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Enterprise Mobility

PERSPECTIVES

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Greetings

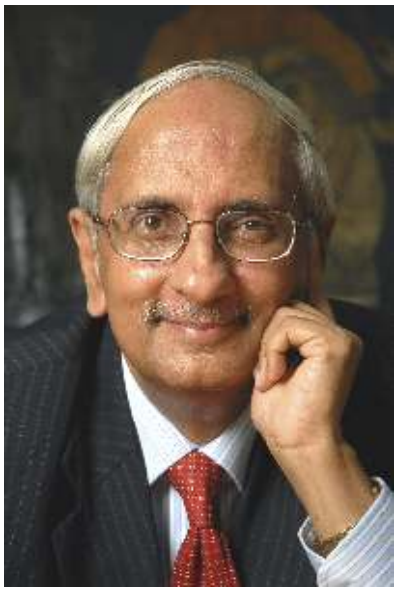
Once again, I have the pleasure of presenting the distilled wisdom from a wide variety of TCS consultants on one of the most urgent topics facing technologists around the globe.

Mobility is a compelling topic in several dimensions, bringing together a parade of innovation in networking, smart devices, and applications. Often overlooked, however, is how the passion to exploit mobility is a proxy for and acknowledgment of the rising importance of IT.

Mobility represents IT moving out of the back office and into every realm, in every location. Because of mobility, IT must be reimagined. We can now think with far fewer limits, which is both an opportunity and a challenge.

Our job at TCS is to help manage the complexity and unearth the business relevance of the potential of mobility and all aspects of IT. I am happy to present a new issue of Perspectives that represents a substantial step forward in that quest.

N. Chandrasekaran
CEO & Managing Director



When applications started to become mobile, a whole new set of challenges faced designers and engineers. To work properly, mobile applications could not assume pervasive connectivity. They had to work in a connected mode and offline. To make this happen, data had to be synchronized. Work done offline needed to be sent to the server when connectivity was restored. While both the client and server application had to be transformed to support this way of working, the result was a better application, one that could do more to help users work wherever they needed to.

The improvement in application architecture sparked by mobility is just one of many examples of how mobility is driving innovation. Mobility is a gift that will allow us to move IT to a higher level. Just as mobile apps are better apps, mobile IT is better IT.

The question is: How do we get there? This question is not theoretical. Mobile technology is ready to go. The challenge is figuring out what mobility means for your business.

In this issue of Perspectives, we outline dozens of specific applications that apply in a wide variety of industries. We present analysis of technology, business architecture, and trends affecting consumers and end-users in both general and industry specific terms. My belief is that most readers should come away from this issue with at least 10 actionable ideas.

I also hope that everyone who reads this issue of Perspectives senses the enthusiasm of the TCS consultants who wrote these articles. We have found that mobility is so exciting that it often reenergizes technologists and the business people they work with to go farther than they have ever gone before.

J. Rajagopal
EVP & Head, Global Consulting Practice

CONTENTS

Vertical Snapshots

What the Future Holds

Prologue: Consumerization from the Outside In

In each generation of the development of IT, the challenges intensify, but as we rise to the occasion, the value delivered to the business grows immensely. As IT has expanded from mainframes to PCs to the modern era of mobility, more and more business activity is supported by technology.

But, as more people and business processes are tracked and automated, a strange thing happened that IT has yet to come to grips with. **The locus of innovation, which had previously been firmly in the realm of business technology, moved to the world of the consumer.**

The opportunity to use consumer devices and other on-demand services for business purposes gave rise to a concept called the **consumerization of IT**. Consumers now have powerful mobile devices at their disposal. It is only natural that these tools are put to work.

The next wave of consumer-led innovation is taking place in the realm of mobility. Mobile applications are providing instant access to information, services, and applications. The key question facing most businesses is simple: "What does mobility mean to our business?"

Most IT departments find themselves surrounded by an army of consumer technology that is pushing its way in. Inside the walls of IT is a collection of technology that was not constructed for the flexible, social, radically distributed, and mobile way we work. There is no reason for IT to resist consumerization, but to accelerate it to offer more of the ease of use, immediacy, and intimacy of consumer technology.

The IT Impact of Mobility

If we look at the forces driving consumerization, thinking of the transformation in terms of mobility captures all the important trends and raises all the vital issues. Mobility combines advances in wireless networks, in devices, and in applications. **If an IT department fully embraces mobility and the changes it brings, it will have become consumerized and the business will reap massive benefits.**

But it is a long trip from the current state of IT to a fully consumerized mobile world. A variety of issues must be addressed for the full value of mobility to be realized. Perhaps most significant is the shift in the power of IT to call the shots. **The IT monopoly is over**. Users select devices, install their apps, and work when and where they please. In general results are positive, but many dangers lurk with this freedom. Restoring monopoly control is not an option. Many measures are needed to ensure security while allowing mobility to enhance productivity.

The biggest nightmare associated with mobility is company data that flows into a wide variety of mobile devices and applications, many of which were not built to meet enterprise standards. **Supporting mobility while at the same time keeping data safe and secure is daunting** and requires new approaches.

Ensuring a quality user experience for both employees and consumers is going to change the way that applications are built. Not everything that is possible on a desktop application or on a web site must be on a mobile device, but the user experience must be pleasing and consistent. The same underlying business process must be exposed in an appropriate way.

Mobility will change business processes as different types of work migrate to the people and locations best suited for them. Indeed, these process changes may be the engine of the largest impact of mobility, as information becomes available when needed and needless delays are eliminated. Such changes represent a significant challenge to the design of business processes and to the structure of existing applications.

Needless to say, to handle these challenges, IT will have to be managed differently. The goals of secure, reliable, speedy access to the best computing resources remain the same, but new skills, processes, and technology are required. New approaches to IT Service Management, new methods of managing devices, and new ways of building applications all represent a starting point on a long journey.

The articles in this edition of Perspectives, summarized below, provide more information and guidance about mapping the journey that may be right for your company.

The Evolution of Mobile Telecommunications Technology

How has mobile communications technology evolved? Mobility is delivered through three layers: networks, devices, and applications. Each layer has been the focus of tremendous innovation and progress in the last decade. The first article in Perspectives looks at how each of these layers has evolved, where it is going, and the implications for those mapping out an enterprise mobility strategy.

In networking, wireless personal area networks, wireless LANs, and wireless WANs are all leading to the creation of a seamless IP network providing ubiquitous connectivity. As newer wireless technologies are adopted for enterprise use, the CxO must keep three factors in mind when deciding on technology: cost of transition, throughput, and security. Phasing out existing wired infrastructure entirely is tempting, but that transition must be balanced against the payback period for legacy investments, requiring careful planning.

Mobile devices have advanced in mobile OS technology, user interfaces, increasingly powerful mobile processors, smaller form factors, displays, and a plethora of new features such as support for HDMI and HD video recording. The current state of consumer mobile technology can seamlessly support complex enterprise applications, thereby necessitating mapping out a strategy for mobility.

Mobile applications have evolved from simple scratchpads and calculators to PDAs and media players, and now are powerful enough to serve as rich gateways to cloud applications. The power of modern applications in conjunction with networks and enhanced device capabilities is exciting and bewildering. Context-aware applications that take into account location, time, and proximity to other services and capabilities may be the next frontier for applications.

Takeaways

- Conversion to all-wireless networks is feasible now, but wired infrastructure must be phased out taking into account such factors as depreciation of assets. The technology is ready, awaiting the business case to be made
- Near-field communications (NFC) may pay off on the promise of earlier technologies like RFID and Bluetooth. For example, NFC devices are already being put to commercial use in public transit in France
- Though understanding the range of wireless technologies and their evolution takes some time, understanding wireless telecommunications trends and their implications going forward is time well-spent

Developing a Strategy for Mobility

The second article in this edition provides guidance about what to do when crafting plans to make mobility work for business. A sharp distinction is drawn between creating a technology-focused mobile strategy, which refers to helping employees find the right devices, platform, and applications, and a business-focused strategy for mobility, which analyzes how mobility will affect stakeholders.

To please customers, it is vital to identify the "mobility voice of the customer" in order to analyze where mobility is most beneficial. To make a difference, mobility must improve the customer's life in some tangible way. This is a high standard, but the only one that matters.

The same standard applies when expanding mobility inside a company. The benefits to various workers must be identified. Based on that segmentation, strategies should be crafted that make for more productive workers and more efficient processes.

If this focus can be maintained, the result is m-powerment, meaning significant payback. A more superficial approach will result in lots of shiny new devices, but little business value.

Takeaways

- A mobile strategy and a strategy for mobility are very different in their implications for the organization
- Decisions about mobility technology cannot be made unilaterally; the customer and partner ecosystem has an important role to play and the organization cannot dictate their use of mobility
- As mobility pervades an organization, roles and responsibilties change. One goal is to help workers optimize the way they use mobile technology in alignment with applications that offer an ROI to the company and have a high impact on key buiness processes

Mobility's Broad Impact on Enterprise IT

The largest impact of mobility is the way it transforms business processes. Initial efforts essentially treat mobility as a spice, a way to enhance what you are already doing, to make applications and information more widely available. But to get the benefit of mobility as a main course requires a deeper and more systematic analysis. IT systems can be broken down into applications, information and technology infrastructure. Each of these layers is used by different stakeholders, from customers, to vendors, partners, and suppliers, to executives and staff.

A systematic approach to mobility requires an assessment of the impact mobility will have on the individual components of IT systems: applications, data, and infrastructure. Only by taking a holistic view of mobility that incorporates all of these levels can CIOs effectively assess the challenges that they face in creating a strong mobility strategy.

Takeaways

- Think carefully about the users when choosing between thin clients, rich clients, and on-device applications to ensure compatibility with the end-user segment. Recognize the device and data requirements for each type of app, with thick clients requiring both code and data on the device, rich clients pulling data from the network, and thin clients being the most lightweight
- Use of an enterprise app store can help ensure that users have the latest version of all apps
- Plan changes in infrastructure with the growing impact of mobility in mind. Almost every upgrade to any layer of the technology stack will be affected by mobility. Each upgrade should increase the ability to support mobility

Examining the Mobility Stack

While mobility will change a large number of aspects of the way we work today, it will not replace the current application portfolio. Rather, the work we do in ERP, CRM, Supply Chain Management, Procurement, and dozens of other applications will become more valuable because mobility will allow the information to be delivered where it is needed and flow back as people perform tasks using mobile devices.

But given the size of the potential application portfolio that could benefit from mobility, it is clear that a piecemeal approach will not work. For companies to succeed in mobilizing their workforce and in extending their offerings to customers through mobile devices, they will need a platform strategy that can solve many problems at once. New capabilities will be needed at the user-device layer, the transport/network layer, the device management layer, the applications/services layer, and the enterprise portal layer.

Takeaways

- Of the five layers of the mobility stack, the top two layers are owned by the enterprise while the bottom two are owned by the telecom service provider. The middle layer, the device management layer, is shared by the enterprise as well as the telecom service provider. The enterprise IT function and the telecom service provider must work in harmony. In this light, collaboration of these two entities is essential to a successful deployment of the device management layer
- Critical functions exist at the device management layer. Inventory and configuration, application control and upgrades, and policies and security must all be enforced at this layer
- The essence of a successful platform strategy lies in the formulation of an integration layer that can ensure the proper working of all of the platform layers, which will require a unified platform architecture

Safeguarding Mobile Data

The nightmare has already happened to other companies. A smartphone left on a plane falls into the wrong hands. Sensitive data becomes widely distributed, leading to damaging news reports and drops in market value.

The world of mobility has dramatically increased the threat of data leakage and challenges IT to allow freedom but reduce risk. The fifth article in Perspectives describes the paradigm shift that is taking place with respect to device and data management.

The challenge, of course, is that the dramatic growth in the number and diversity of devices increases the risk of losing data. This challenge will not yield to one approach. Data security technologies such as digital rights management, data encryption, and application signing help ensure the safety of corporate data. This article also encourages implementing an Information Security Governance Framework to underpin these technology solutions.

By crafting the right mix of solutions, CIOs can ensure that mobile data is safe, secure, and well managed.

Takeaways

- It is important to understand the data security lifecycle in the context of the changing landscape of mobility to identify effective solutions
- Data theft in the age of mobility is a real threat. Such breaches are front-page news with devastating impact on reputation and stock prices. Companies are not investing enough to mitigate this risk
- Adopting an information security governance model provides a way to keep up with a changing landscape and focus attention on the areas of greatest vulnerability

Fostering IT Service Management Maturity through Mobility

One of the key achievements in the world of service management is the formulation of the IT Infrastructure Library or ITIL. The sixth article in this issue of Perspectives examines the impact that mobility will have in IT Service Management (ITSM), the larger management discipline that has grown out of ITIL.

The article recommends that IT service managers break out of the confines of concepts like Quality of Service, which focuses on the system more than the person using the system. While Quality of Service emphasizes that a service is reliably available, Quality of Experience focuses on making sure that the users get what they want. Prudent IT service managers should embrace Quality of Experience as a metric, which has become something of an imperative for mobility.

To ensure effectiveness of service management in a multi-device mobile world, it is important to assess the impact of mobility before embarking on ITSM processes of service design, delivery, and support.

Takeaways

- Service design, delivery, and support will be radically changed by the diversity of devices and platforms that are chosen by end-users and under the control of third parties
- It is necessary to assess the impact mobility will have on the components of ITSM, to fully understand how the processes of service management such as service design, delivery, and support will change
- As a serendipitous outcome, adopting mobility may help expedite a transition to a higher maturity of service management (ITILv3 versus ITILv2)

Mobility in Banking

The seventh article in Perspectives covers the ways that mobility can be applied in the banking industry. In addition to traditional segmentation factors, based on their banking transaction usage, mobile customers may be further categorized as online savvy customers, offline branch customers, and unbanked but highly mobile Gen X and Gen Y customers. Each segment has innate needs that banks should address using proactive business initiatives that focus on the users' requirements and comfort level with technology.

Takeaways

- Attracting mobile savvy customers requires targeted strategies ranging from customized and automated wealth management advisories to location based services and virtual banking with cross selling opportunities
- Banks have so far focused on simple information based banking services at the cost of interactive transaction based services. As technologies like Near Field Communications become more widely available, banks should be poised to offer more advanced services
- ROI depends in part in helping offline branch customers become comfortable with online banking, with the help of mobile and laptop/desktop applications

Mobility in Insurance

The eighth article in Perspectives covers the potential insurance industry applications for mobility. Analysis of the insurance value chain shows how mobility could impact processes in life insurance and property and casualty, value chains that are ripe for redesign and optimization using mobile devices. The potential of telematics applications is analyzed along with specific suggestions for applications related to product development, marketing, distribution, new business and underwriting, account management and services, and claims.

Takeaways

- By mobilizing agents, insurers can reach new target markets faster. Agents who are provided with access to information anytime anywhere can not only improve consumer satisfaction, but close business more quickly
- By improving self-service options and pushing more tasks to agents, insurers can reduce customer service calls and improve operational efficiency. Enabling claims capture from the field and providing real-time access to required information including third parties or service providers will allow insurers to control and manage losses better
- Mobile telematics allows automatic data collection that can enable new products and provide information to customers about how to avoid risky behavior. In future, telematics can be used to prompt drivers if an accident seems imminent

Mobility in Manufacturing

Applications of mobility in manufacturing are the focus of the ninth article in Perspectives. The application of mobility inside the plant is examined but so are opportunities for customer facing applications for gathering information and providing value at product facilities, in providing after sales service, for gathering research information, and in product marketing processes. Some of these areas could revolve around customer interactions, inventory management, quality assurance, and asset tracking.

As employees are among the biggest users of information inside an organization, it is important to expose important Key Process Indicators (KPI) to expedite better decision making. A fascinating, multi-dimensional graphic maps the chief enablers in the areas of network, devices, and applications and shows how those enablers are related to the process in both customer facing and other value chain related areas.

Takeaways

- Extensive use of mobility in the workplace will force organizations in the manufacturing industry to redraft many of their technology strategies in order to adapt to this evolution
- It is important to take a closer look at the manufacturing value chain to assess where mobility can be applied most effectively. One promising area is in capturing customer feedback
- Creative use of mobility could see GPS-enabled sensors attached to mobile assets such as dump trucks, which could allow workers to track assets using wireless handheld devices. In fact, mobile devices could serve as safety devices, alerting workers who enter a hazardous area

Mobility in Retail

Applications of mobility in retail are the focus of the tenth article in Perspectives. For retailers to decide what technologies to adopt, they need to determine the basic ways the industry's three predominant customer segments, at home, on the road, and in-store, will use mobile devices. Robust purpose-based applications need to be designed and offered as native on smartphones. If a unified customer engagement platform is selected, creating and maintaining many versions of apps can be avoided.

Takeaways

- "M-retailing" should not be treated as a differentiator but as a complementary strategy
- Security is an important foundation for m-retailing; customers won't buy if they fear that personal information is at risk
- M-retailing strategy should incorporate existing customers, who have conducted multiple transactions with the company
- Retailers should think of mobility as a part of a unified customer engagement platform

Beyond Mobility: From Everywhere to Every Thing

The eleventh article in Perspectives looks ahead to new forms of applications that fall under the domain of ubiquitous and pervasive computing. When defining ubiquitous computing, Xerox PARC researcher Mark Weiser said, "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." The power of applications on mobile devices equipped with sensors that detect aspects of the environment or interact with other devices enables a whole new class of applications. Applications will emerge that are embedded, context aware, personalized, adaptive, and anticipatory. Opportunities for ubiquitous applications abound for consumers, in industrial settings such as manufacturing and utilities, and in verticals such as banking, insurance, and healthcare.

The article introduces the technology stack needed for ubiquitous computing and suggests ways that companies can start experimenting to understand the potential of this powerful application paradigm for their businesses. This forward-looking article offers compelling ideas about how smart devices can be used in various industries.

Takeaways

- The Internet of Things and Machine-to-Machine communications are paving the way for the era of ubiquitous computing
- Ubiquitous computing is poised to gain broad acceptance as "Digital Natives" enter adulthood
- Challenges to ubiquitous computing include privacy concerns and device heterogeneity, since a variety of appliances, networks, applications, context-specific content, and decision support algorithms must all be connected

Mobility: The Changing Business Landscape

An interview with Gartner senior analyst Ken Dulaney provides a finely nuanced view of where mobility is and isn't impacting the business landscape today. For example, mobile payments, an area where the technology is ready, have failed to take off in most of the world because of a lack of coordination among key market players. Dulaney projects it will be 2015 before mobile payments become mainstream. In other areas, he sees mobility's growth as organic and uneven. Traditional devices like refrigerators and cars are incorporating chips with mobile communications capabilities, and smartphones and other mobile devices are increasingly enabled to act as remote controls for other devices, which can be diagnosed, remotely started, or monitored over the Internet.

Reaping the Maximum Value from Mobility

As always, this issue of Perspectives is only important if it makes a difference to you. The topic of mobility is so urgent, so compelling, and so ripe for adoption that we are confident most readers will find new and actionable ideas in these pages.

We hope that this issue of Perspectives exceeds the standards set so far and helps chart a pathway to an IT infrastructure which embraces mobility, and that amplifies the talent and energy of everyone in your business.

As always, we look forward to hearing your thoughts about the insights presented in these articles. Please email us at **global.consulting@tcs.com**.

Developing a Strategy for Mobility

Mobile Telecommunications

Telecom Technology Evolution

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Gain a full picture of the future of mobile telecommunication technology by examining the evolution of networks, devices, and applications

Abstract

In order to fully understand the future of mobility, it is important to examine the evolution of individual streams of mobile telecommunication technology. These developments have not happened independently of each other. As mobility-enabling technology improves, three streams of telecommunication technology—networks, devices, and applications—will become truly smart in the future. Networks will converge, devices will become wearable, and context-aware applications will act spontaneously and initiate actions.

In the past, enterprise adoption was a key driver of technology commoditization. By contrast, recent progress in mobile technology has been largely shaped by consumer demand. Enterprises need vision to see how mobility will change over time so that they can help drive its evolution and bring about economies of scale.

A New Era of Mobile Telecommunications

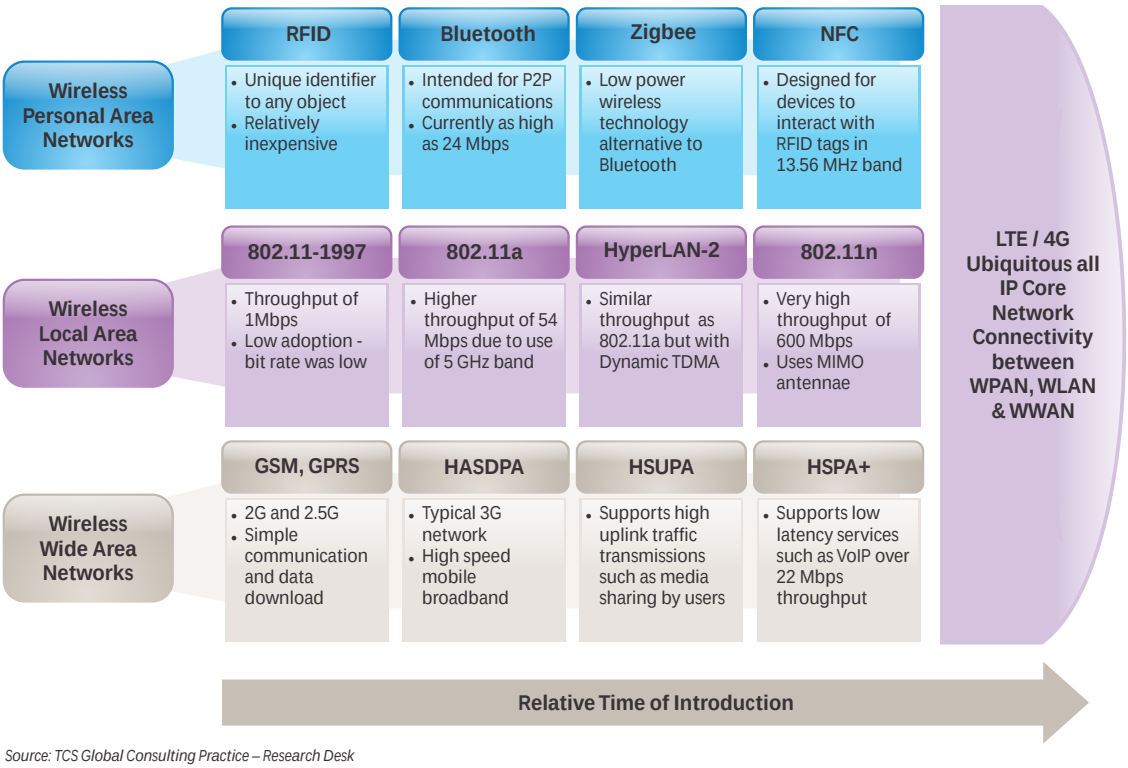
Telecom technology is changing our lives in ways we did not envision. Today, efficient packet switched networks carry media packets (voice, data, and video) to intelligent mobile devices that users carry everywhere.

The past 50 years have witnessed a migration from traditional telephony networks to telephony networks based on an IP backbone and the cloud. Today's telecom technology can be effectively divided into three streams—networks, devices, and applications. Following the evolution of each stream provides background and context for understanding what the future holds.

The Evolution of Networks

Figure 1 traces the evolution of the Telecom Service Provider (TSP) wireless networks. We see that consumer demand shaped the evolution of wireless networks.

