences would not be a barrier in the future.

- **Wellness and information awareness** - Due to instantaneous access to information and due to new devices' capability to monitor, record, and socialize our vital signs at the touch of a button, awareness of the importance of staying fit and healthy will lead to a health-conscious society, and the focus on preventative regimens will increase. The ability to socially network with friends, family, and patients with similar experiences will help create a better environment for sharing information.
- **Preventing drug counterfeiting and theft** - One of the big issues, especially in developing countries, is that drugs are essentially currency for thugs. By putting remotely monitorable sensors on every shipment, one can help ensure that drugs reach their intended destination without tampering. Also, sensors will help maintain the environmental variables for certain drugs, such as just-in-time vaccines that have operational limits.
- **Early detection** – There is plenty of research to show that if a disease is detected and treated early in the process, cost and morbidity rates are greatly reduced. If the impact of the therapy can be monitored in real time and adjusted as needed, the markers in the human bloodstream can allow physicians to follow the disease and evolve medical prognosis into a more evidence and performance based treatment.

m-Governance

Political movements in many countries are coordinated entirely via mobile technology, thus empowering citizens to organize and inflict change at the grassroots level. In several developing nations, where the wireline infrastructure will lag behind mobile penetration for many years to come, mobile communications provide a channel for the national, state, and local governments to engage and interact with their citizens in a proactive way. From awareness of new programs and initiatives to the collection of complaints and feedback, mobile technology will play a central role in two-way communication.

m-Enterprise

As we move into the pervasive-computing era, access to information, applications, and services needs to be independent of devices, networks, and protocols. It is no longer acceptable to just modify content for access by different devices. It is extremely critical for enterprises to be able to securely present real-time, highly personalized information based on user preferences, history, context and device capability and configuration. Companies that see this trend will have many significant opportunities. With the advent of presence and location data, there are huge opportunities to further customize information and truly present "context-sensitive" data that can provide users with instant gratification.

Corporations are looking to roll out applications and services that go beyond mobile email, such as sales force automation (SFA), field-force automation (FFA), and customer relationship management (CRM). As the mobile services platforms evolve, the abstracted capabilities will be leveraged by third-party solution providers to build custom applications as well as launch new product initiatives that take advantage of new features in the platform.

Enterprise mobilization will be a high priority for enterprises that have a mobile workforce and are seeking to be competitive and efficient. By investing in a mobile-services platform and by partnering with appropriate players, enterprise customers will look to both take advantage of mobile technology's unique features (such as location, presence, and communication) and to extend the corporate databases and information repositories for remote access.

As wireless applications are being adopted across various vertical systems, the wireless industry value chain is shifting from transport to applications, security, integration, mobility management. More and more, the communications industry is looking like the computing industry, and vice versa.

m-Public Safety

As we have seen over the past many years, no country, whether in an advanced state of development or in an emerging state of development, is immune to natural and man-made disasters. Mobile technology will have a significant impact on how we detect, monitor, respond, and analyze small and large-scale disasters. One of the areas where mobile capability will have the most significant impact is emergency response. The always-on capability of

mobile technology will open a channel of communication with the populace in an emergency situation. The channel can not only be used to inform, but also to guide the affected in a very personalized way. In the process, this could save millions of lives. Mobile capability will have an impact in the following areas of public safety:

Early detection – As is the case with life-threatening diseases, the chances of surviving a disaster are greatest if it is detected very early. To gain an upper hand on the crisis, the command center must be able to take input from a variety of sources: humans, machines, and sensors. This must happen through a variety of channels: mobile technology, emails, and phone calls With an infrastructure of early detection, many serious crises could be averted, lowering the human cost.

Data gathering – the biggest impediment to effective command control during an emergency is lack of data. Command centers are often operating in the dark without any real-time feeds that can help them prioritize and direct resources effectively. By placing various sensors in the impacted area and by using the available cellular connections as sensor objects, officials will have a much better grasp of "situational awareness"[16] that can have a significant impact on the planning and execution of a strategy. For example, first responders to a fire can grasp the situation more quickly—and respond to it more appropriately—by having the data inputs of GIS, GPS, wind-flow field, temperature, humidity, fuel load, topology, satellite imagery, citizen response, traffic status, and evacuation response.

Modeling and predicting disasters – Disasters don't announce their arrival. As such, significant effort must be put into modeling and predicting the behavior of emergencies from disease epidemics to terrorist attacks and from wildfires to earthquakes. How are you going to direct an evacuation plan? How would you inform all affected citizens? What if the sensor networks fail? How does one feed the modeled data into a real-time evaluation process?