Figure 1: Evolution of Wireless Networks



Source: TCS Global Consulting Practice – Research Desk

Figure 1 lists wireless network types from shortest coverage distance (at the top) to those offering the widest coverage distance. Wireless Personal Area Network (WPAN) involves short distance wireless networking of devices and systems. One of the major uses of WPAN is for replacing wire with wireless access for peripheral devices to enable mobility and ease of deployment. Near-Field Communications (NFC) is a technology comparable to Bluetooth that has wider applications such as reading smart posters, exchanging information between devices (virtual business cards, photos), and conducting transactions. Unlike Bluetooth, NFC doesn't require pairing. NFC-enabled cell phones have many applications; for example, they can be used by security or administrative staff to verify the ownership of an asset or the identity of a person carrying such an asset.

Wider-range networking is provided by wireless local area networks (WLAN), which provide coverage of approximately 100 to 300m. The Wi-Fi standard is quite mature and has been a platform for several innovations. Other than the standard application of Wi-Fi as a wireless Ethernet for network access, enterprises have started exploring it to connect mobile devices as an alternate low cost route for Internet connectivity. Rather than having devices use their TSP networks for connectivity, such devices can be connected to the local Wi-Fi network instead.

The range of a typical Wi-Fi network can be extended to what is called a Wide Metropolitan Area Network (WMAN). Such networks can span a campus, several city blocks, or an entire metropolitan area.

Wireless Wide Area Networks (WWAN) offer the broadest range and are currently generating considerable excitement and interest. In the past, the focus for WWAN was on voice communications. Subsequently, data support was provided by standards such as General Packet Radio Service (GPRS). Data rates were further enhanced with 2.5G technologies such as Enhanced Data Rates for GSM Evolution (EDGE).

Case in Point: Using NFC to Boost Ridership

A leading French transport operator is one of the first organizations to introduce Near-Field Communication (NFC). They have installed NFC and 2D barcode-enabled information points in their entire local transport network. Passengers with NFC-enabled mobile devices can access real time information about the movement of buses and cars. They can also buy tickets through their NFC-enabled devices. Additionally, the feed has events listings and the latest news from leading newspapers. The introduction of NFC has boosted the transport operators' passenger volumes.

As network technology evolved, it ushered in yet another standard: 3G. For GSM, Universal Mobile Telecommunications System (UMTS) can offer download speeds of up to 2 Mbps. The only other technology that competes with this download speed is CDMA2000.

Next generation technologies such as 4G consist of Long Term Evolution (LTE) and World Interoperability for Microwave Access (WiMAX). These 4G networks are all-IP packet-switched networks. There is a move to consolidate the efforts of future versions LTE and WiMAX toward a unified standard to achieve the vision of 4G. These networks will involve the evolution of both WPAN and WLAN, as they will provide for a single ubiquitous network that supports speeds of over 100 Mbps for mobile devices. Convergence is the key to ubiquity, and ultimately we may see a single network mesh that covers the whole globe and realizes the dream of every network engineer – seamless wireless connectivity.

The Takeaway

Today, networks such as WPAN, WLAN, and WWAN are evolving. In the future, seamless mobility between WLAN and WWAN will be addressed by the evolution of 4G. This will be aided by context acquisition through multitudes of sensors and markers involving technologies such as RFID, NFC, Bluetooth, and Zigbee. Networks will be more intelligent, have higher throughput, and be more secure.

Implications to the Organization

As newer wireless technologies are adopted for enterprise use, CxOs must keep three factors in mind when deciding what technology to deploy: cost of transition, throughput, and security. A transition plan for phasing out the existing wired infrastructure should be designed keeping in mind the payback period for each of the legacy investments.

The Evolution of Devices

Mobile device technology has undergone changes, and its evolution has been largely consumer driven. With the increasing availability of low-cost bandwidth, mobile devices are used not just for communication and content creation, but also for web browsing with rich graphics, and for tasks such as handling workflows.

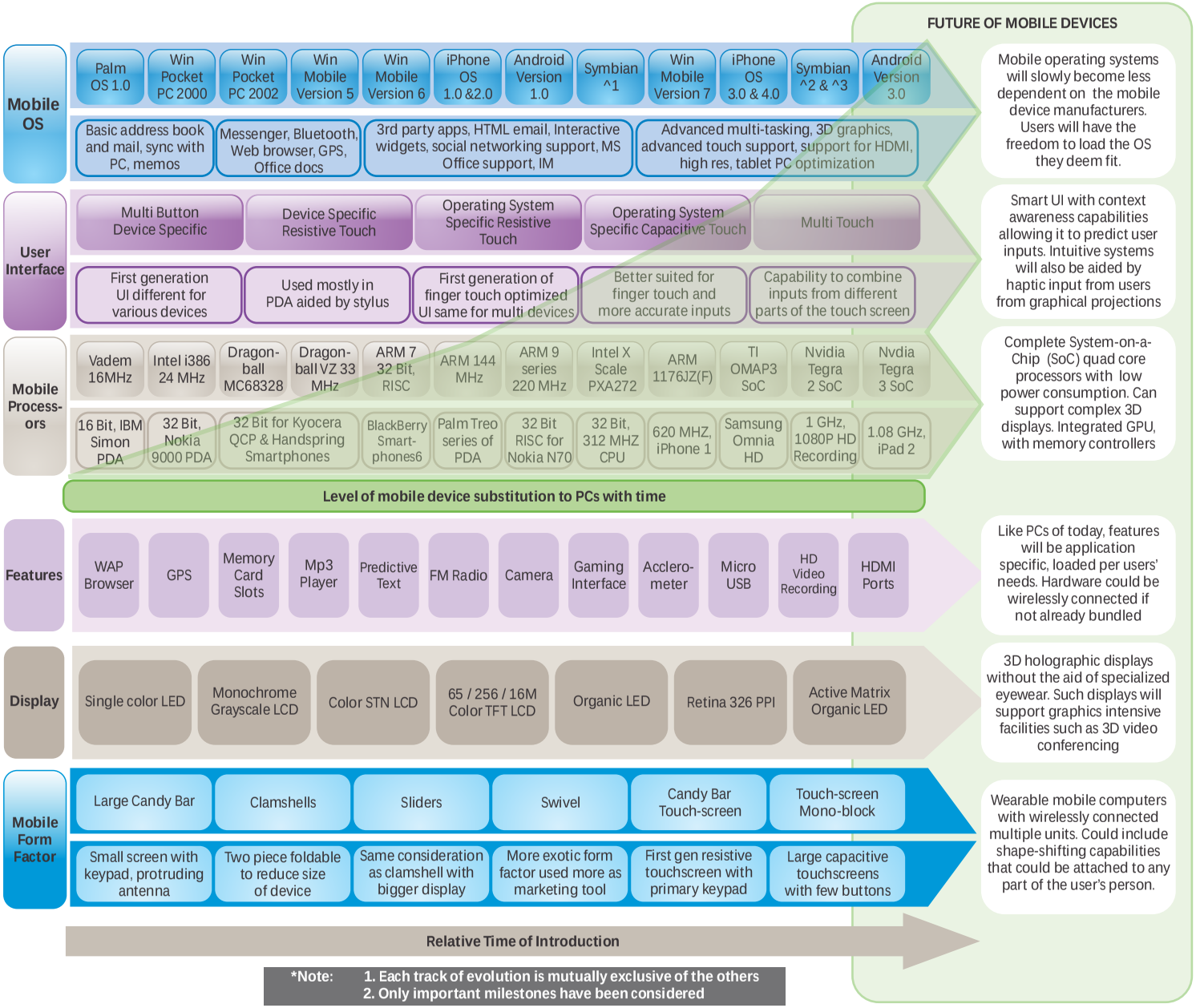
Usage patterns continue to evolve, which can be traced to three primary drivers of device technology evolution: mobile operating systems, user interface technologies, and mobile microprocessors/ semiconductors. Other factors include new features, crisper displays, new applications, device miniaturization, and resulting form-factors, which have also played an important role (see Figure 2). The three primary drivers require a little more analysis to better understand their individual evolution and their influence on what we might see in the future.

Case in Point: Mobile Devices in the Construction Industry

A medium-sized demolition and transport company had most of its employees and assets dispersed in the field. Coordinating employees and assets was a challenge.

Mobile device technology offered a solution. The company decided on a two-pronged approach—a mobile device supported with appropriate software. They selected phones that were designed for the construction industry. These phones supported Push-to-Talk or PTT facilities and iDEN technology, which allows for radio as well as cellular communication. The phones also have location-based awareness via GPS. Coupled with specialized software, these phones could be used for both communication and for locating company assets. This helped the company save time on auditing assets as well as fuel. The company estimates savings of over US $1 million.

Figure 2: The Evolution of Various Aspects of Mobile Device Technology



Source: TCS Global Consulting Practice – Research Desk

The first driver of device technology evolution is mobile operating systems. Enterprise customers saw the dramatic rise in popularity of the Blackberry OS, particularly for email access. The future could include decoupling of devices and operating systems, where end-users will effectively be able to run the OS of their choice on any device as long as the hardware is compatible.

Second, input device technology for the user interface (UI) has changed as well. Devices have moved from the keypad-based interfaces on the older mobile phones to touchscreens. Touchscreens are also undergoing evolution as they provide an increasing number of features such as multi-touch gestures. Today, in addition to touch-based input devices, gaming consoles use gesture-based remotes. In the future, haptic gestures may be captured by sensors on mobile devices, and the interface could be a projection onto a blank screen.

System on a Chip (SoC) integrates a processor, a Graphics Processing Unit (GPU), and memory controllers on a single chip. This integration improves overall system performance. With the advent of quad core processors, complex 3D display systems are possible. Nanotechnology is promising in this area.

Case in Point: Augmented Reality for Customer Satisfaction

A global bank offers a mobile augmented reality app that can be used by customers to locate the nearest ATM. Context awareness for this app comes from the camera and the GPS of the mobile device. Needless to say this has had a positive effect on customer satisfaction.

The Takeaway

Device computing power and memory have significantly increased and will continue to do so. Along with low-cost bandwidth and the limitless nature of the cloud, tremendous computing power is possible. User Interfaces and battery capacity and life will continue to play a crucial role in this evolution. With a quasi-standardization in the device platform landscape in terms of operating systems in use, today's consumer devices are suitable for deploying complex enterprise applications.

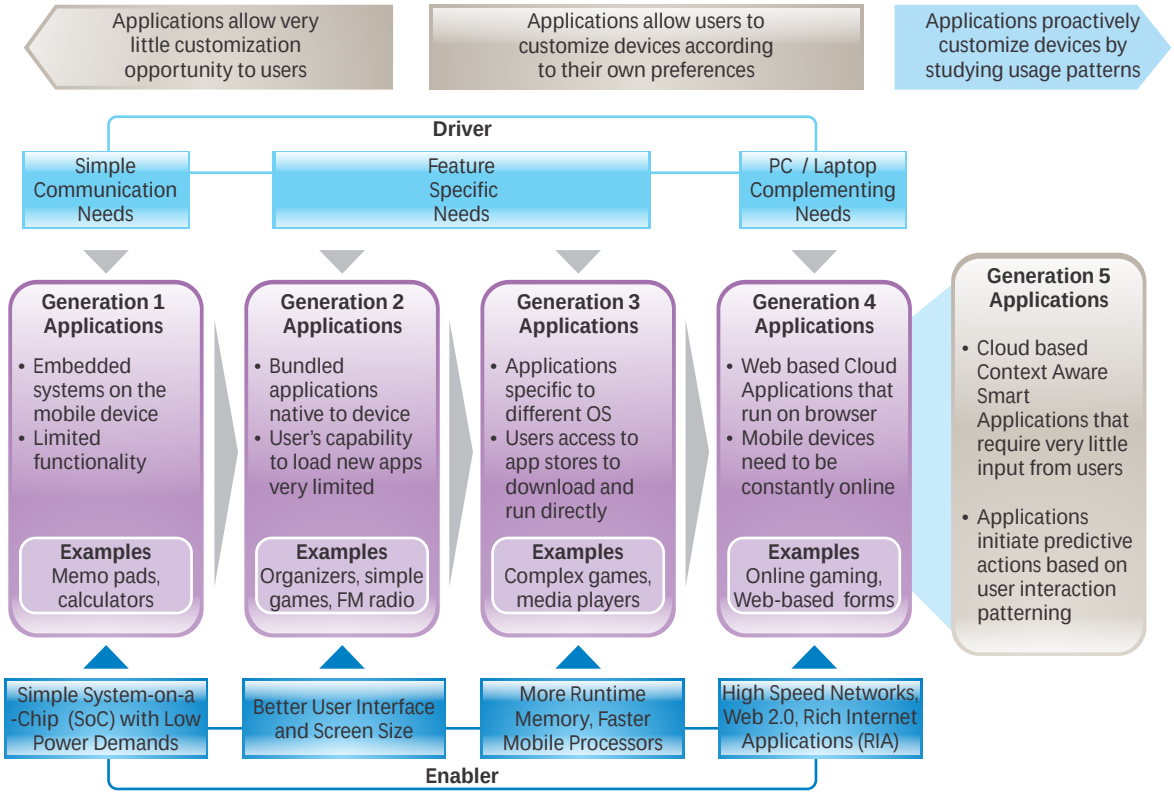
Implications to the Organization

As multiple mobile devices make their presence felt and the number of smart device users increases, the enterprise should ensure that its IT systems integrate well with these devices. A good approach is to first consider the impact mobility will have on the individual components of the IT infrastructure, and then design a technology adoption and transition roadmap. Organizations should also strongly consider adopting device management software in order to support a diverse set of smart devices, ensuring that patches and apps are up-to-date.

Evolution of Mobile Applications

Before mobile operating systems, applications had to be specific to various phone models. Figure 3 shows the evolution of mobile applications.

Figure 3: Evolution of Mobile Applications



Source: TCS Global Consulting Practice – Research Desk

One of the drivers of third-party apps was open source OSs such as Symbian and Android. A fourth generation of apps is cloud-based and runs on the mobile device's browser. Utilizing the best-of-breed Web 2.0 technology and creating rich Internet applications for mobile browsers, these applications turn smartphones into mobile thin clients, where minimal code and data resides locally on the device.

Interestingly, evolution of Web 2.0 promises to be one of the biggest technology champions for mobility. This is true if enterprises want to extend their applications to the latest portable devices by enabling them to deploy applications on portable personal devices using app stores and widget stores. Such use of Web 2.0 technology allows organizations to extend Enterprise 2.0 concepts to employees' devices. Also, by adding context-awareness to such applications, the enterprise could use the device's GPS to pinpoint an employee's exact location. Accessed through the enterprise portal, such applications could use augmented reality features to direct the employee to a required area. One of the biggest advantages of these types of cloud-based mobile applications is that irrespective of device change or loss, the user enjoys seamless application usage on their next device. Context awareness can also aid autonomous applications to initiate machine-to-machine transactions on their own.

This form of context-aware cloud applications may very well be the next generation of mobile applications. Context awareness will not only include GPS and accelerometers but also may encompass devices that sense everything from elevation, altitude, and pressure right down to an individual's blood pressure and other vital signs. These will allow the applications to predict user inputs by assessing usage patterns. This may one day become a reality as mobile devices become wearable (for example, the circuitry of the device may be woven into the fabric we wear). Such a device could gauge the pulse of the user together with the blood pressure and based on his or her history of cardiac trouble not only warn the user of an impending heart attack but also call the doctor automatically. Take this example to a newer level, smart applications running on pacemakers can call emergency units the moment the user suffers a heart attack. Could all this one day be called Mobile Artificial Intelligence (MAI)?

The Takeaway

Mobile applications have evolved to take full advantage of the powerful hardware of today's devices. Context awareness is helping some applications conduct autonomous machine-to-machine communications. But in the future, mobile applications may further evolve into smart applications that are context aware to such an extent that they will initiate most transactions proactively with very little, if any, input from users. These applications may not even reside on the devices themselves, but run from the cloud on the device browsers.

Implications to the Organization

There are multiple options that may be adopted for enterprise mobile applications. These can range from thick and rich clients to thin clients. These options have strengths and weaknesses ranging from cost to security implications. The best strategy is to adopt a mix depending on the context of usage.

Enterprise-Driven Technology Evolution

Mobility technology evolution has traditionally been consumer-driven rather than enterprise-driven. This slow and steady adoption of new technologies by enterprises stems from the balance they seek to create between the benefits that each new technology brings and its maturity at the time of implementation. The inherent need for stability and risk aversion has meant that enterprise customers adopt technologies only after they mature and are deemed stable.

At the same time, the enterprise has the potential to catapult any technology into mainstream by providing a scale of consumption and related efficiencies that are necessary to ensure mass adoption of new communications technologies.

From an adoption perspective, we see a shift from the traditional pattern of enterprise-enterprise-individual to an individual-enterprise-individual pattern. Improved connectivity and mobility in users' personal lives has heightened connection expectations of employees, customers, shareholders, field workers, and other stakeholders. In fact, the point of inflection has already been reached, beyond which the cumulative sales of smartphones and tablets will exceed the number of PCs, laptops, and netbooks sold globally. It will also mark the first time that any such inflection point has been driven by the consumer as opposed to the enterprise.

The future promises more consumer segment driven changes, bolstering the case for enterprises to accelerate the pace at which they adopt and adapt to new technologies. Resisting change brings the risk of being unable to capitalize on the productivity that the new era of mobility and the significant productivity gains that each subsequent transition will bring.

Enterprise customers need to move faster and ride new technology transitions with less adoption latency while embracing the new communication modes and models that result from these transitions into their business processes. Those that do so will effectively be creating highly evolved, self-optimizing business models and environments that are capable of continually discovering new sources of highly profitable revenue growth. As the future unfolds, evolution in telecommunications will help create a digital utopia for both consumers and enterprises, where everyone is connected, and smart devices become an extension of our consciousness.

m-Powering the Enterprise

Developing a Strategy for Mobility

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Is your organization ready to go mobile? Examine your strategy for mobility to see if it supports business growth

Abstract

Regardless of the industry, the key objectives of any business remain the same: enhance customer value, increase efficiency, find new ways to cut the cost of operations, and create new or expand current business models. Obviously, taking advantage of emerging technologies has become more and more important to achieve these objectives and sustain profitable growth.

Mobile technology in the workspace has already altered the way we respond to situations. In the coming decades, mobility will transform our lives and be taken for granted as part of the services and products we consume.

This change will have a profound effect on those employed in an organization. Not only will their roles and responsibilities change, but so will their relationship with the organization. How should CIOs balance the effects of this change?

The Meaning of "m-Powering"

Terms such as 4G LTE, WiGig, and M2M are sprinkled into news about mobility. We would like to introduce the term m-Power to this ever-expanding dictionary:

m-Power: "To enable or authorize through the quality, or state, of being mobile"

m-Powering an enterprise will impact how it functions, thereby affecting its business model, technology architecture, sales and marketing, and workforce management. Ultimately, m-Powering the enterprise increases productivity (Intel research shows that on average mobile users are productive for an additional 51 minutes each day), provides a higher degree of personalization, and fundamentally changes business processes and the way that the business is organized to achieve a competitive advantage. It's important to take the right approach when adopting mobility.

M2M – The new frontier?

It is impossible to speak about m-Powering the enterprise without mentioning M2M.

Initiatives such as Ericsson's 50 billion connections program and M2M partnerships such as TeliaSonera and Alcatel Lucent characterize this ever-changing market.

Innovation potential can be seen in smart cars, smart homes, and other smart objects. To take an example from the automotive industry, the need for "connectivity on the move" means next-generation audio and video electronics and applications for drivers and passengers. For tech savvy automotive users, this includes media players, video chat, wireless music sharing, place shifting (the ability to watch or listen to media from afar), and Internet radio.

Another innovation in automotive technology is the Advanced Driver Assistance Solution (ADAS), which will become standard over the next few years. An in-car Human Machine Interface (HMI), integrated with advanced driver assistance solutions, enhances driver efficiency and reduces risks related to distractions. Features include traffic-sign recognition, sleep detection, and pedestrian detection.

Strategy for Mobility or Mobile Strategy?

There is an important difference between having a strategy for mobility and developing a mobile strategy. A mobile strategy refers simply to the mobile technology or technologies selected by the CIO. In a strategy for mobility, the CIO selects and organizes the building blocks that comprise a mobile work environment. A strategy for mobility helps create an environment that prepares the organization as a whole to adapt to mobility across people, processes, and technologies. Such a strategy extrapolates mobile technology trends and opportunities to create a strategic plan tailored to the organization. A mobile strategy, on the other hand, simply helps employees select the right devices, platforms, and applications to support the company's strategy for mobility.

The difference between these two concepts is huge. To achieve competitive advantage and be a market leader, you can't be content with copying your competitors. Adopting a mobile strategy without tailoring it to suit organizational needs will not suffice. The differentiator lies in the robustness of your strategy for mobility.

Outlining a Strategy for Mobility

Mobility has matured from remote data access to location-agnostic transaction processing. According to IDC, by the end of 2011, 73% of the US workforce and 30.4% of the world's workforce will be doing business using mobile devices. With 94.4% of the mobile workforce using smartphones for both personal and business already,[1] it is imperative for organizations to define and design the right ecosystem for mobility adoption.

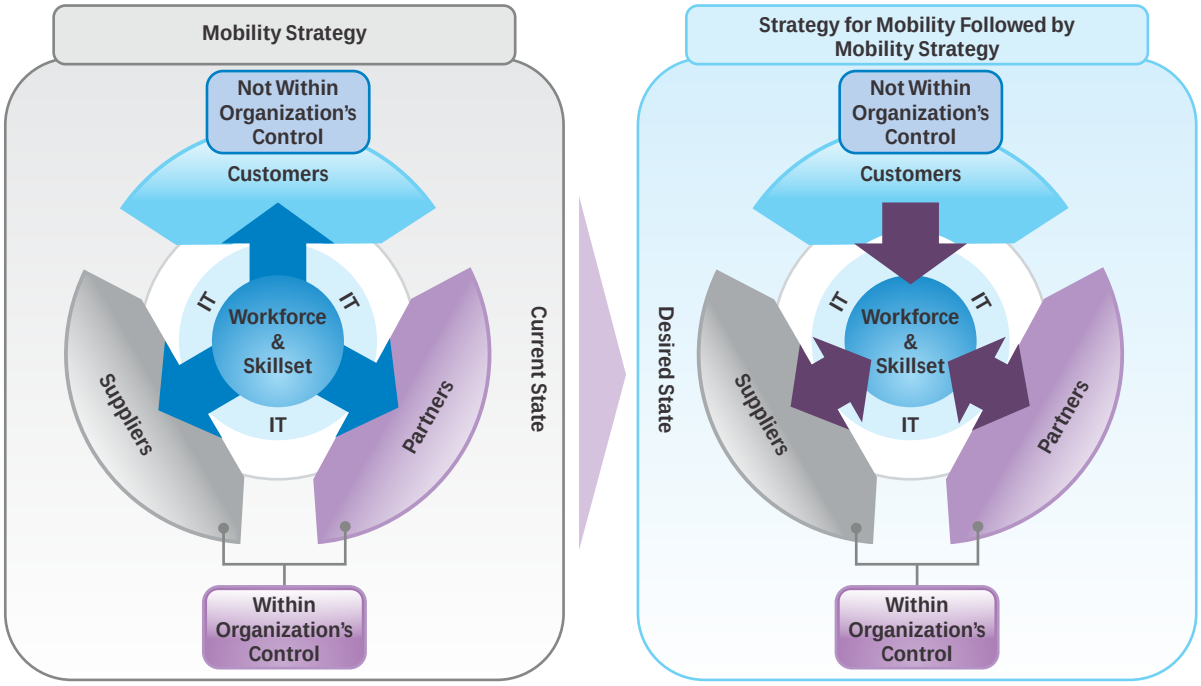
Traditionally, organizations have taken an "inside out" approach (creating a mobile strategy). They have jumped on the technology bandwagon, letting technology drive their mobility strategy, following the "whatever sounds cool" route, and then had stakeholders adapt to their technology infrastructure. Organizations ended up with a web of immature applications and technologies to integrate and manage.

A better approach is the "outside in" approach (creating a strategy for mobility). The philosophy is to identify what technology stakeholders are using, evaluate it in the light of the organization's current technological maturity and comfort, then select the best possible technology combination. With this strategy, the organization can avoid trying to change the external world, which is outside its control, and concentrate only on what is in its realm of influence. The next section explores the differences between these two approaches, which is illustrated in Figure 1.

[1] *iPass Mobile Workforce Report 2010*

How It All Connects – The Role of the External World and the Internal DNA

Figure 1: The Ecosystem



Source: TCS Global Consulting Practice – Research Desk

Creation of an Ecosystem

In an ecosystem, abiotic constituents such as weather and climate are linked to biotic (or living) constituents. In short, biotic constituents need the abiotic constituents—but not the other way around. To a large extent, suppliers, partners, and customers form an ecosystem tethered by the organization's internal technology and workforce management team. In the enterprise, suppliers and partners are like biotic constituents because of their dependence on each other and on the organization. Customers are like abiotic constituents because not only are they self-sustaining, but they also provide the life-blood for the other constituents.

Technology adoption does not impact all stakeholders equally. Because of their lack of dependence, customers' IT maturity to a large extent may dictate an organization's strategy for mobility because of their dominant position in the ecosystem. If customers use a mix of technology hardware, in effect demanding that websites be built using WML or XHTML, the organization has no option but to offer a platform that supports all possible combinations. On the contrary, the organization may be able to influence partners and suppliers to align with its internal mobile strategy because of their inherent reliance on the organization for their survival. Therefore, when formulating your strategy for mobility, keep in mind the degree of influence that each stakeholder has on another (suppliers, partners, and customers) and take an "outside in" approach (see Figure 1).

An Insight on the Components of the Mobility Wheel

Together, the biotic and abiotic constituents work like cogs of a mobility wheel: organizational IT functions as the bearing and the workforce as the pivot. As mobility tightens, the interdependence of the stakeholders in the ecosystem increases the complexity of how services and products should be offered in order to maximize value, so it is important to identify and transition only those business processes that maintain equilibrium between the risk and return for adopting mobility. Due to the risks involved with adopting new technologies and factoring the likely speed of change, finding the right traction in the ecosystem is going to be crucial.

The Pivot - The Mobile Workforce and Skill Base

An organization works only as efficiently as the people who run it. As mobility crosscuts the components of the IT organization (application development, infrastructure management, architecture design, and business analysis), it is important to redefine the roles and responsibilities of the people who use mobile technology. This requires planning to help the workforce adapt to the changes brought by mobility.

Figure 2: Changing Roles of the Organization Workforce

Workforce	Premobility Scenario		Post Mobility Scenario		Degree of Change
	Responsible	Role	Responsible	Role	
Data Creators	Field Workers	Data Collection	Field Workers & Office Workers	Data Collection Data Entry Data Analysis	
Data Aggregators	Office Workers	Data Entry Data Analysis Data Validation	Office Workers	Data Validation	
Data Users	Management	Data Usage for Inference	Management	Data Usage for Inference	

Some examples of change interventions due to change in roles & responsibilities:
- Technology training
- Competency training to fit workforce into new roles
- Workshops to create awareness and acceptance toward mobility

Source: TCS Global Consulting Practice – Research Desk

When planning, organizations should prepare employees to understand the impact of mobility and to educate them about various facets of this new working model. This in turn can help the organization optimize how knowledge workers use mobility. For example, if we define organizational roles based on employees' relationship with data, a typical organization has three types of workers: field workers (data creators), office workers (data aggregators) and management (data users). Mobility impacts each of these groups differently.

Inventory Management

A leading manufacturer of golf equipment used mobile field inventory management services to help retailers update real time inventory data. This helped to bring down the stock level check time to 20 minutes from one and half hours. It also increased sales force productivity by 25 to 30%.

Data aggregators are most impacted by mobility. In a pre-mobility scenario, a field worker (data creator) would go out to the field and return with a completed questionnaire to hand off to the office worker (data aggregator). The office worker then entered the data into the CRM database and ran analytics and validated the report before sending it to management (data user). Management in turn used the data to make business decisions. However, with mobility, field workers seek information from people and plug the data directly into the CRM database through their smartphones. The office worker's scope is now reduced to data validation before sharing the data with management. The field workers are now data creators as well as aggregators whereas the office workers are no longer data aggregators but only data validators. The enhanced scope of work assigned to data creators requires additional workers, which can be sourced by retraining office workers. Therefore, for data aggregators, the change management intervention may require retraining for newer roles while the change management intervention for data creators may require technology training within the same role. As the impact of mobility varies among different people, each person will use mobility in their own unique way to manage and transform one or many defined business processes.

The Bearing - Information Technology

The biggest challenge to the expansion of mobility in an organization is not affordability but adaptability. Mobility needs to be incorporated into the existing IT organization to create a mobile environment for all stakeholders. Since the workforce is often the largest user of IT, it becomes even more important that organizational IT facilitate the adaptability of mobility by creating a well-integrated and flexible environment. In a mobile strategy, IT has a larger role to play in terms of security, service management, enterprise architecture, enterprise collaboration, platform integration, and device selection. Indeed, the day to day management of all these elements can overshadow the long-term strategic view of helping the business. However, in a strategy for mobility, IT assesses technology readiness and acts as a trusted advisor to the business.

Organizations often begin with a technology or a process view while framing a strategy for mobility, but disregard usability. A case in point is Nokia, which used its own organization as a test bed for an email client for the Nokia 9500 Communicator. Nokia found that some workers were still using SMS texting instead of the device's email client because it required cumbersome authentication. Nokia realized it had taken a technology view of security at the cost of ease of use. The company leveraged employee feedback and introduced an easier mail feature in the 9500 Communicator rollout, which reduced all other methods of email to almost zero.

It is important for IT to proactively identify tools that simplify employees' lives and roll out only those tools. Examples include enabling print-functionality through an application built into all company-sanctioned smartphones (no installation required), automatically disabling phone cameras when employees enter a secure area, and remotely connecting to office desktops via a remote access protocol.

ViaForensics, a security company, recently analyzed mobile phone banking apps and found that many had serious security flaws. It again becomes the job of technologists to identify vulnerabilities and threats and institute standards like RSA SecurID authentication and HTTPS connections coupled with code signing and digital certificates in order to relieve users of the burden of compliance and risk management.

The Voice of the Customer

Based on strategic business goals, the CIO should, together with the lines of business, outline an agenda called the "mobility voice of the customer". This is not an easy task. Typically when customers hear you are going mobile, they assume easy access to information and applications regardless of location, time of day, or device. This may not be what you are offering. The prime concern of the organization is to analyze where mobility is beneficial for the customer and see if the investment makes sense in terms of ROI—and then communicate accordingly.

For example, a high net income investor may not really want a mobile financial planning application whereas a technology-savvy retail customer may want to order household products using her phone. The point is, customers attach attributes to any product and service they consume, and it is important for the organization to be sympathetic to that need. For any service or product, you should ask whether any aspect of mobility be incorporated to improve existing services. The next question should be, "What does the customer value?" These fundamental questions lay the foundation for better understanding and drive innovation along with the demands from the market. Naturally, any ideas must be subject to evaluation to confirm feasibility and help prioritize initiatives.

The Voice of Partners

It is important to understand the impact of mobility adoption on and by partners. Partners are closely connected to your organization's business processes. They are an extension of the organization's marketing function and are tied to the top line. Consider

the example of credit cards. A Citibank customer tries to make an urgent bill payment using her Citibank Visa card. The transaction authorization fails because of a bandwidth bottleneck in Visa's servers. Would the customer find fault with Citibank or Visa? The response is a no-brainer. Another case in point may be the Dell-DHL relationship. Dell will only commit to a certain delivery schedule if DHL assures its support. These examples stress the importance of business collaboration in which both the organization and its partners must understand each other's objectives and the business model for the best customer experience.

The Voice of Suppliers

Suppliers are the lifeline of any organization. Collaboration with suppliers is always a concern for the CIO, and mobility adds another dimension of complexity. Suppliers are attached to the purchasing function that impacts an organization's bottom line. Although any organization needs to keep in mind the suppliers' adaptability while designing the strategy for mobility, as a customer, the organization can mandate that suppliers adapt to their requirements and offer the necessary support. As a result, the supplier organization is a two-way relationship, in which the organization should consider its suppliers' convenience while on the other hand the suppliers accommodate to ensure collaboration with the organization.

Achieving Enterprise Readiness

Consumers and customers across the globe will use mobility, although in varying degrees, to improve their way of life. Any organization that does not take mobility seriously will lose out to the competition.

Measuring "enterprise readiness" is the first step toward minimizing the associated risks and maximizing the potential benefits of enterprise mobility solutions. This insight will enable decision makers to become more knowledgeable about the characteristics of the technology, form opinions and acceptance around it, and choose a technology fit that is suitable for the organization's culture. It is imperative that field workers and office workers work well together because mobility will impact these two groups the most. As employees' professional life begins to encroach on their personal time, management will probably expect non-core work such as approvals and training to be accomplished outside office hours, quite contrary to the interest of the employee. For example, a sales manager who is religiously on the move will likely lag in approving timesheets and be slower to respond to team members' requests, slowing down the turnaround time of the organization's processes. Management will not be pleased to see this noncompliance. As a workaround, the sales manager may be allowed to access the online time system from a mobile device, enabling quicker response and potentially reducing turnaround time. However, there is an associated cost: the cost of burnout and negative social ramifications. It is, therefore, as important to identify the right candidates for mobile positions as it is to identify the right processes to be available on mobile phones.

Thus the transformation will be based on the use of mobility and be driven by people comfortable using mobile technologies. It will also speed up the proliferation of technology. The kinds of solutions and services that will be successful are unfortunately impossible to predict.

Over the next couple of decades, the companies that best manage and implement a strategy for mobility will be in a better position to reap the benefits of customer value. CIOs can either wait and watch and let others dictate the company's fate or proactively start m-Powering the enterprise today.

The Impact of Mobility

Enterprise IT

Mobility's Broad Impact

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How deeply will mobility impact corporate IT systems given the diversity of mobile devices and enterprise applications running on them?

Abstract

Evolution in mobility has resulted in a number of mobile devices with diverse capabilities. To exploit the full benefits of this technological revolution, organizations have to recognize mobile devices as a separate channel for driving business. The rapid evolution and adoption of devices means that enterprises can no longer control and mandate a device or platform. Organizations should consider the options for enterprise applications to run on a variety of mobile devices. All of this will have an impact on the organization's existing IT systems.

IT systems consist of applications, data, and information technology infrastructure. The impact that mobility will have on each of these areas is as diverse as the mobile devices themselves. Therefore, a roadmap to leverage mobility requirements should be drafted only after considering the unique impact of mobility's adoption on each of these three areas.

Accept Diversity

Every form of human interaction is unique to the actors involved; heterogeneity is what defines us as humans. For years, tools were developed to support every kind of interaction, be it collaboration, transactions, information exchange, or a simple form of communication. As technology progresses, these tools started to evolve into standalone devices that could support more forms of interaction—hence the emergence of the mobile smartphone, a small computer that allows us to stay connected and interact with people and computers in a variety of ways.

Case in Point: A Pharmaceutical Company

A major Pharmaceutical company wanted to adopt mobility to improve efficiency. We collaborated with the organization to develop a platform-independent strategy which now enables mobile workflow processes that provide insights to a highly mobile sales and marketing workforce, keeping them updated and saving them considerable time.

Today, the mobile device is an essential extension of the user. Organizations know this and accept the device as a tool that supports stakeholder interactions to stay connected. These interactions can range from simple synchronous voice communication to more exotic asynchronous collaborations over social networks and from simple information exchange to more complex transaction processing such as workflows.

Figure 1: Examples of Diversity in Mobile Interactions

Type of Interactions	Examples
Communication	Promotional Emails, Official Emails, Video and Audio Calls
Collaboration	Social Networks, Supply Chain Planning, Knowledge Sharing
Information	Live Product Demo Videos, Price & Availability Checks
Transaction	Mobile Payments, Mobile POS, Workflows

Source: TCS Global Consulting Practice – Research Desk

The evolution of mobile devices has resulted in smartphones as diverse as they are capable. Each class of device has its own strengths and weaknesses. Though these devices are powerful enough to handle most kinds of interactions, other characteristics such as usage comfort, form factor, and interface ultimately influence how the user interacts with the device.

Mobile solutions will be used by vendors, suppliers, outsourced contractors, and others. All these groups cannot be expected to use the same devices. The choice of features should be left to employees and other stakeholders. Users prefer their own mobile devices and don't want to carry more than one. They use the same devices for their personal and professional lives.

In other words, IT can no longer mandate or ban particular devices. Importantly, if an organization mandates a particular device for its employees, it will not experience the full benefits of mobility. It makes more sense to allow employees to choose what they are most comfortable with and build an IT strategy around that.

The IT systems of an organization should be such that, regardless of the device, all interactions with enterprise applications are the same. The question is, why should the use of multiple devices affect IT in the first place? The answer to this question lies in the organization's need to allow use of enterprise applications on mobile devices.

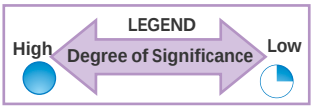
Enterprise Application Options for Mobile Devices

When Malcolm Forbes defined diversity, he said it is "the art of thinking independently together". Of course, the founder of Forbes magazine may not have envisioned that quote being applied to mobile applications. One good mobile application strategy is to keep applications independent of mobile operating systems. To create such a strategy, the organization must assume a mix of certain mobile application options (Figure 2). Figure 2 lists some of the popular mobile application options available; there may be others that are specific to a particular organization.

Figure 2: Enterprise Mobility Application Options

Option	Consideration Aspects					Where Applicable
	Richness of Features	Security Advantage	Cost Advantage	Device Compatibility	Device Resource Intensiveness	
Thick Client Apps	Network not required to use all application features	Device loss may result in critical data leakage	Expensive to create	Multiple versions need to be created for different Oss	May take up a lot of space due to local processing and data storage	• Applications that are not mission critical from a data security standpoint • Applications that are required to operate in low/no network areas
Rich Client Apps	Some features will be dependent on network availability	No data stored locally	Moderately expensive compared to native applications	Client may be designed for different Oss	Only processing is done locally	• Applications that deal with critical data • Majority of devices have space constraints
Thin Client Apps	Heavily dependent on network for most features	Limited to HTTPS	May use web browser of mobile device	Will work on most devices	Only web browser may be used for interfacing	• Simple applications that are not resource intensive (e.g., those that may run using only FlashLite, etc.)

Source: TCS Global Consulting Practice – Research Desk



Thick client apps reside completely on the mobile devices. Also known as native applications, they run only when the code and the data reside on the device. Although these types of apps can be rich in features, they are very expensive to create and test, with the length of test cycles being directly proportional to the richness of features. Since the data required by the app resides in the device, misplacing the device can be catastrophic from a data security standpoint. Remote wipe must be enabled to help alleviate this threat. From a device perspective, these apps can be resource-intensive because both data and code reside locally. The other challenge these types of apps pose is that a separate version has to exist for each OS. Some mobile OSs do not support backward compatibility, so a separate version has to be made for different releases of the same OS. In spite of these shortcomings, the biggest advantage thick client apps have is that they work with or without network connectivity. This is the deciding factor for deploying this type of application. Mobile barcode readers are a good example of an app that can decipher barcodes and store information locally, even when there is no network. When the device detects a network, it automatically transmits this information to the centralized database.

Case in Point: Interfacing Smartphones with a Portal

A best-in-class application developer created a thin client to allow smartphones to connect with the corporate portal.

The application collects information from the device such as SMS, calls, data logs, and other types of phone data and updates the portal.

As instructed by the portal, it also updates security policies, file management, and updates applications and settings to control the activities of the user's smartphone.

Rich client apps do not have all of the features of thick client apps but they have other advantages. For starters, rich client apps store code locally but data comes from a server. Although this reduces the richness of features requiring network connectivity, it ensures that the device's storage resources are not overburdened. This has another benefit; from a security standpoint, no sensitive data is stored locally. This reduces the threat of organizational data loss if the device is lost. Although cheaper to create compared with thick client apps, rich client apps may still require different versions for various mobile operating systems. As a result, these apps are best suited for use cases where safety of critical data is the paramount consideration, such as CRM applications with access to sensitive customer data.

Thin client apps are the least resource-intensive of the lot. With thin client apps, both code and data come from a server. They may utilize the web browser that comes preinstalled on a device. Connectivity is of utmost importance if all the features of the application are to be accessed. These apps do not work well in areas of low or no connectivity, something the organization should be wary of, specifically in the case of mobile workers sent to remote locations. Although the only security provided during data transfer is HTTPS, the fact that thin client apps do not store data locally ensures that they are safe from data leakage. Most mobile devices are able to support these apps,

since the on-device browser suffices in most cases. Since a single version can meet the needs of all or most devices, development costs are relatively low. A good example here is Ajax-enabled web applications. The only thing that needs to be ensured is a strong backend system that provides seamless integration.

In the future, a new category of apps may come to the fore: cloud-based apps. These applications would be entirely platform agnostic and allow access from any device. The biggest advantage, as with thin client apps, is security. Enterprises can outsource management of these apps to specialized cloud providers. To unleash their true potential, these applications need two things: Web 2.0 technologies such as Rich Internet Applications and high-throughput, next-generation networks. When these types of apps become context aware, one can only guess their level of sophistication; imagine smart applications that anticipate and initiate actions without any user input.

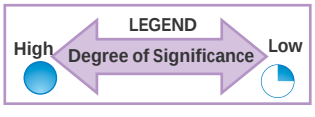
As organizations use a mix of app types to provide mobile access to enterprise applications, they must understand the impact mobility will have on the applications portfolio (see Figure 3). The diversity of mobile devices poses a challenge: that of multiple mobile OSs. The simplicity of feature phones has been replaced with rich mobile OSs. How do we support apps for this large variety of OSs, given that each OS is unique?

Devices also need to have the ability to run both line-of-business and staff organization applications. The mix of apps depends on the unique mobility needs of each. Staff organizations such as HR may not have a great need for mobility, except for managerial workflows on mobile devices that appeal to employees on the move.

Figure 3: Impact of Mobility on Applications

Business Challenges to Applications Portfolio due to Mobility	Areas of Impact	Level of Impact	Rationale
• Standard applications that used to be accessed from devices need to recreated for mobile • Capability of applications to run on multiple mobile Oss	Operating Systems		• Multiple mobile OSs have to be supported
	Apps for Staff Organization (DMS, HRMS, etc.)		• Low to moderate adoption as most of these apps would used by a largely stationary workforce
	Apps for Lines-of-business (ERP, CRM, etc.)		• High adoption as most of these apps would cater to mobile employees such as field force
	Service Support Systems		• Escalation procedures created using workflows to manage incidents • Advent of self service/help applications in mobile devices
	Middleware Applications		• Integration with backend systems will be made possible by software tools such as wrappers, etc.

Source: TCS Global Consulting Practice – Research Desk



Line-of-business applications, on the other hand, are a whole different matter. Here the impact of mobility will be felt significantly. Most of these applications would benefit from mobile access. Mobile devices that serve as extensions of the Point of Sale (POS) terminal and are dynamically connected to ERP could be a boon to retail employees. Desktops and laptops easily handle access to ERP, but when the same thing is attempted via a mobile device, it is too resource intensive. Although a simplified view can be presented using a thin client, such an app will need the network to access all the features of the application. The best option here may be a rich client app that allows access to some features even when the network is unavailable. Some of these apps could be context aware, with certain features activated only under certain circumstances. Consider the possibilities of incorporating location awareness using GPS. The opposing force here is the cost of creating such rich client apps for multiple mobile Oss.

Seamless integration fails if middleware is not smart enough to allow mobile applications to talk to backend systems. The impact here is considerable because these middleware applications have to ensure that mobile applications are integrated with the backend using techniques such as wrappers. Mobile Device Management is essential in order to ensure that the latest versions of all apps are incorporated on the devices. It also helps users immensely if the organization maintains an "Enterprise App Store" where all the latest certified apps reside. This could be directly accessed from the device and the user could download the necessary apps (or permit them to automatically update without user intervention).

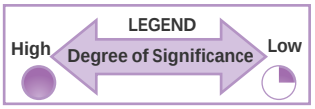
Mobility Impact on Data and IT Infrastructure

IT systems consist of applications, data, and information technology infrastructure. We have already looked at the impact of mobility adoption on applications, but in order to understand the full impact of mobility, we must consider the impact on data and information technology infrastructure. Figure 4 depicts these impacts and enumerates likely IT interventions.

Figure 4: Interventions Based on Impact of Mobility on Data and IT Infrastructure

Business Challenges due to Mobility	Affected Components of IT System	Level of Impact	Typical IT Intervention
• Multiple network technologies to support mobility will phase out existing wired networks. • Choosing the right network mix within the enterprise	IT Infrastructure		• Network strategy should consider cost of legacy phaseout, throughput and security • Newer high throughput network options such as 802.11n
• Critical company information leaves brick and mortar confines • Data accessed by mobile devices that are highly prone to misplacement / theft	Organization Data		• Encryption techniques such as Enterprise Rights Management • Application sandboxing, application signing, file permission techniques

Source: TCS Global Consulting Practice – Research Desk



As mobility forces organizations to shed their brick-and-mortar outlook, one thing is certain, much of the company's data will not remain on-premise. The biggest impact of mobility is probably on the way an organization's data is created and managed. Once an enterprise embraces mobility for most of its functions, it has to accept the inherent risk this poses to critical data. This kind of risk can come from multiple quarters, ranging from device theft to mobile malware to user impersonation to risks from third-party applications that the user downloads. Though such avenues of data loss have been around for some time, mobility has brought them into renewed focus. To combat them, proactive measures such as newer encryption techniques must be deployed. Other methods such as isolating suspicious applications and not granting them access to critical data could also be used. If the device is stolen, reactive methods such as remote wipe also need to be in place. Data is not actually lost because it is maintained in a parallel database. Of course, the more critical data the organization decides to make available on a mobile device, the greater the level of data protection needed.

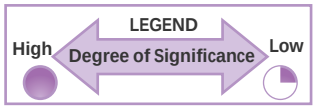
For small- and medium-sized businesses that have a substantial mobile workforce, such considerations are vital to survival. These aspects of organizational data protection are covered in detail in a separate article in Perspectives vol. 4.

Let's look at the impact of mobility on IT infrastructure (Figure 5). IT's efficacy can be gauged by the infrastructure's ability to adapt to new technology. It is essential to have a fresh look at the impact mobility has on IT infrastructure before framing an effective change strategy. A good IT strategy should consider mobility at the lowest level and then assess the cumulative effect. Typically, in this context, IT Infrastructure consists of three parts: hardware, the network, and the facilities that house them. Figure 5 depicts the effect mobility has on these elements. Analysts state that assessing the impact and then formulating mobile strategy is something that 25% of the top global companies are already doing.