Guidance in emergency response – The effectiveness of a response is determined by how rapid it is and how good its communication is. By coordinating well with the application platforms and operators, command centers can issue very specific guidance and information to the end users so they know exactly what to do, which route to take, and how to contact the authorities. The guidance platform is not only for the end users, but will also help the authorities to coordinate their response by tracking their assets and resources; providing up-to-the-second status reports; and, most importantly, determining what to expect in the minutes and hours to come based on real-time modeling.

In addition to the above vertical systems, practically every other industry segment will benefit from advances in mobile technology, which can help in the realms of education, agriculture, travel, consumer products, and materials and construction.

What Does It Take to Make It Happen?

The gains discussed above won't be realized unless the various players in the ecosystem come together to lay out an implementation road map in their respective regions. Laying out a vision is one thing, but implementing in a time-efficient manner is another. There are significant hurdles to realizing the goal of an m-services platform that will enable the services discussed above. First and foremost, such efforts require investment. How do such projects get funded? What's the financial incentive? Is it a commercially-driven endeavor or something that is pushed by governments? Who is going to drive it? Answers to these questions will dictate the pace of deployment over the course of next 10 years.

In addition, the use of wireless technology for enterprises such as health care, emergency services, agriculture, and education will raise some serious questions around security, privacy, regulations, legal ramifications, public policy, and the cost of any proposed projects. The introduction of mobile technology into the equation will help decentralize any efforts, infrastructure, and costs. Some entities will find their power and control in the ecosystem redistributed. Many will embrace it as an opportunity--or even as the new reality. Nevertheless, some will resist change fiercely and force the pace to slow down. How will the information and success stories shared and replicated be key in realizing the vision of the m-services platform for 2018? Given the scarcity of resources, we can't afford to reinvent the wheel time and time again. Leadership will be needed to distill and distribute information and best practices. Leadership will also be needed to build and share infrastructure to minimize costs.

Over the last 10 years, we have seen the average selling price of mobile devices come down significantly. To reach the rural markets around the world, handsets that cost less than $20—or are free—will be needed. What business

models will enable such deployments? Better user experience and increased access to information on mobile devices will also lead to changes in consumer behavior and expectations. How fast will the various industries collaborate to respond to such needs?

Finally, the world order in telecom has been turned upside down in the last 10 years. In the future, the majority of the growth will come from the emerging markets. Will these economies drive the innovation, the requirements, and the future platforms in mobile technology? How will ecosystems adjust to such changes? Will the efficiencies of newly developed health-care systems in some regions in India be readily transferable to the United States?

Also, we must always keep the bigger picture in sight. Regions where starvation is the primary challenge are not going to embrace mobile technology until their most basic needs are met.

Clearly, we will answer many of these questions as we progress toward building future mobile-services platforms, applications, and services. The following will be needed to make the vision discussed in this paper a reality.

Private-Public Partnerships

One of the most important elements that will have an impact on the evolution of the mobile-services platform—irrespective of the applications that are built on such an infrastructure—is the collaboration between the private and public enterprises: the profit-driven companies, the research institutes, the government agencies, the not-for-profit entities, the charitable concerns that might be focused on specific goals, and the consumers at large. This is essential for the following reasons:

Funding - As we all know, without significant funding and focus, even the simplest of the goals face challenges. The various participants in the ecosystem need to come together to serve common goals that impact people in their communities. Financial and technical resources need to be pulled together to ensure that the best teams are in place to tackle the challenges and to ensure that the minimum amount of resources are wasted due to the duplication of efforts or a lack of dissemination of information. The deployment of emergency services in the state of Andhra Pradesh in India is a good example of how private-public collaboration to bring about change can have a lasting impact.

Technical collaboration - The 2006 wildfires in San Diego in the United States led to the biggest evacuation in that country's history. The emergency command center didn't have the capability to send citizens SMS messages based on their location or the severity of impact. The process required to work with the operators wasn't in place and would have taken weeks to work out. Similarly, the scientific community knew about the 2004 tsunami in Southeast Asia hours in advance, but didn't have a way to communicate the danger to unaware citizens. It is imperative that local agencies and operators work on a plan to enable instant communication from emergency command centers.

Education and awareness - Even the best technology and plans will fail unless there is sufficient education and awareness about the initiatives, capabilities, and expected responsibilities of the evolving landscape. Efforts should be put in place to make citizens aware of the various options and the information available and how to use and respond to such resources.

Regulations - The government and related entities have the responsibility to foster growth and remove impediments by keeping policies and regulations up-to-date. With respect to mobility, work needs to be done to ensure market competition, protect customer privacy, secure sensitive information, and have the boundary lines of liability clear as technology evolves to become more ingrained in our daily lives. As commerce will inevitably move toward mobile technology, the threat of fraud, money laundering, identify theft, and violations of privacy will be of concern. Adequate laws and protections need to be in place to comfort those involved.