Figure 5: Impact of Mobility on IT Infrastructure

IT Infrastructure Pillars	Typical Components	Level of Impact	Rationale
Hardware	UPS/Printers/Other Peripherals		• Minimal impact as they continue to support existing desktops/laptops • Possible Interfacing with devices such as printers through wireless networks
Network	Wireless Networks (WLAN, etc.)		• Network technologies like 802.11n, public hotspots, LTE, Real Time Location Systems will revamp the wireless infrastructure of enterprise IT
	Wired Network		• Prominence of wireless network leading to phase out of wired network
Facilities	Data Centers & Server Rooms		• Role of server and data centers facilities would remain mostly unchanged
	IT Workplace		• With IT workforce becoming mobile , IT workplace facility undergoes considerable impact as the way employees work and interact will change

Source: TCS Global Consulting Practice – Research Desk



Consider the impact mobility is likely to have on each of the aspects of the IT Infrastructure. Figure 5 includes typical aspects of mobility that will have a direct impact. However, there may be other aspects unique to an organization or its industry. On the hardware front, peripheral devices such as printers, UPSs, and scanners that support older computing devices will be minimally impacted for at least two reasons. Printers are not impacted because mobility may lead to a reduction in printing; after all, data is available at the user's fingertips. UPSs aren't needed because mobile devices have their own power source; scanners are not needed because users can scan documents using their built-in cameras. Next generation printers and scanners have the capability to connect to smartphones using Personal Area Network technologies such as Bluetooth. However, for the most part, hardware peripherals will probably not see a substantial impact from mobility.

Case in Point – US Educational Institute Goes All-wireless

Inspired by the goal of ubiquitous network access and high speed and reliable communication, a US educational institute adopted an all-wireless infrastructure to connect multiple devices such as smartphones, laptops, and more.

Taking advantage of wireless technologies, like 802.11n, to enhance coverage and provide network robustness, the institute is now incorporating voice over IP and video on demand.

This wireless programs delivered certain tangible benefits, including reduced CAPEX by 25% to 45% compared with its wired counterpart, as well as reduced OPEX. Easy to use applications and tools reduced training costs. The SaaS-based pricing model further reduced OPEX.

Perhaps the area most impacted by mobility is the network. This impact will be both constructive—creation of newer network infrastructures—and destructive—obsolescence of older technologies. The essence of mobility lies with the operating network. It can either be a network within the organization's control such as Wireless Local Area Network (WLAN) or outside its control, such as Wireless Wide Area Networks (WWANs) belonging to Telecom Service Providers (TSPs). Since TSP networks are outside the control of the organization, they may not form a part of the change strategy. WLAN however is a whole different matter. Today, most mobile devices are Wi-Fi enabled, so it would be economical for the organization to have hotspots that cater to the networking needs of not just mobile devices such as smartphones, but also Wi-Fi enabled laptops and desktops. Newer and faster network standards such as IEEE 802.11n are excellent from the point of view of very high throughput using Multiple Input Multiple Output (MIMO) systems, in the range of over 100 Mbps. Voice over LAN over such networks could allow mobile devices to function cost-effectively as VoIP units within the confines of the organization. These dual-mode devices could have smart applications that access the WLAN network on the organization's premises and switch to the TSP network when the device leaves the premises. One very important factor to consider is the security and coverage of the network. If the organization feels that its

available options are limited on both of these counts, it can always approach a TSP. Here, next generation network options such as WiMAX, based on the 802.16 standard and existing 3G standards can be considered. WiMAX promises a much higher throughput compared to High Speed Downlink Packet Access (HSDPA). In the light of these wireless network options, existing wired networks will slowly become obsolete. The enterprise must design a phase-out plan for its wired infrastructure, keeping wireless network adoption and implementation cost in mind.

When it comes to IT facilities, there will be a considerable impact on the IT workplace itself. Mobility will change the way employees operate. Contemporary smartphones have the capability to collaborate with multiple people using built-in features such as videochat. Workplaces will actually shrink to the size of a small mobile device while the coverage of the work itself will go beyond the confines of brick and mortar establishments. This impact of mobility on the workforce and network is described in greater detail in separate articles in Perspectives Vol. 4.

Formulating the Right IT Strategy

Considering the impact of mobility on IT systems at all levels, CIOs can decide on a change strategy by considering various solutions. These solutions are covered in greater detail in separate articles in Perspectives Vol. 4.

All components of the IT system are important, and a well-thought out change strategy will consider the unique impact mobility has on each one. Once the solutions are identified, a cost/benefit analysis can help streamline the choices. Only then will IT ensure that the organization not only embraces mobility, but also utilizes its strengths to add more business value.

After formulating an IT strategy, to ensure its continued effectiveness, it is important that the plans are agile enough to embrace new technology as it arrives on the scene. After all, the only thing constant about the evolution of technology is the certainty of change.

Mobility Platforms

Examining the Mobility Stack

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A comprehensive understanding of all the layers in mobility platforms is required in order to develop an effective enterprise mobility platform strategy

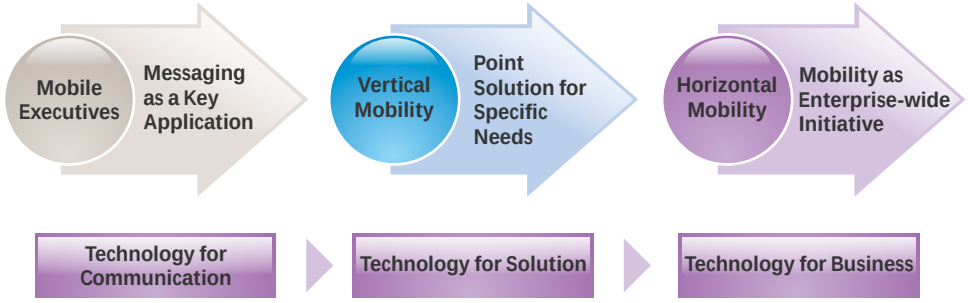
Abstract

Organizations need a strong mobility platform to gain the benefits from enterprise mobility. Before selecting a platform, it's critical to sort out confusion surrounding platform requirements. The key to addressing this problem lies in correctly defining each of the layers in mobile platforms and examining how those layers mesh with the organization's IT architecture. Only with this information can IT organizations see whether their mobile platform strategy is sound.

Redefining an Old Concept in a New Way

The topic of enterprise mobility has been analyzed academically for more than a decade, and efforts toward creating rudimentary mobile applications started around the same time. Well-known examples such as Lotus Notes and Microsoft ActiveSync became popular because of their focus on enterprise mobility. In addition, advocates for unified communications also focused on mobility, although in a limited way. Several investments in converged devices provided mobility to enterprises through incorporating unified messaging and presence.

Figure 1: Evolution of Mobility



However, mobility technology and applications have undergone a sea change over the past ten years. With advancements in telecommunication and high-speed wireless data transfer made possible through 3G and 4G mobile systems, enterprise mobility has gained significant momentum. It has been further fueled by the surge in a variety of smartphones.

The need for enterprise mobility is hardly a point of discussion anymore. A good mobility platform can provide competitive advantage for the enterprise from two angles—lowering the cost of operation and delivering more value to the customer.

A mobility platform should enable better information exchange with partners and other stakeholders in the industry value chain. Nonetheless, there is still a lack of consensus over the standardization of architecture when it comes to platforms required for enterprise mobility.

Simple Objectives, Complex Hurdles

Despite the business needs, technical possibilities, and a desire to use mobility as a lever for productivity, the complexity of the mobile ecosystem creates a certain ambiguity around the platform requirements for both enterprises and telecom service providers. Key reasons for ambiguity stem from multiple factors and manifest themselves in the form of challenges (Figure 2).

Figure 2: Areas of Ambiguity Lead to Challenges to Adoption

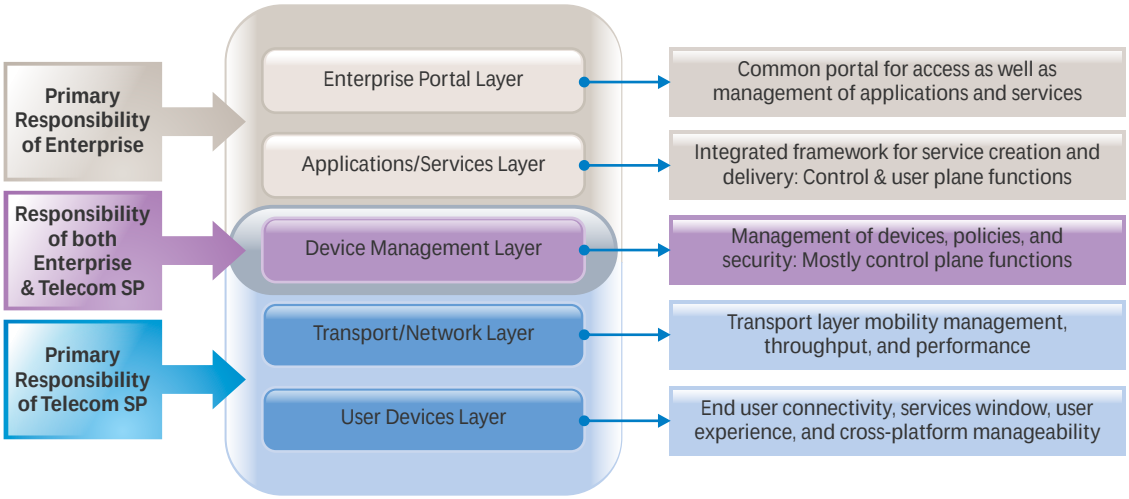
Ambiguity around Platform Requirements….
A host of mobile platforms with diverse feature sets and capabilities
Lack of certainty/future proofing with respect to mobile platforms
Which aspects of an enterprise provide more value on a mobile device?
Role of legacy systems in day-to-day enterprise operations
Dependence on IT services vendors who lack business/domain knowledge
Telecom service providers unsure of what to offer in platforms and how much to invest
Typical inflexibility of telecom architectures

Leads to Challenges…	Which Have Implications…
Lack of standardization for a uniform service creation and delivery platform	Fragmented market and no comprehensive solution
Varied level of control of smartphones and often limited control of other communication devices (such as modems and routers)	Deployment and implementation-level issues
Need for clear distinction of control and user plane for mobility platforms (e.g., adequate security at both the control and user plane)	A mish-mash of telco-oriented architecture and IT architecture
Complexity in system integration path into classic IT systems of a telecom service provider	Fragmented deployment and process Inefficiencies

Uncovering Layers of Challenges

To meet these platform-related challenges, multiple layers must be understood and addressed from the platform perspective. These layers can be broadly categorized into the User Devices layer (mostly smartphones and tablets), Transport/Network layer, Device Management layer, Applications/Services layer, and the Enterprise Portal layer (Figure 3).

Figure 3: Multiple Layers from the Platform Perspective



From an enterprise operations point of view, the top three layers are of the most importance whereas the telecom service provider is involved with the bottom three layers. This means that both entities jointly manage the Device Management layer, which plays the most critical role in a good mobility platform strategy.

Mobility Management: Convergence on the Enterprise Portal Layer

In most enterprises, the Enterprise Portal layer serves as the gateway for authentication and provides access to applications and services. Enterprise mobility requires integration of this portal into the Device Management layer. This layer has two views: the administration view to manage the mobility of the enterprise and the application access view for users of enterprise applications and services.

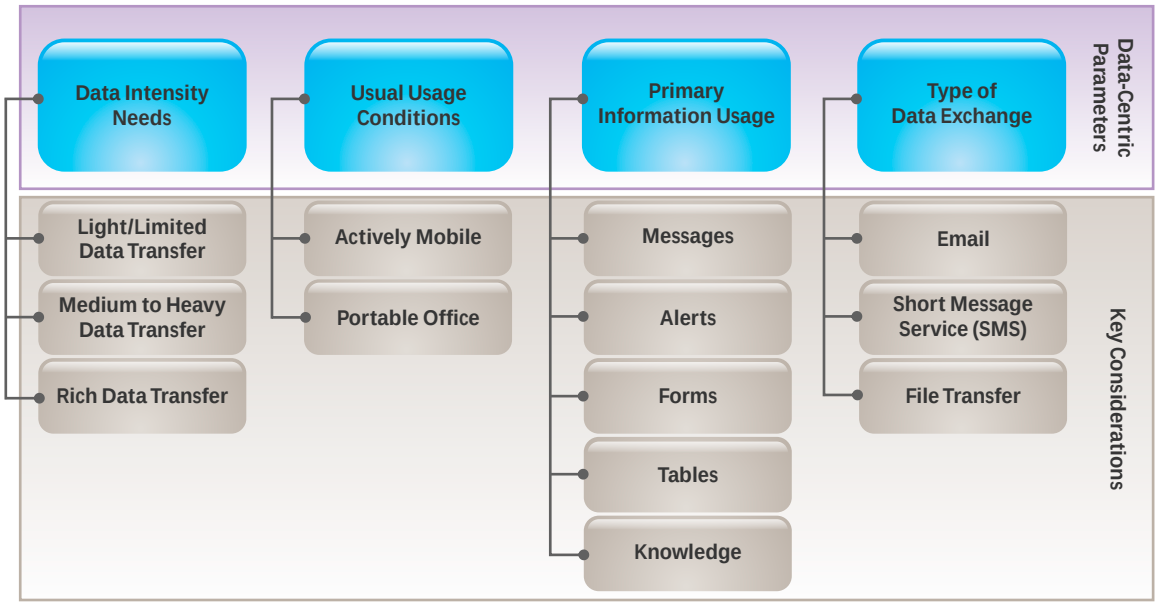
Key considerations at this layer include an integrated view that enables system administrators and operators to manage most of the aspects of the mobility of their employees and associates. In other words, this layer should not only serve as a window to all the layers below it, but also facilitate the integration of this platform into any other classic IT systems. Considering the fact that many enterprises have outsourced their IT and infrastructure management operations, this layer should ideally be extendable to IT service providers with the requisite access, authentication, logging, and reporting mechanisms.

Additional capabilities at the Enterprise Portal layer may include a window for users to access the applications from their desktop or laptop. To increase user experience, it is desirable to provide an analogous view (on-device portal or an equivalent mechanism) of the same window for the users' smartphones and/or other mobile devices.

Application/Services Layer: Integrate Mobility into the Business Process

The Application/Services Layer is the core framework for service creation and delivery. To a telecom service provider, it can be compared to the Service Delivery Platform, with additional capabilities for creating and managing enterprise applications. This is the fundamental user plane layer exchanging enterprise data between the applications on the smartphones and the backend enterprise application. Ideally, this plane should be seamless between the user device and backend IT; specifically, a database on the device which is used by one or more applications (multiple databases can exist if required). This layer should also support online and offline modes and provide synchronization with backend systems. It requires a thorough analysis of parameters such as the data intensity needs (e.g., light or limited data transfer, medium to heavy data, and rich data transfer) of the applications, the usual usage conditions (e.g., actively mobile, portable office, etc.), primary information usage (i.e., messages, alerts, forms, tables, knowledge, etc.) and the type of data exchange (i.e., email, SMS, file transfer, alert, etc.).

Figure 4: Key Considerations for Seamless Interaction with Backend Systems



Application creation and inclusion in the service delivery mechanism should be part of the framework, allowing development and maintenance of the device applications as a continuous process. Both thin-client and thick-client approaches are being used today. The primary consideration when selecting an approach relates to the variety and capability of the user devices the enterprise workforce is using. An enterprise with mostly smartphones that have good computing and data storage capability can use a thick-client approach, but if you must support feature phones, a thin-client or mixed approach yields better performance and manageability.

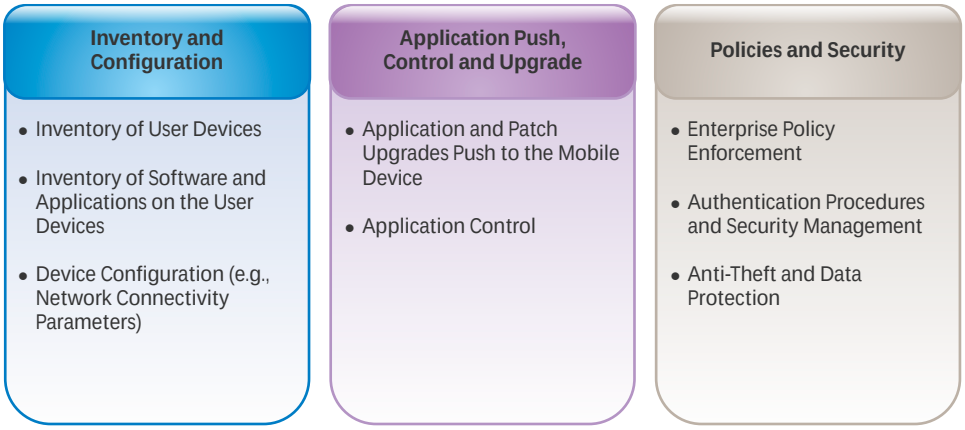
Device Management Layer: Critical to Mobility

The Device Management Layer, a relatively new addition, is what makes mobility feasible. It plays a critical role from both the end device perspective and the enterprise operations perspective. It provides an inventory view of the enterprise mobile assets and their status, verifies compliance to corporate policies before access to enterprise data, and provides remediation solutions. The functions that should be performed at this layer are shown in Figure 5.

Case in Point: European Government

A European government entity faced difficulties updating approximately 500 mobile devices. Each device had to be updated separately whenever settings had to be changed or a new application added or updated. The government entity adopted a three-pronged solution consisting of a global device manufacturer, a wireless hosting service provider, and a mobile device management suite provider. Post implementation benefits included remote administration and updating, heightened security, and a single point of contact for the help desk.

Figure 5: Mandatory Functions of the Device Management Layer



Apart from these mandatory functions, it is good to leverage the troubleshooting and problem solving capabilities that most device management platforms offer. These capabilities offer easier and faster troubleshooting, debugging, and problem solving. In the absence of such capabilities, devices may be needlessly returned or sent for repair.

The Device Management layer also performs critical functions of device authentication. It can lock the device in case of undesirable handset changes by the user, loss, or theft. Most device management products allow remote wipe. A comprehensive Device Management layer also allows pushing applications and patch upgrades to the mobile device in both silent mode (without user intervention) and assisted mode (with user intervention), making it appropriate for problem resolution separate from policy enforcement and security management.

From an operations perspective, this layer has greater significance for the telecom service provider partner, which provides the transport channel (IP and wireless connectivity) to the enterprise. From a deployment view, this layer may very well reside in the IT stack of the telecom service provider, integrated into its operational and business management sub-systems (OSS/BSS).

Transport/Network Layer: Effortless Communication

The Transport/Network Layer is the layer for voice and data connectivity from the telecommunication service provider partner. However, with convergence and unified communication, this layer has been extended beyond the traditional telecommunication service provider domain.

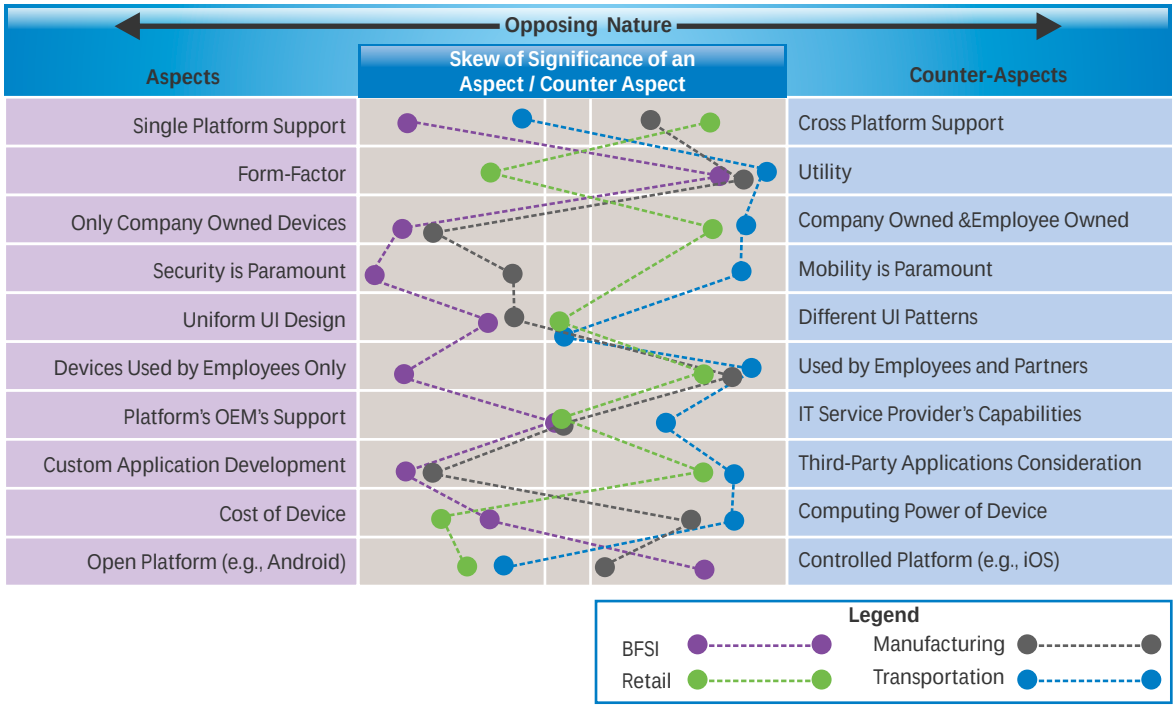
With IP and WiFi inside the enterprise as well as hotspots, mobility is not totally dependent on standard mobile communication systems (such as 3G and 4G). Most smartphones today can switch to a WiFi network, saving on data costs. The platform for enterprise mobility should leverage this feature and incorporate security management at a separate layer (i.e., not tied to a particular access mechanism). In essence, an enterprise mobility platform should remain decoupled from the access network.

User Devices Layer: Serious Consideration Required

The User Devices layer is fundamental to mobility because it is the end device that provides the mobility and serves as a window for applications and services to the end-user. While end-user devices have motivated enterprise mobility programs, they also bring significant challenges. One of the key reasons for the challenges lie in the focus on consumers by most of the platform and device OEMs and ignoring or at least underplaying the needs of the enterprise. This trend is changing now, albeit slowly (e.g., 'iPhone in Business' initiative incorporating enterprise needs like connectivity, security, encryption, local/remote wipe, etc.).

The aspects to consider at this layer, which obviously vary depending on the nature and goal of business, are shown in Figure 6.

Figure 6: Platform Aspects Considerations – For Different Industries

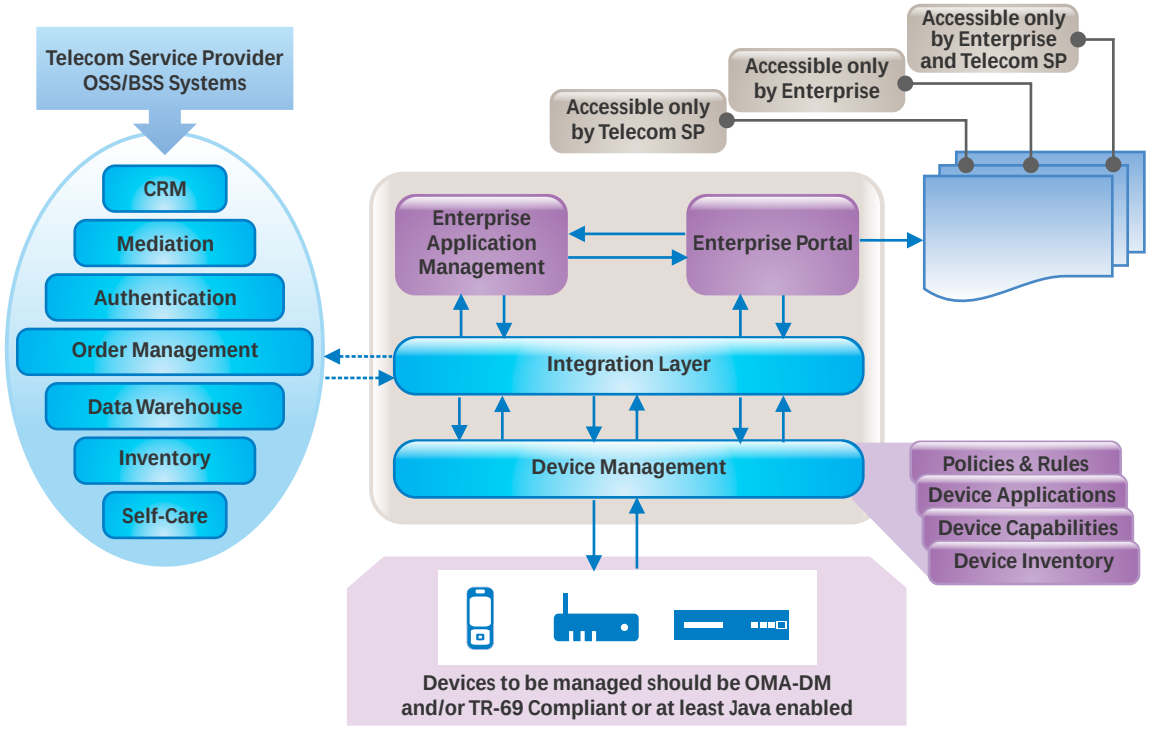


Considering the many aspects to take into account, the User Devices layer is one of the most critical in the decision making process for an enterprise. It has bearing on users, scalability, manageability, cost, future roadmap, and day-to-day operations.

Putting the Pieces Together

If an enterprise or a telecommunication service provider decides to go for a "build and operate" model for the mobility platform, the following components and functional view should be considered for platform requirements and capabilities. Figure 7 only shows a functional view. Actual IT architecture would depend on existing enterprise architecture, products, and the telecom systems under consideration.

Figure 7: Integration of the Multiple Layers



In Figure 7, the Integration layer is the key to communication and control with classic IT systems. It should enable the Device Management layer to interact with the two layers above and forms a bridge between the mobility platform and other classic IT systems (mediation, inventory, CRM, etc.). In actual deployment, it can be a collection of scripts based on the business logic and specifications communicating with the enterprise portal, the telecom service provider's OSS/BSS components, and the Device Management layer through standard APIs exposed by these components or web services. This integration may be challenging based on the availability of APIs and exposed interfaces and may require custom API development or an alternate data exchange mechanism. The business logic obviously varies from one scenario to another, thus the interconnection logic will be specific to the implementation. For example, every time a new device is added to the enterprise, the Telecom Service Provider's order management system could update the device management system. When the device management system has to push a service or product onto a device, it follows the instructions given by the order management system. One may choose to implement this in other ways too, such as the device management system deciding on each device-related action after receiving verification from order management.

One of the prime considerations for mobility programs are setup and operation costs. Regardless of the benefits of a mobility platform, a full-fledged platform may not be justified for every organization. In such a scenario, opting for mobility services from a hosted/managed services vendor is a viable choice. Now that many service providers are moving to the cloud for better services penetration and cost optimization, this option

should certainly be explored by enterprises. There are pros and cons. Procurement of services does lower the associated CAPEX and OPEX and reduces the need for operational and technical capabilities. Nonetheless, using a service provider may mean marginal to significant changes in the strategy with respect to devices, applications, and data management.

Culture and Processes Are Critical

Amid all the technical considerations for the platform lie the important aspects of organizational culture and existing business processes. Both aspects need to be carefully dealt with and will have an impact on the platform architecture.

Case in Point – Multinational Toll Operator

A multinational toll road owner-operator introduced mobility for its substantial workforce. Workers needed to access email which became more challenging as the workforce grew, resulting in two major problems: higher cost of mobile email services and slow data connectivity. The toll operator shifted to a best of breed platform that increased user satisfaction, improved security, and featured shorter device setup time as well as lower costs.

An application that is hard to use, a combination of manual and automated processes, a difficult sequence of steps for a field worker, and other challenges may lead to poor user experience and be a weak link in the productivity chain. While some challenges can be addressed technically, others may require organizational change management. Care should be taken to avoid poor user experience to ensure success of adoption. Business processes are an entrenched part of organizational culture and many of them are not easily adapted to incorporate mobility. Careful consideration of the potential return on investment for each business process is a better approach to deciding where to incorporate mobility.

Some people in the organization may feel that a comprehensive mobility program may usher in a high level of automation resulting in job losses. It is important to consider this to garner ample support for implementing this change. Finally, training programs can add immense value in putting the platform in place.

Organization Data Protection

Safeguarding Mobile Data

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Are you well equipped against the threats mobile devices pose to your organization's data?

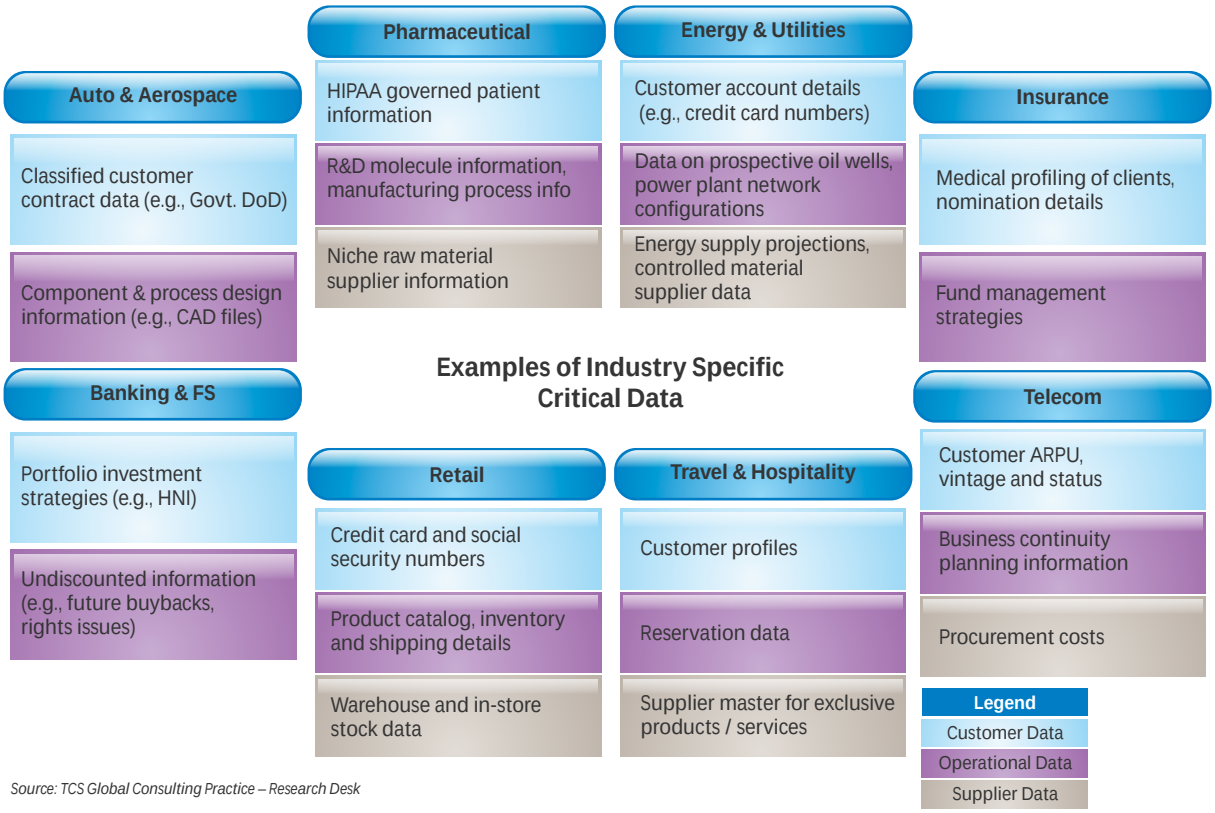
Abstract

As the corporate world moves into the era of mobility, the proliferation of mobile devices has introduced a new dimension to the age-old problem of data security. These range from device theft to more specialized malware designed specifically to steal information from mobile devices. There needs to be a paradigm shift in thinking that uses a holistic framework to address threats to corporate data.

Data Security—Old Problem, New Context

"Where ignorance is bliss, 'tis folly to be wise". When Thomas Gray coined this phrase some two and a half centuries ago, he described a line of thought many would follow in the future, though in a totally different realm—the security of an organization's data. Sadly, some organizations make the mistake of ignoring the threats posed by mobile devices. Though the nature of data lost may very well differ from industry to industry, these threats apply universally. Figure 1 shows the impact of data loss for various industries.

Figure 1. Important Data Sets in Various Industries



Source: TCS Global Consulting Practice – Research Desk

In today's knowledge-driven world, data is the lifeblood of every organization. It has become imperative to safeguard this vital asset against the threats that loom around it. From customer data to intellectual property, confidential communications to proprietary knowledge and privileged information, data can either make or break the future of an organization. This topic has been raised so often that even bringing up the subject may be seen as a cliché. So why are we talking about this again?

Let's begin by introducing a hypothetical case to set the context.

The Curious Case of Charlie

Charlie, a consultant with XYZ Enterprises Ltd, is a very busy person. His work keeps him on his toes. He was excited when his company gave him a smartphone. He could now enjoy more time with his family and still stay connected with his office and make critical decisions on the go.

In the first few months, Charlie was able to increase his productivity at work. One day, to his surprise, a few of his colleagues complained that they received unwanted emails from him in which he recommended a product. Charlie was taken aback and concerned about how his distribution list had been compromised along with personal transaction details. He thought that someone had access to his login details, so he changed his credentials and informed his IT department.

Because all his work transactions were done via his mobile device, security-conscious Charlie decided to safeguard the information on it. He downloaded an application from the Internet to encrypt key information. However, this did more harm than good because the software was not from a trusted third party. Confused, he went to his company's IT department again. They reformatted his device. Charlie wrote to the CIO to recommend that employees avoid using applications from untrusted sources. This was added to the organization's security policy so that no one else would have to undergo the same problems.

To add to his woes, Charlie's smartphone was stolen at a metro station. The next week, the company's stock price fell by almost 2%. They were shocked by news of a data breach that exposed information of 500 customers. An investigation revealed that the culprit was the unencrypted information stored as plain text in the stolen smartphone. The company not only lost shareholder value and customer trust, but also valuable existing and future business.

Charlie's company finally decided to encrypt all the information in mobile devices, but they learned the lesson the hard way. Had they been aware of the threats to their assets, a comprehensive security strategy could have been implemented and a huge loss averted.

The proliferation of smartphones has added more device end-points to a company's IT infrastructure. More end-point devices mean increased potential for data leaks that could sink the corporate ship. Mobile devices have come of age and so have the exploits against them. In today's era of mobility, this can be a serious problem if organizations are not sufficiently proactive.

New Challenges

Research shows that the number of mobile devices such as eReaders, tablets, and smartphones is growing at a much faster rate than traditional desktops and laptops. The number of smartphones shipped is expected to rise from 178.3 million this year to 330 million units in 2014, according to ABI Research. This exponential rise has brought with it some challenges unique to this category of devices. Given the compactness of mobile devices, theft is one of the most important issues to consider. And when a mobile device does get stolen, all the stored sensitive data goes with it.

Figure 2. Mobile Data Threats

Data Protection Threats	Interesting Facts/Benchmarks
Theft	According to Forrester, mobile devices are 50% more prone to loss or theft compared to PCs
Mobile Malware	Around 100,000 devices on a popular mobile OS were infected with malware in mid-2010
Untrusted Third-Party Applications	10% of the applications in SMobile (about 5,700 apps) analyzed by Juniper contained three or more potentially dangerous security permissions
Uncontrolled Deployment of Applications	Forrester says that customers install 40 applications on iPhone and 25 on Android, of which not all are trustworthy
Spam and Social Engineering	A Techworld study says that spam accounts for 75% of all email
Virus Attacks	1 million Chinese smartphones were infected by a virus in late 2010

Smartphones are designed to function like small computers, so some of the old demons of the PC era have evolved for the mobility age. Some notable examples are spam, mobile malware, and untrusted-third party applications. All of these can hide malignant code designed to steal data from mobile devices.

Adding fuel to the fire is the uncontrolled deployment of mobile applications. Most of the powerful smartphones have access to OS-specific app stores that stock thousands of applications ranging from video players to games. Not all of these applications are as innocuous as they seem; they may contain malware or viruses. Recently, an OS manufacturer had to remove certain applications from its app store, which had been created to manipulate user data. There is also the threat of account impersonation, where a perpetrator tries to impersonate the owner of a mobile device.

In today's era of social networking, multimedia and easy connectivity make information exchange child's play. Smartphones store a lot of personal information as well as confidential company information (or easy connections to that information). These devices accompany people almost everywhere. They have become the primary

communication devices for carrying out vital business functions. The popularity of smartphones is on the rise in the corporate world—and so are the corresponding threats. Worms, spam, malware, viruses, and hackers—these threats are no longer focused only on the laptop or desktop.

Constant innovations in technology, miniaturization of devices, increases in computing power, and growth in networks are posing challenges to data protection. Exploding data growth is making security a mammoth task. Information is now available almost everywhere, from the data center to a wide range of end-points. The naïveté of users themselves is sometimes a problem. Research shows that less than a quarter (~23%) of smartphone users activate security features built into their devices.

Added to all this, the complex operating landscape and fierce competition has underscored the need to share and use information judiciously. Organizations adopt various standards and approaches in their struggle to protect sensitive data and maintain compliance with the regulatory landscape, data protection laws, and contractual obligations. Though various tools and technologies are deployed and implemented, new threat scenarios surface each day. This leaves many questions unanswered—such as, whether implementation of industry-standard information security based on ISO 27001:2005 is sufficient. And if you extend to the organization's customers, the first question is whether the customers trust organizations with their data.

Solutions for all of these problems exist, but they are only effective when they are implemented as a part of a framework. Should organizations create a separate security framework or adopt one that already exists and extend it to mitigate new risks? The latter is a more cost effective and proven option.

You Can’t Stop the Waves, but You Can Learn to Surf

It requires a paradigm shift to address the problem at hand—protecting the organization’s data. It’s a given that new technologies are constantly arriving and data continues its exponential growth. Let’s look at what can be considered a good solutions framework. Protection of an organization’s data is ensured by information security, so an information security governance framework should be extended to handle data security issues related to mobility.

Figure 3: Information Security Governance Model

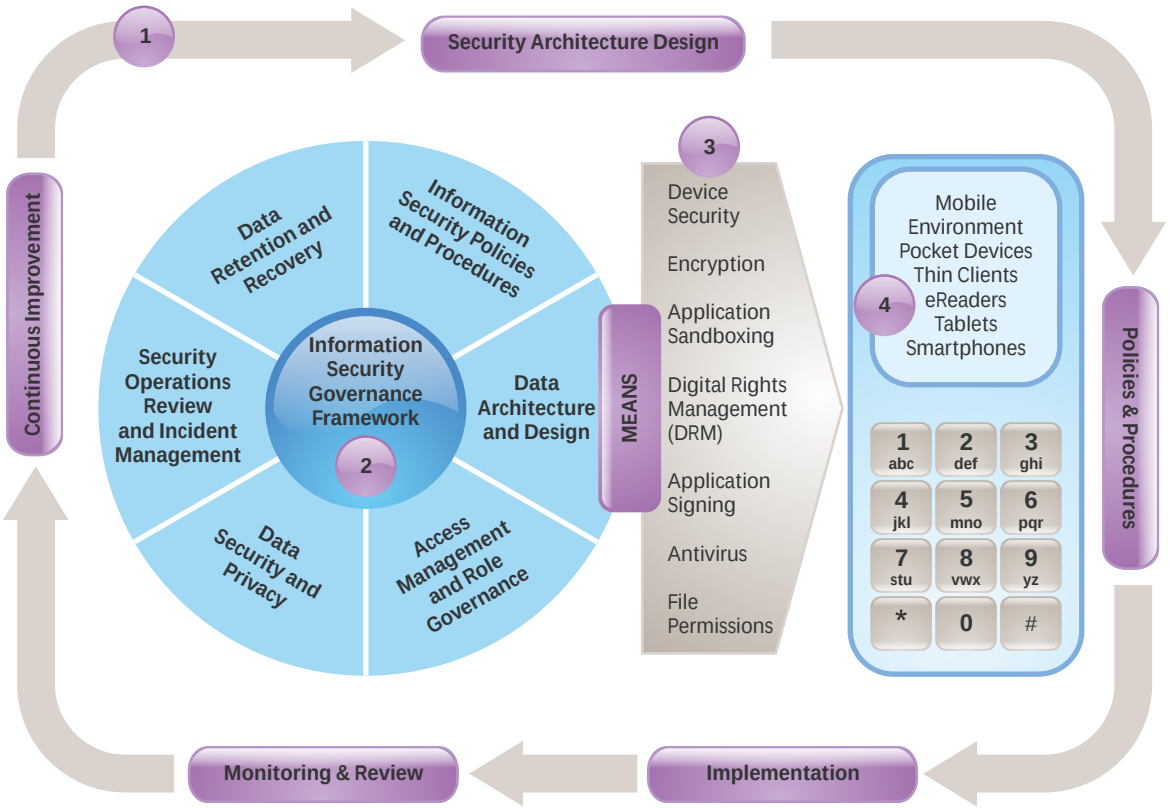


Figure 3 depicts an information security governance model. It consists of two distinct parts—the information security governance lifecycle (1) and the information security governance framework (2). Let's examine the information security governance framework before getting into the lifecycle.

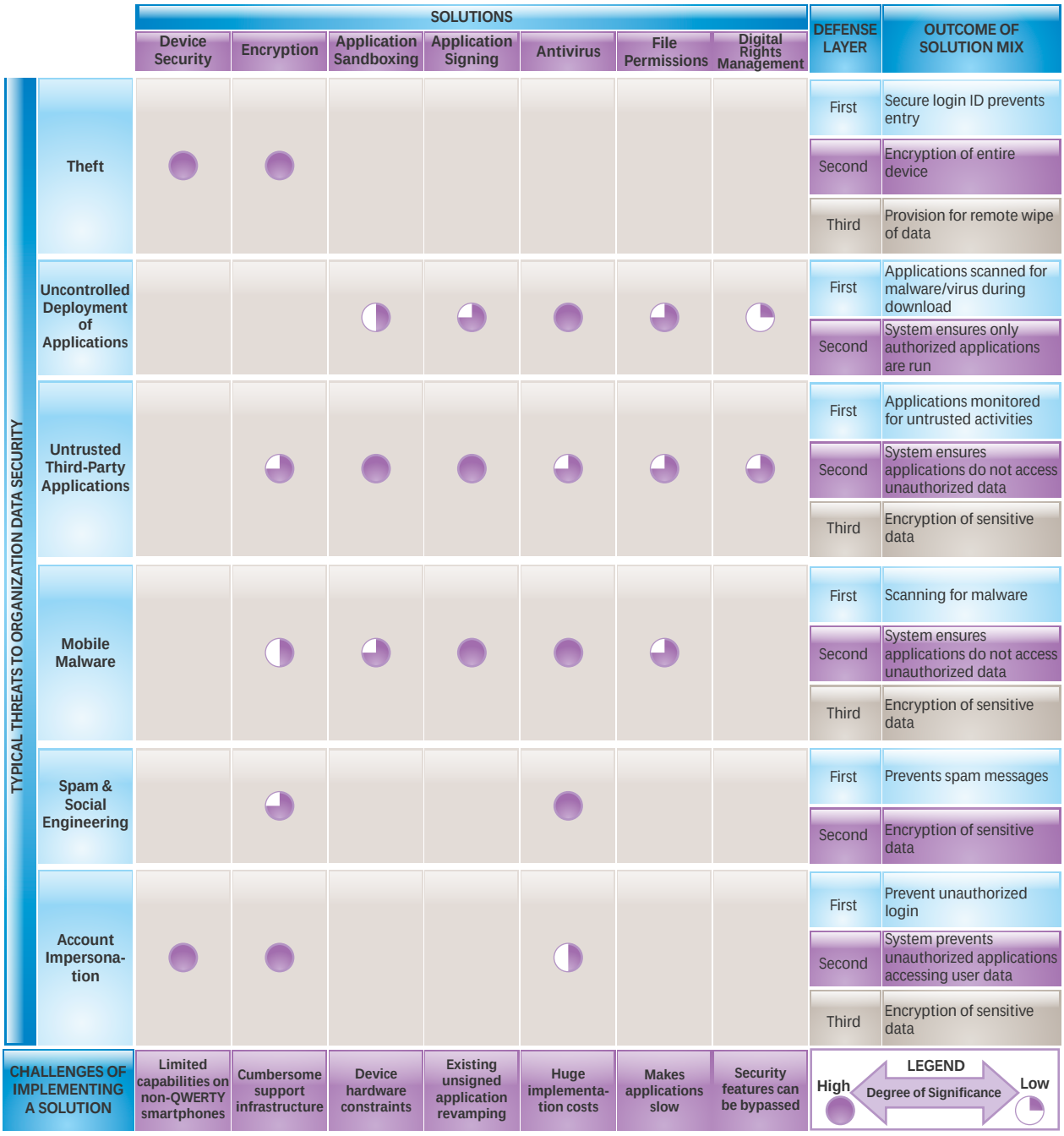
Six pillars uphold the information security governance framework. These pillars—such as Data Retention and Recovery, Data Security and Privacy, and so on—represent the major areas to manage to ensure security and privacy across a business and technology environment. In other words, the information security governance framework mandates the existence of these areas. It is imperative for any information security governance framework to cover these areas because they are central to maintaining data security throughout the organization. In a generic sense, these six pillars are sufficient to construct the information security governance model.

However, to extend this model to the arena of mobility, some specific solutions have to be included (3) so that the information security governance framework can evolve to tackle most of the issues discussed earlier. These solutions are means to achieving an end. Solutions such as encryption and device security are single solutions that, on their own, do not wholly address the problems. But mixing these 'partial solutions' in a manner unique to a problem will actually address data security issues related to mobile devices. These mixed solutions will be discussed a little later.

Next is the security governance lifecycle (1), which consists of five phases. The dynamic nature of this lifecycle ensures that the information security governance model is continually refreshed to address emerging security problems.

Thus, the seven solutions (3), ranging from Device Security to Digital Rights Management (DRM), are partial solutions, a combination of which can be used to ensure data security. We will now delve a little deeper into these solutions and see how combinations can address various threats.

Figure 4. Solution Mix Template



The Solution Template Approach

Given the diverse nature of data security threats discussed earlier in this article, finding only one partial solution to mitigate each of these challenges is not prudent. The solutions that exist cannot solve a problem effectively on their own. They have to be combined to create solution mixes to address the problems. Like specialized task forces, these solution mixes can help in building a data stronghold with multiple lines of defense. To determine these solution mixes, the typical areas of threats must first be enumerated and then matched with the available solutions. A combination of two or more of these solutions can then be identified as the solution mix specific to one of the problems. Another detail can be introduced by describing the level of significance a solution has in the mix for a specific problem. These levels of significance can be recalibrated as a part of the post-implementation step of Continuous Improvement in the Security Governance Lifecycle. What will be achieved in the end is a template, very similar to the one depicted in Figure 4, that clearly structures the solution landscape.

Let's illustrate the usability of this template with an example. We'll consider one source of threat to an organization's data—untrusted third-party applications. A mix of six solutions can be used to address this threat. Application sandboxing ensures that all data generated by an application is associated with that particular application, thus reducing sharing of information across the operating system. On the other hand, application assurance by application signing is another control that can associate the authorship and privileges of an application with an independent certification body. This can help organizations and associates separate legitimate applications from illegitimate applications or malware. Antivirus software helps ensure that untoward activities of an application are thwarted and encryption ensures that if data is stolen, it cannot be read without a decryption key. Similarly Digital Rights Management can be employed to enforce extensive access control. Finally, file permissions can be explored to ensure that applications have access to only their own files and folders and controlled access to data of other applications. The degree of significance associated with these solutions as components of this particular mix can be traced to the outcome, listed in the last column. This particular solution mix allows the organization to create a three-level data fortress. In this example, the three layers of defense protect the data from threats related to untrusted third-party applications.