New Business Models

Wireless technologies are developing rapidly, which allows for infrastructure to be rolled out on a more cost-effective basis. This is creating anytime-anywhere connectivity at lower prices, which drives up demand and speeds adoption. To get the latest and greatest in the hands of consumers, we will see different business models take shape. For a consumer, the next cellular connection and service could come from a bank, insurance company, hospital, handset provider, grocery chain, content portal, search engine, or research institute. It could come from any number of organizations that would subsidize the connection for access to the consumer.

There will be some models for which data is gathered via WLAN or WPAN devices and the cellular or wireline connection is used to connect to remote servers. Alternate devices that will have inbuilt cellular connections without monthly

subscriptions paid by consumers will be common. This will lead to new devices designed for specific purposes such navigation, health-care delivery and disaster response.

Conclusions and Recommendations

It is clear that mobile technology is going to become a utility so imbued with the infrastructure that it will be tightly integrated with everything we do. The last 10 years were about providing access to voice communications to the masses while laying the foundation for mobile-data services. The next 10 years will see a rapid growth in the way applications and services are built in each vertical segment to reach an ever-expanding mass market that will achieve close to 100 percent penetration by 2018. There are significant opportunities to leverage mobile technology in health care, emergency services, enterprise applications, governance, and other segments. However, while opportunities are rich, the challenges that await us are daunting. It is hard to anticipate our needs 10 years from now, but if we lay the foundation of a robust and modular platform, it will be capable of delivering on any new opportunity. Specifically, industry players will need to work together to chart out the functionality of the mobile-services platform going forward.

Acknowledgement: Many thanks to Michel Gaultier, Don Jones, Dave Smiddy, and Sarla Sharma for their assistance with this paper.

References

[1] http://www.ubiq.com/hypertext/weiser/SciAmDraft3.html
[2] Source: Chetan Sharma Consulting. Some images are adapted from Qualcomm and Motorola
[3] Due to multiple SIMs, the actual number of subscribers is 15-20 percent lower than the total number of subscriptions, which is generally used interchangeably with the number of subscribers.
[4] Source: ITU, Chetan Sharma Consulting
[5] As we mention in the paper, the definition of being wireless will change as cellular connection becomes available in most electronics devices. Additionally, the deployment of millions of sensors will mean that the actual subscriptions will be significantly higher than we can estimate at this time. The estimates presented here are based on mobile phone subscriptions only and do not include estimates for sensors, consumer electronics, and devices that will have built-in cellular connection as well as an airtime subscription bundled with the device (e.g. Amazon Kindle or Portable Navigation Devices)
[6] Source: Chetan Sharma Consulting
[7] The dichotomy between developed and developing nations is a very simplified concept that has been around for about 50 years. It is clear that a transformation in the distribution of wealth worldwide will change the picture in the next 10 years. Countries that are considered developing by today's definition will become economic superpowers in 10 years. China and India and more dominant than some of the developed nations, even if they have not caught up with some in terms of GDP or per capita income. Many observers today assume that the middle classes of India and China together in 10 years will represent about the same group size of the middle class of other "rich" countries. However, purely for the purposes of comparison, we will use the existing definitions to discuss the shift in the mobile ecosystem.
[8] Source: Chetan Sharma Consulting
[9] Source: ITU, Chetan Sharma Consulting
[10] Source: Chetan Sharma Consulting
[11] The Emerging Personal Health Information Network, Inside Edge, September 2007, Volume 13, Number 8.
[12] We will also see health-care-specialized devices with wireless connectivity like the ones from CardioNet, a United States-based company.
[13] Many phones already have biometric sensors for authentication. We will be using these same sensors and additional ones to monitor vital signs and transmit them. Some of the innovative concepts being worked on are measuring heart rate with a cell phone and also using the measurement for authentication for other purposes like banking and payments. Pharma companies are likely to use bar codes and NFC (near-field communications) to provide more information on labels and drugs so users can just scan the labels from their cell phones and get relevant information or instructions.
[14] Research shows that poor adherence leads to increased drug resistance. For example, if a patient with tuberculosis takes treatment once a week rather than the prescribed regimen of twice a week for the duration of the treatment, the risk of a positive culture at 12 months is five times greater. Source: The Role of Mobile Phones in increasing Accessibility and Efficiency in Healthcare, The Vodafone Policy Paper Series, Number 4, March 2006.
[15] Data gathering will not only be for physiological measurements like ECG and blood pressure but also for measurements at the biomolecular level, which require much finer measurement. Information will be digitized and continuously transmitted depending on the need.
[16] Some of the ideas discussed in this section were developed during discussions at the Future in Review 2008 conference