Case in Point: A Software Company

A major international software company selected best-of-breed mobile security solutions to protect sensitive information of its mobile workforce through certificate-based-authentication, automatic resetting of the mobile device to its factory settings (in case of device loss), and specialized malware protection.

The bottom of the template lists challenges associated with the implementation of the suggested solutions. When considering a solution mix, the CIO must consider all of these challenges to get an idea about what to expect if this mix is implemented.

Case in Point: US Department of Defense

The US Department of Defense has a security policy of performing a remote wipe of employees' official BlackBerry devices. This data is backed up in a database so loss of the device doesn't mean loss of data.

Though device security was not considered a part of this example, it is nonetheless a very significant component of the solution mixes for theft and account impersonation (see Figure 4). One of the ways device security can be enabled is by using a four- or eight-digit PIN for the device. This can provide security against attackers who try to access the device with the intention of pilfering information. Besides this, organizations can also adopt another measure for device security by implementing an organization-wide swipe policy where the irrelevant information is deleted either weekly or biweekly. This can also be extended to what is called a remote wipe where official data such as email and sensitive customer information on a mobile device can be deleted remotely by the organization, as it deems necessary. A caveat—this should only be done after the organization has assessed ethical issues that may crop up, such as the deletion of personal data of the employee. Network security, yet another indirect aspect of device security, should receive special attention to specifically combat the widening threat from tracking mobile devices. This is important, given the plethora of technologies at play, such as Bluetooth and 3G. Organizations should secure the communication channels through Secure Sockets Layer (SSL) and Transport Layer Security (TLS), providing entity authentication, data authentication, and data confidentiality. WTLS is the wireless variant for securing the WAP gateway. Lower level protocols such as the i-mode proprietary protocol of NTT DoCoMo can also help in securing wireless devices.

In addition to whatever solution mixes are implemented, all organizations should pay special attention to identity management and access control. This should be carefully managed, especially in the context of confidential company information on mobile devices. Most mobile devices do not include robust access management solutions nor do mobile applications. Credentials are sometimes stored in plain text. Therefore, organizations should consider identity and access management as an elementary step for data protection. Having a dedicated centralized security team that detects infringements and prevents serious damage is also helpful. These teams can then generate periodic security reports that will eventually feed into the Monitoring & Review phase of the Information Security Governance Lifecycle.

Finding the Point of Equilibrium

The solution template is one of the ways to mitigate threats related to data security. It helps the organization identify the correct solution mix for a specific threat. As is true with all forms of technology, each of these solution mixes has its fair share of challenges. The CIO has to understand the company's priorities before deciding on a solution mix. In all types of analysis, two opposing forces help find the point of equilibrium and in this case the two forces are the cumulative challenge of a solution mix and the solidity of the security measure. The point of equilibrium is the level of risk an organization is willing to

be exposed to. Emerging technologies will give rise to newer partial solutions related to data threats. Implementing any of these should not come at the cost of addressing the larger issue of data security.

Employees do not usually download malware with the intent of harming the organization. There is a pertinent need to download applications that forces them to resort to accessing uncertified sources. Malicious code usually piggybacks on applications from those sources. This is not to say that all applications are bad. In fact, preventing an employee from downloading anything may have an adverse affect on morale. This may eventually reduce the popularity of enterprise mobility among the employees. Organizational data protection in the age of mobile devices should be a carefully choreographed process in which the enterprise considers both the effectiveness of security techniques and the impact of such measures on the uptake in use of enterprise mobility. The age of mobility has arrived and the CIO must select the appropriate technology for the given scenario, taking into account the risk appetite and the practicality of the security implementation, to shield the organization to the greatest extent possible.

IT Service Management

Fostering Service Management Maturity through Mobility

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Can mobility transformations be leveraged to increase IT Service Management maturity?

Abstract

As technology evolves and mobility gains greater acceptance in organizations, IT Service Management must adapt. The standard processes of Service Design, Delivery, and Support will be affected and will have to be adjusted in order to ensure their effectiveness in a multi-device mobile environment. To do this, we have to gauge the impact mobility will have on IT Service Management components. Ultimately, by incorporating mobility into IT Service Management, a higher level of maturity may be achieved.

Quality of Experience, Not Quality of Service

John Morley, the famous British statesman, said, "Evolution is not a force but a process. Not a cause but a law". He was being true to the natural inevitability of evolution—everything must change. And when something evolves, everything that critically depends on it must evolve as well. This saying has universal applicability. What John Morley said of biological evolution can also apply to technology. As technology evolves, disciplines such as IT Service Management (ITSM) must adapt or risk losing their efficacy.

This evolution of technology has brought a series of challenges to IT departments in organizations the world over. These challenges, both technical and business-related, pertain to the demand for more efficient IT services and business alignment. With consumer-driven expectations for improved levels of customer service, there is a need for incorporating the latest personal productivity technology.

From an IT perspective, one particular challenge has the potential to create a "perfect storm" for IT functions and the services they deliver. This challenge can be directly attributed to one of the byproducts of technology evolution: the shrinking of computing devices. Mobility is driving a need for IT to deliver services across multiple end-user device types, some of which might be outside the control of the IT department, such as employees' own smartphones or tablets.

Though many pundits have commented on the potential impact of various types of technologies on the supply-side of the IT value network, they have paid less attention to the disruptive potential and inherent risks in the move to different modes of IT service delivery and support across multiple device types and platforms.

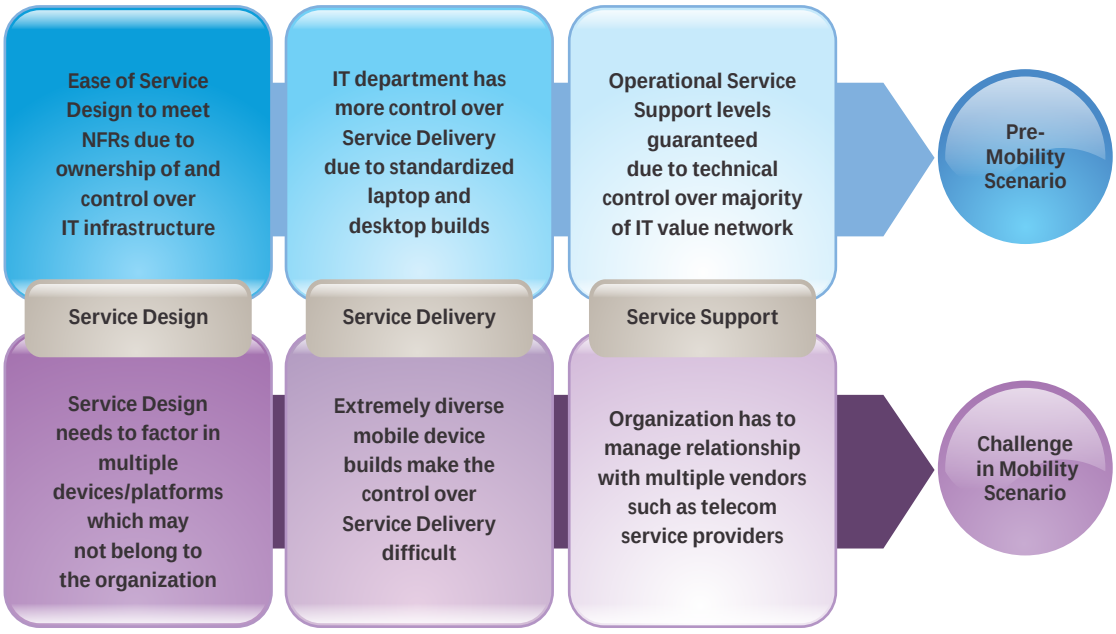
Quality of Service (QoS) has been the buzzword for defining IT service quality levels. The service delivered per contract was enough to meet the expected QoS levels in the past. But as mobile devices make their way into the enterprise computing space, the focus on QoS is no longer sufficient to defend the level of service. IT Service Managers also need to emphasize the Quality of Experience (QoE). While QoS revolves around ensuring the performance of a system, QoE encompasses the user's perception of that performance—the overall user experience. Unlike QoS, QoE greatly depends on the service terminal itself—in this case, the user device, such as a smartphone. As technology evolves and smarter devices are used in the mobility space, QoE will play a far greater role compared to QoS. This is exactly why a prudent ITSM strategy should make provisions for service to the variety of mobile devices and platforms operating in an organization. Thus, as more enterprises adopt mobility in their organizational processes, following a QoS approach will result in several issues. It will neglect ITSM to such an extent that they may not only end up losing external customers, but also end up with extremely poor levels of internal customer satisfaction. QoE is not a new concept. Service Management gurus have expounded its merits for decades. But some organizations have stopped short, simply because the difficulty of measuring QoE has outweighed the perceived benefits. With the era of mobility creeping in, a new dimension is introduced into the equation—that of necessity. QoE is no longer an

option; it is a mandate for IT service delivery and support for the mobile enterprise. Furthermore, the usual tools the ITSM used to tackle QoE challenges in a non-mobile environment may no longer be fully applicable in a mobile scenario.

New Challenges for ITSM

The fundamental purpose of ITSM is to view and manage the IT components that are provided to an IT-consuming organization as end-to-end IT services. It also ensures that the IT services delivered to users consistently meet the ever-changing needs of the organization across the standard parameters of time, quality, and cost. This primarily means assuring that key Non Functional Requirements (NFRs) relating to capacity, availability, and performance can be delivered. New services need to be designed around correctly defined NFRs and mechanisms put in place to ensure that the NFRs continue to be met in the operational environment long after the post-implementation review. These NFRs are essential to ensure a high QoE. In the past, IT departments have been able to control the QoS they deliver through three basic mechanisms (Figure 1), but these mechanisms may no longer be sufficient in the era of mobility.

Figure 1: Mobility-led Challenges to ITSM Processes



Source: TCS Global Consulting Practice – Research Desk

It is evident that the entire process starting from Service Design to Service Support (Figure 1) has to be reviewed in the light of enterprise mobility. The IT department can no longer restrict IT services to a small set of devices. As organizations encourage employees to use their own devices for enterprise use, the cumulative challenges of providing an excellent level of service that is platform- and device-agnostic keeps mounting for ITSM personnel. The IT infrastructure is no longer confined to the domain of the IT department. A major aspect of control now passes to the carriers, who literally 'own' the essence of mobility—the telecom network. Mobility technology is a perfect

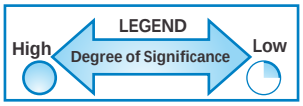
example of Moore's law on overdrive. With every passing day, a new all-in-one wonder device appears. Thus, if ITSM has to ensure nearly perfect QoE, it has to radically rethink the way services are designed, deployed, and supported. A new ITSM process will have to be designed while keeping in mind the uniqueness of the organization's IT service needs.

Redesigning ITSM Processes for Mobility

In order to assess impact, it is important to first identify a few specific areas of service management that may be affected by the enterprise's use of mobility. The impact being referred to can be broken down into two parts—the degree of change and the level of challenge attributed to acknowledging a particular change (Figure 2). The degree of change for a particular area of service management can be defined as an opportunity for positive change, which may work to ITSM's advantage. In trying to capitalize on these opportunities, some challenges may come up as well. ITIL, being a best-in-class compendium of ITSM best practices, could be a good starting point for supporting such an assessment.

Figure 2: Examples of Service Management Areas that Will Be Affected by Mobility

Service Management Component	Degree of Change	Rationale	Level of Challen -ge	Rationale
Service Desk		• Self Service / Help applications can be embedded in mobile devices		• Creation of Self Service / Help applications relatively easy • Service Desk application user training
Incident Management& Problem Management		• Escalation procedures can be made easy using specialized workflow systems in mobile devices		• Extensive training for Incident Managers
Financial Management		• Mobility could allow organizations to encourage employees to use their own devices, reducing IT hardware costs		• Cost provisioning for multiple mobile devices • Calculation of peak time usage costs for mobiles
Service Level Management		• SLAs have to be designed keeping mobility-related issues in mind		• Frequent revisiting to SLAs due to rapid evolution of mobile technologies
Capacity Management		• Proactive capacity planning in a multi-platform mobile device environment		• Critical-to-calculate capacity requirements due to massive proliferation of mobile devices
Availability Management		• Less deviation between actual time before failure and expected time before failure due to less physical and more wireless infrastructure		• Organization no longer has control over network availability as it falls within the purview of Telecom Service Provider
Change Management		• Role of CAB will have to incorporate mobility related considerations		• Mobile device manufacturers need to be consulted in order to implement critical changes
Release Management		• Enterprise app store acts as DSL for all planned releases (applications, device updates, etc.)		• Creating and maintaining an enterprise app store that can be accessed by mobile devices using multiple OS
Configuration Management		• Possible adoption of Federated CMDB may lead to cross-service integration		• Cataloging non-corporate owned mobile devices, and tagging them to associates • CMDB has to be dynamic to accommodate rapid changes in device aspects



These opportunities and the associated challenges are not as difficult to tackle as they appear to be. As the level of mobility adoption in an organization increases, it ushers in concepts such as Device Management (DM), which is just a variation on Release Management (RM). Every time a new software patch is released, all mobile devices are automatically updated. There is no better way for RM to be more proactive. On the same note, enterprise app stores for mobile devices will prove to be a logical extension of the Definitive Software Library (DSL). If an organization is able to run and maintain such an app store, which stocks only corporate-sanctioned applications, it justifies having a DSL. Together, the enterprise app store and DM systems ensure that all devices run the latest standardized versions of mobile software. Similarly, the help desk can now be turned into an application run on the mobile device itself. Since the Known Error Database (KEDB) has predefined workarounds for well-known issues, this data can form a part of the help desk application. When the user faces a problem, this application allows the user to access the dynamically updated KEDB. In fact, a certain part of the KEDB could reside locally on the device itself. This would encourage a greater degree of self-help, thus reducing the load on the help desk. To add a dimension of synergy to this picture, each time the central KEDB gets revised, the DM ensures that copies residing locally on devices are simultaneously updated.

Case in Point: Reducing Incident Resolution Time

When mobile devices were introduced at a major electronics vendor, the IT department needed a service management system to handle service delivery and support issues for nearly 2000 devices. Implementing Mobile Service Management software helped reduce incident resolution time by up to 70% through proactive alerts to the devices. The system also provided graphical visualizations of problem scenarios to IT staff who gained improved visibility into incidents, underlying issues, and possible root causes.

Opportunities such as these will bring unique challenges with them as well. One such challenge will relate to the Configuration Management Database (CMDB). Organizations have been struggling to implement a rock-solid CMDB that encompasses all of the enterprise's assets and their relationship to each other. With mobility, the plethora of non-corporate-owned devices may overload this repository. Devices can be updated or outdated with the addition of new features. This may force the CMDB to be dynamic in nature. While philosophically this is a desirable solution, it may not be practical.

Another area of impact is financial management. With a multitude of mobile devices that run many different operating systems, service costing can become a real challenge. This may, in turn, complicate chargeback methods and affect how SLAs are designed. The ultimate impact of this complexity will be on the user—a direct hit to QoE.

In the light of these impacts on various elements of ITSM, it's important to understand that new developments in service, supply and delivery do not alter the fundamental structure of ITSM. While the basic principles, processes, and practices described in ITIL and ISO/IEC 20000 remain valid, what will change is the approach the IT department takes to implement them. This change in approach is a natural evolution. The

management of services by internal IT departments will focus more on the correct specification of NFRs and ensure that a very high degree of QoE is achieved.

Mobility may in fact usher in a higher state of service management maturity. For example, if an organization is following ITIL V2, introducing mobility will require it to initiate certain steps, which in turn may help it transition to ITIL V3, a higher level of service management maturity.

Case In Point: Law Firm Applies Mobile Service Management

One of the world's largest international law firms applied a best-in-class mobile service management software to reduce the troubleshooting time of service issues in their mobile workforce. The intelligent software helped reduce resolution time. This software encouraged automatic resolution and its asset tracking feature helped the organization to inventory devices and manage carrier costs.

Climbing the Ladder of Service Management Maturity

Making enterprise mobility a reality requires certain interventions. These interventions can result in a few unanticipated positive outcomes, at least from the point of view of disciplines such as ITSM. For example, if an organization currently follows ITIL V2 best practices, mobility-inspired interventions may inadvertently lead to the adoption of certain ITIL V3 best practices. Of course, this does not necessarily mean that mobility will result in the wholesale adoption of ITIL V3. When some of the notable differences between ITIL V2 and V3 are considered, we can see how adoption of mobility automatically leads to adoption of some of these newer ITIL elements (Figure 3).

Figure 3: How Enterprise Mobility May Justify a Transition to ITIL V3

Inherent Mobility-Led Enterprise Interventions	ITIL V3 Transition Element that Correlates Best
Organizations need to rethink which services to deploy and which to retire due to rapid evolution in mobility technology	Service Portfolio Management
Mobile enterprise portal as a catalog of up-to-date services	Service Catalog Management
Steps to ensure security and integrity of organization's data through DLP and encryption	IT Security Management
Device management and network SLAs with Telecom service providers	Supplier Management
Pre-planning of major service releases becomes essential due to proliferation of non-corporate owned devices	Transition Planning and Support
Rapid deployment of satisfactorily functioning services in multi-platform mobile environment	Service Validation and Testing
Mobility-led enterprise collaboration	Knowledge Management
Standard self help pre-FCR (First Call Resolution) applications available on the device itself	Request Fulfillment
Identity access management through predefined policies governing all non-corporate devices	Access Management
	Low | Medium | High
	Degree of Impact

Source: TCS Global Consulting Practice – Research Desk

Here is another example of an action required for enterprise mobility. Two of the most important steps essential to implementing mobility are data security and preventing intrusions via an unauthorized device. In order to implement these steps, tools such as Data Leakage Prevention (DLP), Enterprise Rights Management (ERM), and Identity Access Management (IAM) need to be used. There must be a clearly defined set of policies regarding this, together with the capability to implement them and monitor any security breaches that occur. To a great extent, this is also what the ITSM and access management components of ITIL V3 entail. Similarly, mobility-led enterprise collaboration will encompass certain aspects of the knowledge management component of ITIL V3. Thus it is evident that mobility will lead to adoption of most of the ITIL V2 and V3 elements. These actions may also ease the transition in a post-mobility scenario.

The Way Forward: Adapting to Change

The IT department's ability to accommodate alternative delivery or consumption models such as mobile devices is critical. Consumer technology and its adoption have advanced to such an extent that the IT department needs to provide exemplary levels of IT services to meet user and business expectations. Paying attention to Quality of Experience is not a luxury, it is a necessity.

Thus, IT departments need to overcome their reticence to allow the use of nonstandard and ultimately non-corporate mobile devices. With the advent of Blackberries as a business tool, demand is difficult to suppress at the CxO-level because executives make compelling cases for device adoption. ITSM needs to be prepared to respond to this inevitable demand for unique services, tailored for these new devices, and to understand the benefits and challenges associated with the adoption of these changes. It is also important to understand how such devices will be supported on a day-to-day basis.

Ultimately, ITSM must evolve and ride the wave of mobility or end up being perceived as a growing impediment to business change. By acting now, the IT function will have an opportunity to become a true business enabler and a strategic business partner.

Vertical Snapshots

Vertical Snapshot

Mobility in Banking

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Key success factors for mobile banking include proper customer segmentation and offering transaction-based services

Abstract

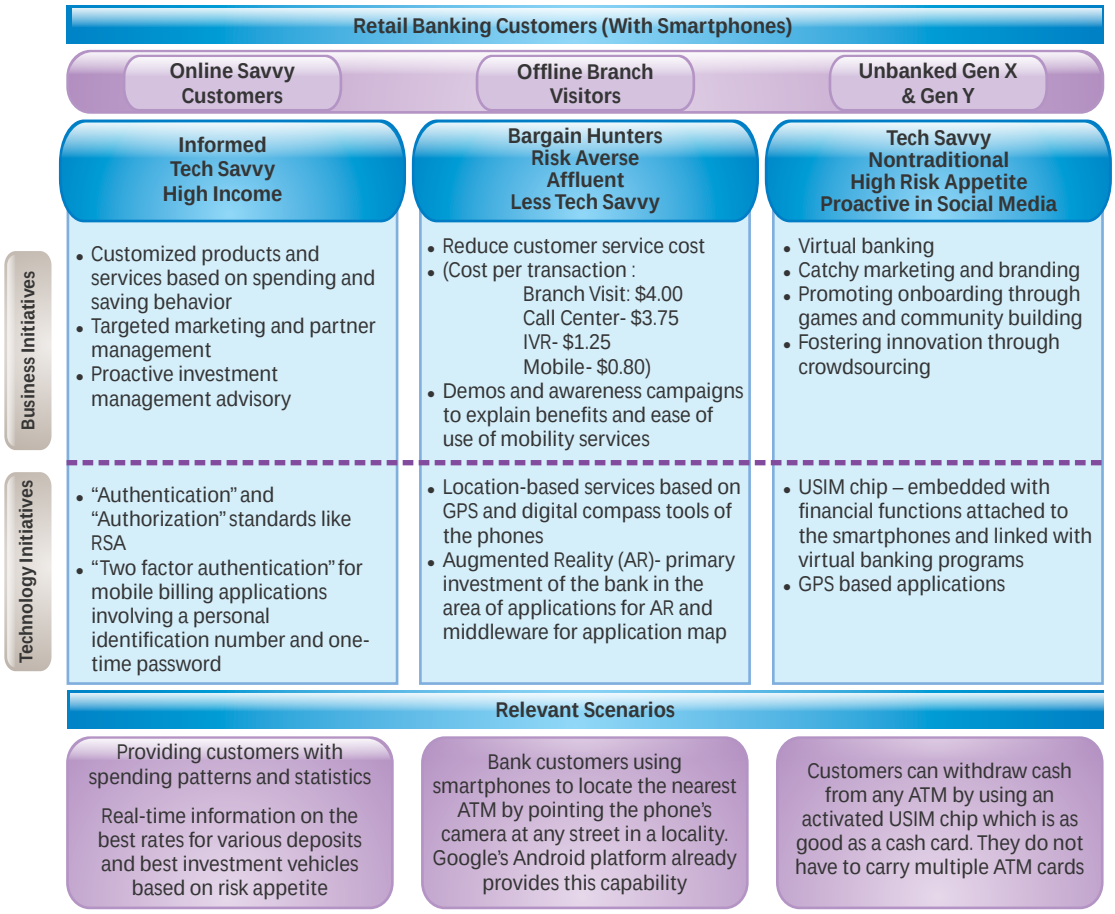
Smartphones offer banks a new means of customer interaction at deeper levels. To increase the breadth and depth of their relationships with smartphone-enabled customers, banks must go beyond providing customized information services and offer transaction-based services. This requires two areas to mature: the development of technologies like Near Field Communication (NFC) and the mobile banking ecosystem.

Mobility: A Variable Impact on Banking Customers

Mobility offers a new channel for banks to reach out to their customers. Because mobile banking is convenient, a large number of educated young banking customers are willing to switch providers if their current bank does not offer the latest in mobile services. This article describes how to overcome the challenges and exploit the opportunities.

Banks have been cautious in adopting mobility and have experimented mainly with customer-facing services. Even for customer-facing services, there are obstacles to the penetration of mobility. One of the biggest hurdles for banks today is to determine how to reach out to customers. They need to find out which customers want to be contacted through which channel, and what products and services they would like to use across channels. Some bank customers are tech-savvy smartphone users. This group wants the bank to engage more personally with them and offer products suited to their tastes and preferences. Then there are customers who bank at branches and do not use their smartphones for banking. The bank needs to work on reducing transaction costs by nudging these customers to use their smartphones. According to the Yankee Group, some 51% of Gen Y (1) and Gen X(2) carry smartphones but do not have checking or savings accounts. As a result, they pay expensive check cashing and bill payment fees every month. This group presents a challenge to the bank's marketing and on-boarding strategy as their service needs are quite different from the other two groups (see Figure 1).

Figure. 1: Customer Groups and Respective Focus



To engage with the online savvy customers, banks should design their strategy around financial advice and planning. Based on strong back-end analytics, banks should encourage users to fulfill their requirements without human intervention, using spending and savings information to facilitate investment decisions.

Case in Point: Smartphone Real Estate App

A major bank in Australia has proposed a best-in-class smartphone application that will connect a piece of real estate with its price. When using the phone's camera and pointing at any property, the application juxtaposes property-related information onto the screen, giving prospective buyers all pertinent information.

Banks should entice the offline branch visitors with technology to dissuade them from visiting bank branches. A good starting point may be location-based services. This would reduce calls to the IVR or the call center for inquiries about the nearest ATMs or branches, thus reducing transaction costs.

A good on-boarding strategy for the unbanked Gen X and Gen Y customers may be to offer virtual banking coupled with a targeted credit card plan. Customers could use the mobile banking program or attach a universal subscriber identity module (USIM) chip with embedded financial functions to their smartphone, either of which can enable an array of services, thereby increasing customers' brand loyalty.

These groups differ with respect to risk aversion and comfort levels with technology. To reach each group effectively, banks should be prepared to offer very simple information services as well as more complex transaction-based services. Let's analyze the challenges banks face in providing these diverse services.

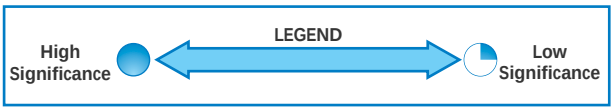
Mobile Services - Adoption and Challenges

Although mobility is capable of broadly offering two kinds of services to banking customers, namely, information services and transaction services, the power of mobility in banking has been vastly underutilized and has been skewed toward information services like generating bank statements, setting alerts on account activity, accessing statements for loans and credit cards, locating ATMs or the nearest bank branches, and verifying account balances. As we saw earlier, a savvy smartphone user will look for more transaction-oriented and interactive services from bankers like domestic and international funds transfers, investment portfolio management, securities trading, transfer of investment funds through mobile devices, and so on. Technologies like NFC will help push the envelope only if associated security concerns are addressed. Figure 2 shows the adoption levels as well as challenges for various services.

Figure 2: Potential Candidates for Mobile Applications

Information Services	Degree of Applicability	Adoption Challenges
Location-Based Services (LBS)		• Complex value chain raises the cost • Privacy is a big hurdle for LBS adoption
SMS/Text Alerts		• Basic functionality and usage possibly limited to online customers
View Bank Accounts		• Service limited mostly to online customers • Problems with handset interoperability might make viewing inconsistent
Personal Information Updation		• Lack of integration with backend systems limits usage • Security concerns
Access Loan/Card Statements		• Resource-intensive applications constrained by current mobile maturity • Security concerns
Document Submission		• Image manipulation chances raises security concerns • Insufficient Mobile Banking Infrastructure and Network Bandwidth
Transaction Based Services	**Degree of Applicability**	**Adoption Challenges**
Fund Transfer		• Anti-money laundering and regulatory risks limit adoption • Regulatory framework will check international remittances
P2P Payments		• Lack of network interconnection due to nonstandardized P2P mechanism • Customers have to remember network and security details
Portfolio Management		• Inadequate application maturity and trading systems connectivity concerns • Handsets features limited in terms of analytics etc.
Check Deposits		• Security concerns and image manipulation possibilities limits usage
Cash Dispensing		• Technical infrastructure incapable of handling high customer expectations • Lack of trusted third party service provider to help banks

Source: TCS Global Consulting Practice – Research Desk



As is clear from Figure 2, information services are prevalent and text alerts are widely accepted among customers with online accounts. Although the number of online banking customers is relatively large in developed countries, developing countries still have more customers visiting bank branches. Another notable feature is the bottleneck due to the complex value chain for providing Location Based Services (LBS). There has been a lot of feedback requesting the mainstreaming of LBS, but due to the involvement of many stakeholders, the cost of such services is likely to be high. Other concerns relate to network limitations to provide services like accessing loan and credit card statements and document submission. These challenges would be partly met by the natural evolution of network technologies and the industrial ecosystem, and partly through technology and infrastructure upgrades in banks to support customer expectations. Both of these can be supported by high-end network and device technologies like NFC-enabled devices and GPS, but banks are waiting to see if they reach mainstream adoption.

Compared with information services, adoption of transaction-based services varies by geography. The overall picture shows that although services like funds transfer and P2P payments are being provided, there are security concerns related to transfers (prevention of money laundering) as well as problems of standardization for P2P payments. Mobile applications can make it easy to transfer money, but may also make it difficult to effectively prevent potentially unethical money transfers. P2P payments suffer from the inability of banks and other stakeholders to standardize on payment mechanisms without getting into complicated details of intermediate networks, parties, and so on. There is a need for standards and cooperative ecosystems to enable such transactions. On the other hand, advanced transaction services like Portfolio Management are gradually gaining traction, but face hurdles in the form of immature applications and the lack of connectivity between various trading systems.

Case in Point: A Global Bank Offers Mobile Payments

We conducted a pilot with a mobile payment partner and a leading global bank. This mobile payment system aimed at making shopping easier for people on the go, enabling them to pay for purchases from select outlets using mobile phones and virtual credit cards. The solution included platform migration, partner product customization for virtual credit cards, and integration with the credit card host system, mail system, and wireless carrier's SMS gateway by developing XML-based ISO adapters. In depth testing, backup and production rollout formed an integral part of our mobile payment solution.

NFC – Future Mobile Banking Technology

With NFC-enabled cell phones already available on the Android platform, there is nothing stopping other device manufacturers from following suit as this technology becomes an enabler for key services in many industries like healthcare, transportation, and other industries. Although device manufacturers and telecom service providers partly control rollout of NFC to consumers, it is imperative for banks to adapt in time to seize the opportunity. NFC-based payment systems have the potential to empower banks and to reduce the cost of payment services. It may,

Case in Point: A US Bank Becomes the First Mover in NFC Technology

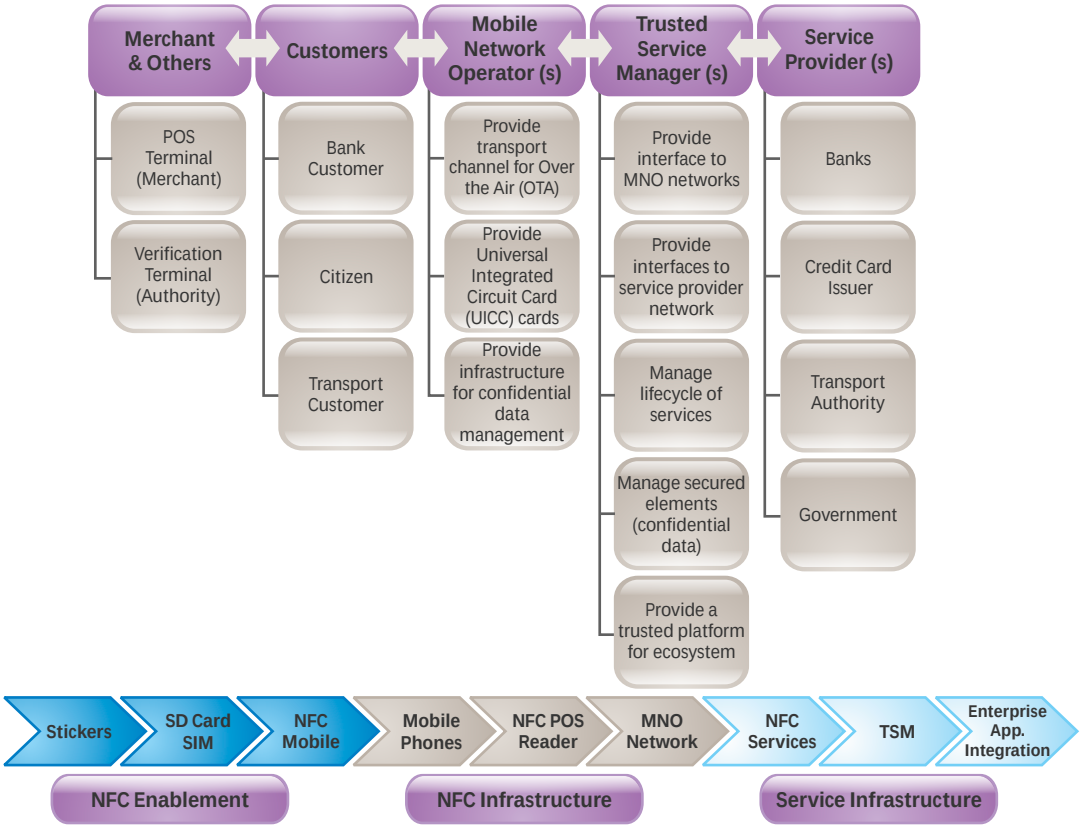
A major US bank became the first to adopt NFC technology for its m-banking as an alternative to traditional expensive payment systems. Because it provides a secure and cheaper mode of payment, within 5 months, 80% of the bank's customers adopted the technology. In three months the bank acquired twice the business accounts as in previous years.

This NFC-based technology system handles 20% of the local debit transaction volume. These systems have enabled a reduction of middlemen, thereby reducing overall costs, and half of the bank's merchants such as restaurants and convenience stores. have benefited from the use of this new technology.

however, take a couple of years to get NFC-enabled phones into the hands of consumers. During this period, banks can consider alternative methods such as NFC stickers (which can be attached to the back of the phone and add NFC capabilities to older mobile devices,) to increase user adoption and comfort. To gain more agility, banks need to invest in technology that will allow the integration of payments from NFC-enabled phones as they become widely adopted.

Let's look at how NFC technology works. It has its roots in RFID technology but is more secure. Future mobile phones will come with NFC tags that will enable consumers to make payments anywhere an NFC tag reader is available. Consider what happens if Sam goes for a drink at a local tavern. When he is ready to leave, he asks for the check. Using the NFC reader, the bartender sends an SMS to Sam's smartphone. Sam views the bill and authorizes payment via the touchscreen. Since so much business will be transacted via mobile apps, such transactions have a huge implication for the banking as well as the mobile industry. Figure 3 depicts an NFC-enabled mobile banking ecosystem.

Figure 3: NFC-enabled Mobile Banking Ecosystem



In this example, technology changes the role of one player in the payments market at the expense of another. Sam receives a bill for his drink on his mobile phone bill at the end of the month. This type of payment could be a serious threat to the credit card business, and banks might have to find new ways to attract and retain the huge customer base that handles daily expenses via their credit cards. However, this is just one aspect of the story. A substantial group of people use credit card loans, which run into trillions of dollars and are a major source of revenue for banks. With the proliferation of smartphones, mobile network operators may offer similar credit for purchases.

Security is the main concern for consumers adopting NFC. Since customer information travels through multiple modes during a transaction, banks need to ensure that customer information is well guarded and that no errors or security breaches occur. This calls for cohesion between the guardians of the network - network operators, service managers, and service providers. Network operators and trusted service managers provide the anchor in the relationship. The mobile network operators have four primary responsibilities; they allow existing SIM over-the-air platform to the service provider to manage the application, create Supplementary Security Domain (SSD) as per global platform standards, assign the SSD to the NFC service provider, and manage overall Universal Integrated Circuit Cards (UICC) memory. As application owners, they manage the allocation of space on the UICC for service providers securely without imposing on other service providers' applications on the UICC. UICC is considered as the best Secure Element (SE) in an NFC ecosystem.

Trusted service managers provide a contact point between service providers and NFC mobile phones with service providers. They remotely manage multiple applications in mobile phones thereby creating an interoperable mobile NFC ecosystem. A best-in-class trusted service manager should issue and manage trusted execution environment, securely download applications to NFC mobile phones, personalize applications, and lock, unlock, and delete applications from the mobile device when requested to do so.

In Conclusion

For mobile banking to achieve wide adoption, two things must happen simultaneously: bringing technologies like NFC mainstream and determining the right channel strategies across the mobile customer segments to leverage those technologies effectively. Banks need to balance their channel strategy delicately since ignoring one group at the cost of another might backfire. Banks should look at low-hanging fruit in terms of mobile technology and offer the right set of mobile transaction and information services. It is important to bring together the right ecosystem to integrate more complex applications so that a plethora of mobile services can be delivered to customers.

Simplifying the existing value chain can make internal processes more efficient. Using the right technology and incorporating to the Voice of the Customer are crucial components needed to provide a rich mobility experience to a broad range of customers.

References

(1) Generation X abbreviated to Gen X, is the generation born after Western post–World War II. This segment includes people born in the '60s and '70s, ending in the late '70s to early '80s, usually not later than 1982.

(2) Gen Y, also known as the Millennial Generation (or Millennials), Generation Next, Net Generation, Echo Boomers, describes the demographic cohort following Generation X. This segment includes people born between the mid-1970s to the early 2000s.

Vertical Snapshot

Mobility in Insurance

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Take a closer look at insurance value chains to identify the immense opportunities mobility provides

Abstract

Mobility is an important technological advancement for the insurance market, offering unique opportunities for different types of insurance. To pinpoint these opportunities, one must take a closer look at insurance value chains.

Taking advantage of services offered by newer and better smartphones, the time is ripe for insurance companies to streamline internal processes and offer leading-edge services to mobile customers.

Mobility Opportunities in the Insurance Value Chain

Over the last few years, mobile devices have evolved into machines with formidable computing power. Packed with advanced features such as large touchscreen displays, faster multi-core processors, larger storage capacity, advanced imaging, and location awareness, these devices will play a major role in supporting applications for key stakeholder interactions in any organization. One of the offshoots of this significant advancement in mobile hardware technology has resulted in unlocking the mobile applications' market potential, which some analysts expect to reach US $32 billion by 2015.

Mobility will transform every industry, and insurance is no exception. Identifying where mobility can be best utilized requires a fresh look at the insurance value chain. For simplicity, we will consider two value chains: life insurance (Figure 1) and property & casualty insurance (Figure 2).

Figure 1: Opportunity for Mobility in the Life Insurance Value Chain

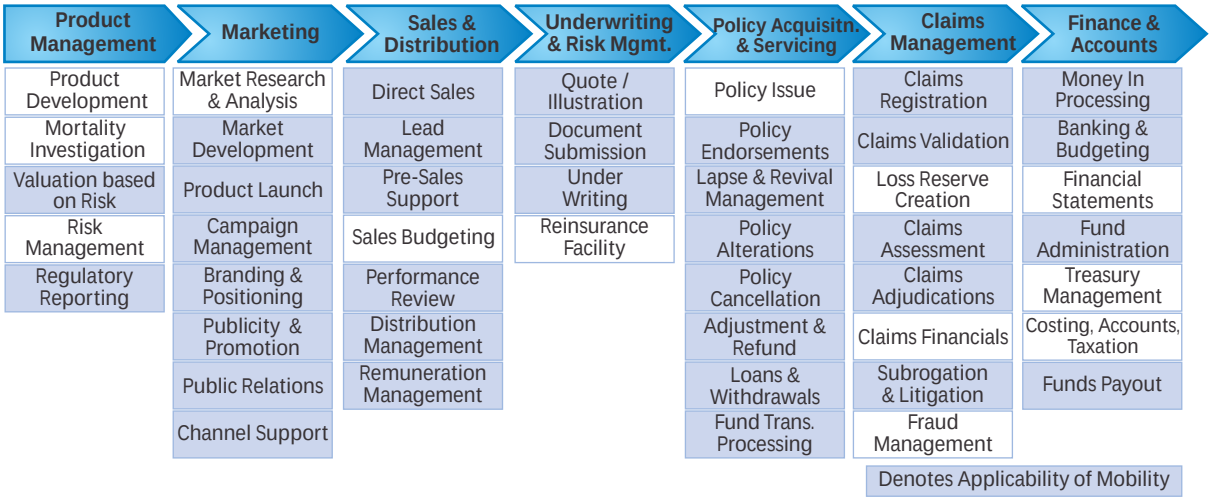
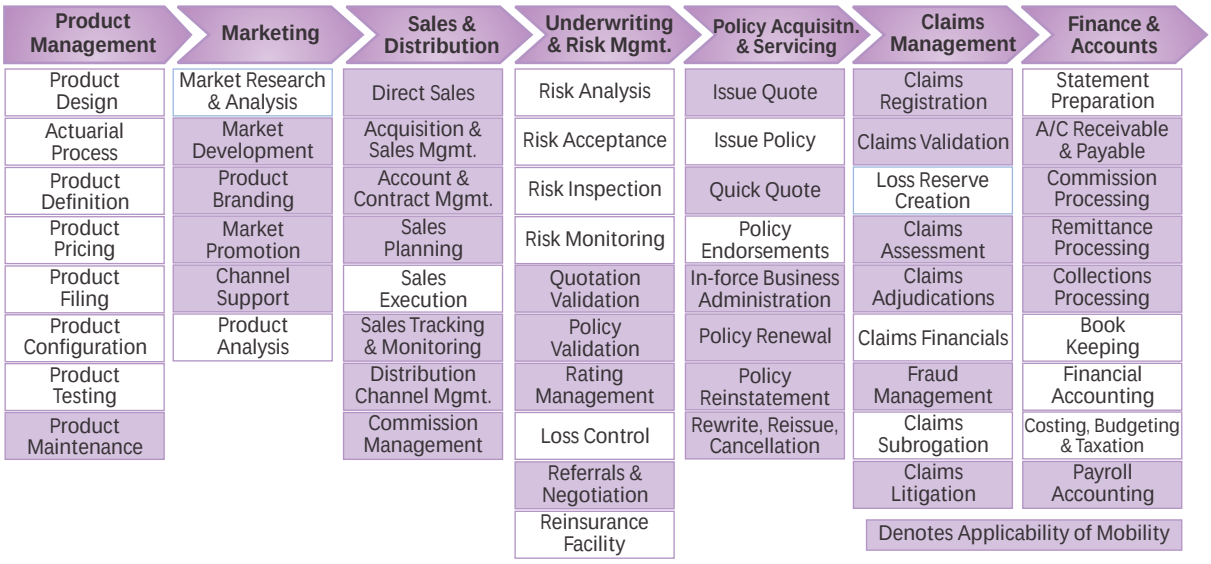


Figure 2: Opportunity for Mobility in the Property & Casualty Insurance Value Chain



As illustrated in Figures 1 and 2, mobility can play an extensive role in almost all business processes in the insurance value chain. Identifying these opportunities can help businesses create a roadmap to roll out mobility in phases across the enterprise. It is clear that mobility can help to add business value when these opportunities are harnessed. The way ahead is to translate these opportunities into mobile applications that cater to stakeholders' needs.

Mobile Applications to Seize the Opportunity

Mobile apps can help all stakeholders—the insured, insurer, business partners do their jobs better, faster, and cheaper. Communication-intensive processes are the first to reap the benefits of mobility.

Self-service customer apps will continue to develop and become more user-friendly. Apps that provide insurance services, such as quick quotes, are already available. However, experts feel that the future belongs to convergent applications that provide an all-in-one interface for every kind of service. Clients can now compare the benefits of multiple insurance options. While processing claims, data that was missing from an initial capture can be easily populated by a customer using a mobile app. Another class of application relates to mobile telematics, which allow insurers to collect data as it is generated for specific products such as car insurance. Individual consumers will not be the only ones who benefit from such technology. Corporate clients could take advantage of applications that track and manage all employees that fall within a group insurance policy.

Among the key stakeholders, the demand for mobile applications will be the highest from insurance agents. Mobile applications (especially those that are tablet-based) such as Sales Force Automation (SFA) tools will facilitate new policy illustrations, provide straight-through processing of insurance applications, and create performance dashboards for sales cycle optimization. Another area of focus is applications that help in claims management, specifically in reporting and adjusting.

Case in Point: A Leading Financial Services Company Applies Mobility

A leading financial services company in the US, providing property & casualty, life insurance and portfolio management services, wanted to provide "smart applications" to its customers. We work closely with the company to achieve this goal by adapting complex UI pages to lightweight pages in case of low bandwidth. Customized device dependent look and feel, integration with Yahoo APIs for location based services, and reuse of business components led to better mobile self-service, improved turnaround time and customer experience, and reduced TCO.

Employees of insurance organizations will benefit from mobile applications designed specifically for their needs. Applications that provide real-time prompts, such as catastrophe alerts and analytics dashboards to enhance decision making, will be especially differentiating. Agents in the field will be able to use mobile apps to collect data about the property to be insured and transmit it directly to the underwriters.

By providing mobile apps to agents and the sales team, insurers can reach out to new target markets faster, which can help grow their business. By improving self-service and pushing more tasks to agents, insurers can reduce calls to customer service and improve operational efficiency. Agents with access to more information, anytime, anywhere, can improve consumer satisfaction and close business more easily. Enabling claims capture from the field and providing real-time access to required information, including information from third parties or service providers will allow insurers to control and manage their losses better.

Some best-of-breed insurance organizations have already ventured in this direction by capitalizing on the opportunities that insurance business processes present them with. These organizations have spearheaded the creation of some applications that not only aid enterprises, but also add to organizational goodwill by helping customers. A few notable examples of mobile applications that are intended for the insurance organization's use include needs analysis, illustrations, quick quote generation, product catalogs, claims assessment, and estimation applications. There are other apps intended for policyholder use, such as tools that provide 24/7 customer service, pension planners, and wellness apps for health insurance that help track whether individuals are meeting their health goals.

It is easier to demonstrate the benefits of mobility through examples. The following sections describe loss control and management applications such as mobile telematics applications and catastrophe claims management solutions. It is important to bear in mind that these examples are hypothetical; actual benefits will depend on factors such as business goals, priorities, existing technology ecosystem, and regulations.

Reducing Accidents with Mobile Telematics

Telematics is essential for the accurate calculation of premiums in usage-based insurance. Conventional telematics solutions involve fitting vehicles with special devices that directly feed information to the insurer's systems. Fraudulent claims and expensive claims management costs due to long cycle times which lead to annual losses of around US $20 billion. Experts believe that this amount can be greatly reduced by adopting telematics systems. The catch is that implementations can be prohibitively expensive. Insurance players have always weighed the cost savings accrued against the expense of implementing these systems. But as the era of mobility unfolds, specialized smart applications running on mobile devices will make telematics available more widely. These applications can turn a smartphone into a cost-effective telematics device that provides much of the same functionality. Benefits can be extended not just to insurers but also to customers. This can be a win-win situation—the insurance company gets the benefits of a telematics unit and customers can use smartphones as a life-saving device – by helping prevent accidents and automatically notifying emergency services in the event of one.

Once installed, these applications run in the background. The moment a user's vehicle moves, the location-aware system built into the smartphone invokes the application. The

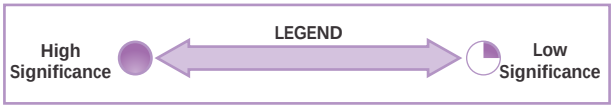
application gets information from the GPS to determine the vehicle speed, compares it with the speed limit for the area using stored values, and alerts the driver if he or she is speeding. The driver can also get traffic and weather updates. When the user is driving, the mobile device can answer incoming calls with a prerecorded voice message asking the caller to call back later. Needless to say, these features, when used together, reduce the risk of accidents. These applications also have accident detection algorithms that use the phone's accelerometer. In case of an accident, a sudden change in g-forces is detected by the accelerometer, and the application deduces that a vehicle collision may have taken place. It can call for emergency services by automatically dialing a preconfigured emergency number and notify the insurer. When the call is placed, a prerecorded message informs the hospital's emergency response unit about an accident in a certain location. Since this is a real-time scenario, the insurer is alerted immediately and can assist the customer faster. This also reduces the chances of fraud because the phone is with the user while driving. These types of applications run using contextual information from the phone.

Such applications can also leverage the power of social media, where drivers' communities may be created to exchange tips on safe driving, better routes between places, and best practices such as ways to save fuel. Since the phone is being used as a telematics device, it can detect users' driving patterns. This data could be used to award "safe driving points" to good drivers. Names of drivers with maximum points could be displayed on social networking portals. For example, these points could be calculated based on aspects such as the driver's response to risk alerts or adhering to speed limits. Points could then be exchanged for discounts on insurance premiums. Not only does this promote safe driving, but it also reduces the number of claims. And, the lower the number of claims, the lower the combined ratio of the insurer. Figure 3 shows the overall benefits to both insurer and insured.

Figure 3: Benefits of Mobile Telematics Systems to Insurer and Insured

Popular Feature	Significance to Insured	Rationale	Significance to Insured	Rationale
Usage Based Insurance	◑	Premium discounts for safe and eco-friendly driving behavior	●	Cost-effective accurate premium calculation based on risk exposure
Accident Prevention	●	Alerts on speed limits and prerecorded responses to incoming calls while driving	◕	Reduction in accident claims
Automatic Accident Detection & Notification	●	Detects the accident with the help of phone's accelerometer. Faster crisis response through automatic emergency call option.	◑	Reduction in fraud by validating cases of accidents. Faster service deployment in case of genuine emergency
Social Media Integration	◕	Enables the insurer to publish on social media details of the best driver based on points earned through good driving	◕	Works as marketing tool to attract potential customers

Source: TCS Global Consulting Practice – Research Desk



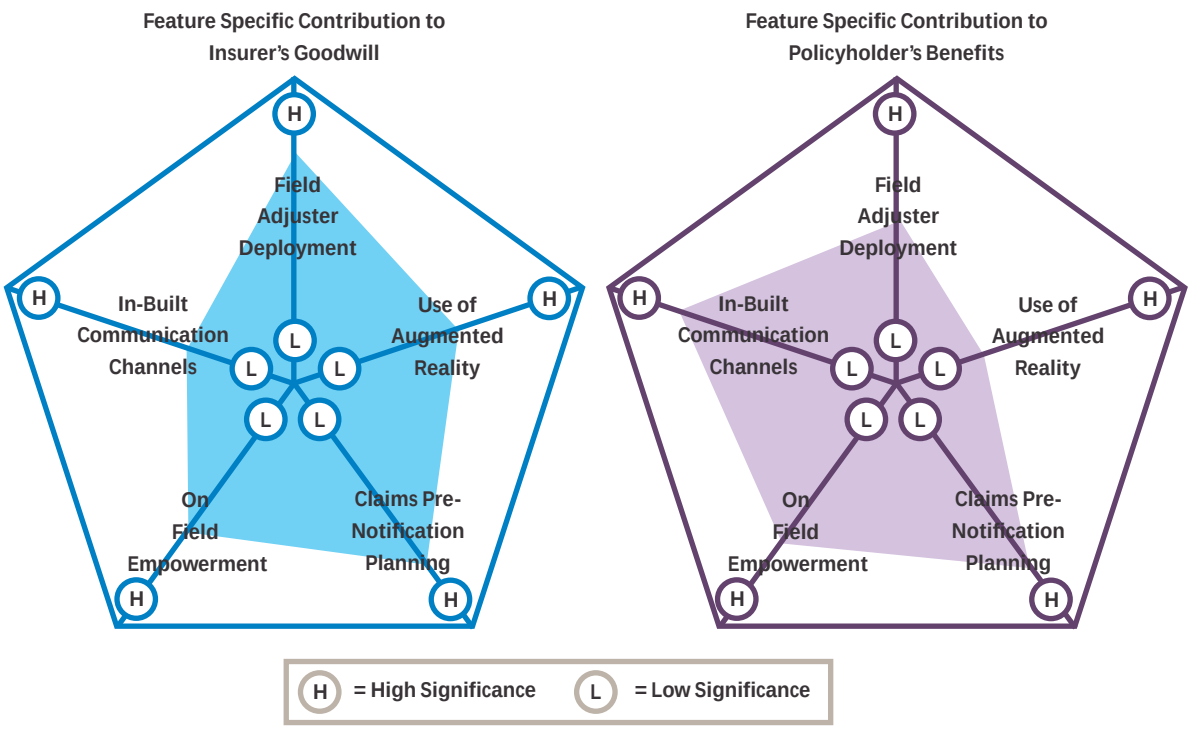
Managing Catastrophe Claims

According to the Insurance Information Institute, catastrophe claims are the second greatest source of insurance claim costs, after medical claims. The worst impact to the brand image of insurance companies stems from mismanagement of claims related to major calamities–a time when customers rely on their insurers to help them through a crisis. With catastrophes, managing customer expectations can be a daunting task. One of the ways this challenge can be handled is by deploying field adjusters to the affected sites and giving them information about customers. To this end, advanced catastrophe claims management systems that use mobile devices enabled with specialized smart applications can help adjusters.

Catastrophe Claims Management Systems consist of two components—the server component accessible to claims managers on a desktop, and the client component accessible to field staff from their mobile devices. The server component allows managers to track the development of potential catastrophes with GIS capabilities. The mobile component, on the other hand, allows field adjusters to access information such as client profiles related to claims records and updates to claim status. Field adjusters can visit damaged properties, take pictures, and upload them to the insurer's database directly from the device. This kind of enterprise collaboration, through the use of collective intelligence, results in benefits for both the insurer and the insured.

By allowing insurers to proactively create claims records, not only for policyholders who are impacted by the calamity but also those who are likely to be affected, these types of catastrophe claims management systems allow insurance companies to assess how many field adjusters to deploy and what locations have been hardest hit by the event. This results in better deployment of emergency response units to the right places and ensures that impacted policyholders get the best possible service regardless of their ability to ask for it. As an additional aid to field adjusters, the mobile device client can map affected customers in a particular area that is likely to be impacted. It can also be used to communicate with customers using channels conducive to them such as mobile calls, email, and social networking tools and advise them about how to stay safe in affected areas. Another advanced feature is the use of augmented reality mashups, utilizing the power of GPS, maps, and camera images to locate affected policyholders easily. Figure 4 shows benefits for both insurers and policyholders.

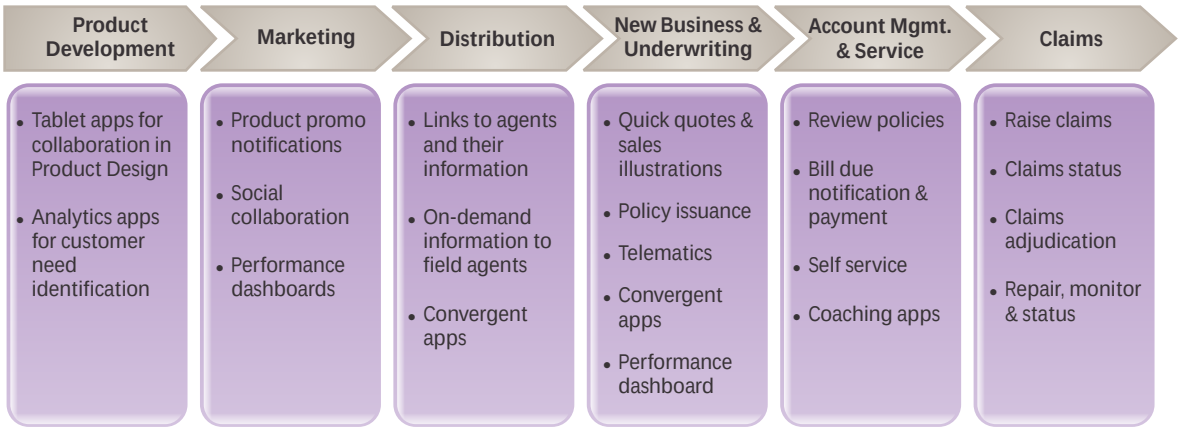
Figure 4: Benefits of Catastrophe Claims Management Systems



Opportunities for Mobile Applications for Insurance

There is a significant scope for insurers to develop and deploy mobile applications and systems to tap into mobility-led innovations. Figure 5 depicts some examples of mobile applications.

Figure 5: Examples of Mobile Applications to Augment Insurance Value Chain Components



As mobility makes inroads and the technology supporting its evolution matures, the insurance industry can greatly benefit by tapping into many opportunities. Some of the top insurance companies already view mobile technology as a trusted ally in their efforts to add business value. This is not to say that the opportunities for adopting mobility lie only with companies that sell life and property and casualty insurance. Reinsurance companies can also use mobility for many of their processes, both internal and external. Though the proliferation of this revolutionary technology in this line of insurance may not be as substantial as it would be in life or property & casualty, mobility will nonetheless find a place with workers such as claims adjustors. Insurance companies should take a closer look at their value chain, and assess where mobility can make a difference.

Vertical Snapshot

Mobility in Manufacturing

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How enterprise mobility can be leveraged in manufacturing business processes

Abstract

In manufacturing, mobility can add business value by simultaneously improving workforce productivity and attracting new customers. Extracting the maximum possible benefits from mobility requires looking at the manufacturing value chain and identifying where this innovative technology can be utilized.

One challenge that will arise is that the manufacturing industry can be split into multiple sub-verticals that present their own unique opportunities for mobility. A carefully laid mobility strategy should consider this challenge before being finalized.

Mobility Opportunities in Manufacturing

Mobility has largely been consumer-driven, thriving in a B2C environment. Since the manufacturing industry focuses on B2B, it takes more effort to see how mobility applies. Today, investments in IT for manufacturing trail behind those of most other industries, with companies setting little over 5% of their IT budget aside for mobility. As technology evolves, these organizations will have a greater incentive to embrace the advantages that mobility provides. The biggest consumer of information in an enterprise today is the employee. Visibility of KPIs and access to critical transactions on smartphones yields an immediate advantage in terms of productivity and better decision making. A growing mobile and "socially networked" workforce coupled with the acceptance of emerging technologies in the workplace are forcing organizations in the manufacturing value chain to rethink their innovation strategies in the technology space. So, if mobility is the next technology mantra, we must justify its capability to add business value (Figure 1) by improving productivity and by building closer connections with the customer base and attracting new customers.

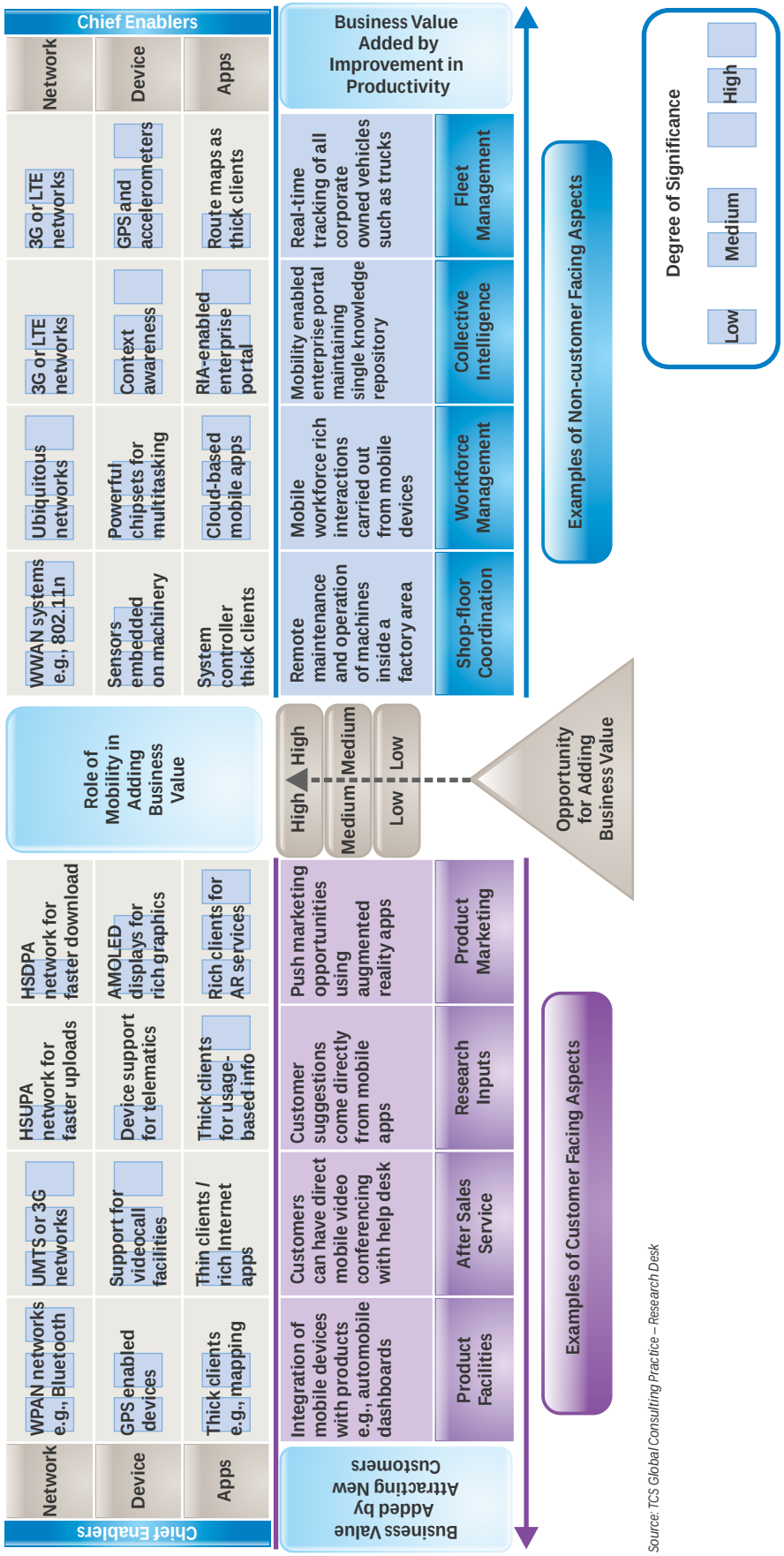


Figure 1: How Mobility Can Add Business Value in Manufacturing

Source: TCS Global Consulting Practice – Research Desk

In today's work environment, executives need to be closer to the customer, support the supply base, and manage operations, while remaining aware of what is happening in the entire value chain and understanding the impact of their decisions. As depicted in Figure 1, customer-facing aspects such as marketing and after-sales services can gain a lot from mobility. For example, capturing feedback has been largely enabled by the use of social media, accessed from mobile devices. Such initiatives will help organizations gain a larger and more loyal customer base. Essentially, getting feedback on a product or service and hearing about the customer experience need not rely solely on focus groups or other traditional forms of market research. These traditional forms are bottlenecks; it takes time for key data to flow back into the organization.

Case in Point: BlackBerry Employee Search at an Auto Manufacturer

We developed a search application for a leading US automobile manufacturer. Using ours application, an employee can search for and connect with colleagues while on the go. The application integrates with the enterprise database and provides search through a secure BlackBerry enterprise server, enabling better workforce management.

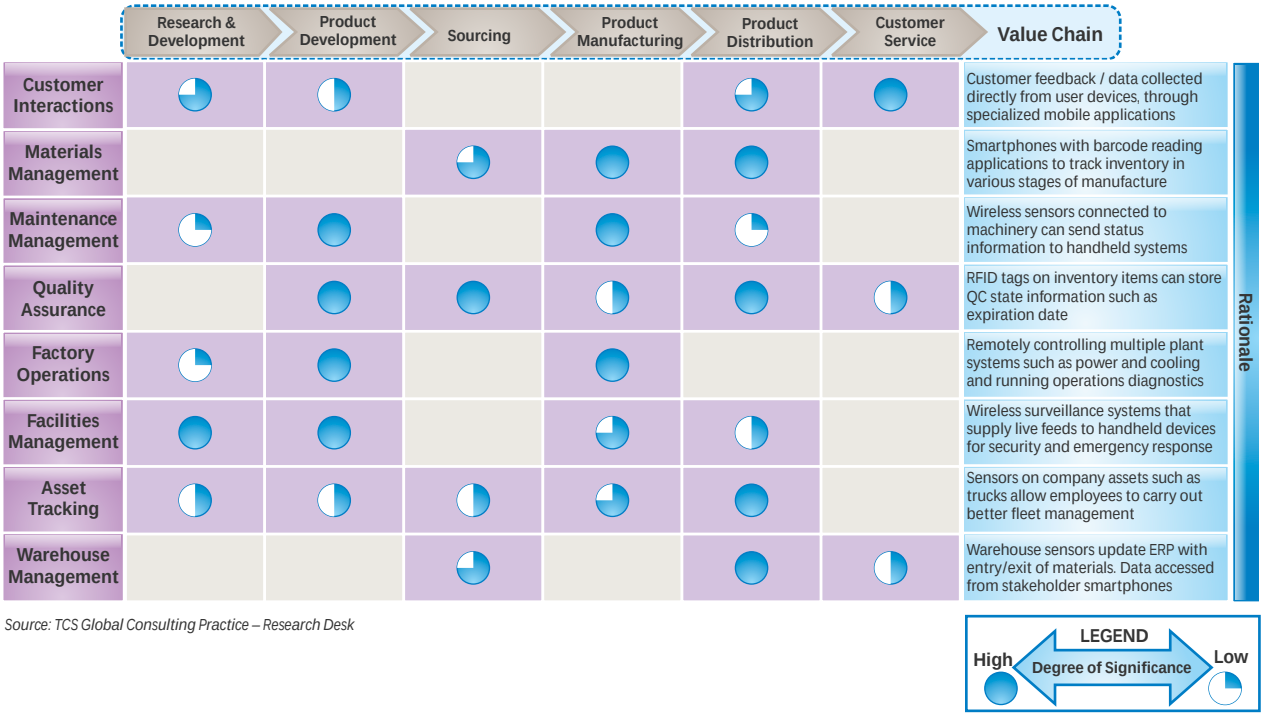
Aside from the customer-facing aspects, organizations can also consider mobility as way to become more productive, especially by helping their workforce. Context awareness in mobile devices will allow information to be sent to a central repository. This repository can then be utilized to make faster, more informed decisions. The first level of this kind of mobility adoption can already be seen for the enterprise's legacy applications, which are transactional in nature. Such applications are being rolled out onto smartphones to expedite information channelization to the stakeholders, using a mix of thick, rich, and thin clients. In the near future, we could see near real-time business intelligence dashboards being generated on mobile devices themselves – a clear advantage when it comes to faster decision making. As an example, Bluetooth-enabled mobile devices carried by fire marshals in a very large petrochemical factory can keep updating their current position on the floor supervisor's dashboard through wall-mounted sensors. In case of an emergency, the sensors in that sector would automatically alert the nearest fire marshal, resulting in faster response time. The technology enablers for such facilities – networks, devices and applications – have already been discussed in other articles of Perspectives Vol. 4.

Decision makers can keep their ears to the ground and monitor events like commodity pricing, government policies, competitor strategies, technology advances, and so on. Such events have a large impact on the financial and operational parameters of global businesses. Many organizations have invested in Early Warning Systems (EWS) that carry out an analysis of events that directly or indirectly have an impact on organizational well-being. Collective intelligence gained from such sources can now be presented to executives on their smartphones the moment they are generated, drastically reducing decision-making time.

The Manufacturing Value Chain

Mobility can allow manufacturing organizations to generate business value. The next step is to understand where mobility can be implemented for business benefits. Let's look at the manufacturing value chain. It is estimated that by 2013, two-thirds of the employees in manufacturing organizations will be using mobility solutions to manage their operations. To enable these solutions, the industry will spend about US $17 billion across the mobility value chain covering smartphones, data plans, telecom carriers, app stores, technologies, and development and testing tools. Though the investment in devices and technologies in manufacturing is being approached cautiously, taking a fresh look at the manufacturing value chain will be important since this will allow executives to understand where mobility can be utilized (Figure 2).

Figure 2: Opportunity for Mobility in Manufacturing Value Chain



Source: TCS Global Consulting Practice – Research Desk

Based on the value chain, let's explore how mobility can support these opportunities across select examples.

Opportunities in Customer Interactions

Mobility plays an important role in customer interactions. Traditional channels for collecting customer feedback are slow. For example, for an auto OEM, important customer information came too late in spite of the traditional channels of customer surveys, warranty reports, and dealer service feedback. The problem that was developing wasn't detected until 6 months had elapsed. This time lag resulted in a loss of market share coupled with brand dilution. The negative sentiment was increasingly evident in social media but remained unnoticed by the OEM executives in warranty, service, and product engineering functions, simply because there were no systems in place to capture this information. This example makes one thing clear: the closer the organization is to its customers, the sooner it can get feedback. The sociotechnological tool to use in such cases is the ubiquitous smartphone.

Today, feedback can be captured by applications that are available on app stores. Enabled by the mobile device and OS manufacturers, customer reactions can be instantly recorded. Since mobile devices are with users, their experiences, comfort, and problems with products and services can be quickly expressed and gathered at the point of contact. Applications can be built to capture such unstructured data and gain meaningful inferences from it. Product and engineering managers can choose how and when they would like to react to such information by monitoring it regularly. Negative customer feedback related to a particular product can prompt the backend system to "red-flag" the product and instruct product engineers to conduct a Root Cause Analysis (RCA). Consequently, product development teams can use the insight while researching new products. Researchers can study demographics through data collected from specialized mobile applications and plan better marketing campaigns. Such mobility solutions will ensure that geographically and functionally dispersed teams are aware of potential product-related problems in real-time.

Customers can also approach the help desk using video-conferencing facilities supported by their mobile devices the moment they face a problem with a product. Richness in communication channels will help product development and marketing, where enterprises can exploit the capabilities of today's mobile devices. For example, they can use augmented reality applications to conduct product demonstrations, and also address consumer pain points faster and more effectively.

Using Mobility to Better Manage Inventory

A globally dispersed supply chain and workforce/operations makes the supply chain manager's job challenging. The volume of parts, suppliers, warehouses, and logistics services that need to be synchronized is huge. Real-time visibility into the processes at every step, coupled with centralized monitoring can ensure that operations flow smoothly. Specifically designed mobile applications can provide such visibility. Another area of opportunity lies with the use of mobility in inventory management. Applications that allow smartphones to scan barcodes already exist. Coupled with this, RFID tags connected to inventory items can be read using Near Field Communication (NFC)

enabled mobile devices. When connected to the ERP system, supply chain managers can get real-time information on materials movement, which is crucial in a Just-In-Time (JIT) environment. Connecting such systems to the organization's Business Activity Monitoring (BAM) system can reduce inventory costs to a bare minimum.

The same RFID tags can also help with quality control, particularly in manufacturing verticals such as pharmaceuticals, where the expiration date of the final product, which is incorporated into the tag, is very important. When these products are stored in a warehouse, an NFC-enabled smartphone can be used by a worker to scan the units that are fit for distribution. All the worker needs to do is to walk around the warehouse, and the mobile device accesses the information stored on the RFID tag, as long as it is within the NFC range. The smartphone screen could show a schematic of the entire warehouse. When wall-mounted sensors detect the presence of the product nearby, the warehouse management system updates the ERP system. The smartphone is then updated and small gray boxes representing the products to be scanned appear on the schematic. When the NFC-enabled mobile device scans an RFID tag, these gray boxes could turn green to indicate the product's readiness for dispatch. If the gray box turns red, the product failed its quality assurance test and must be discarded. The only caveat is the expense involved in incorporating NFC. Until such NFC reader-enabled mobile devices become cheaper, an alternative in the form of detachable limited use NFC decoders that can be attached to the worker's smartphone can do the same job. Analysts believe that some of the largest opportunities for mobility lie in inventory management and quality control.

Case in Point: Mobile Sales Reporting for Manufacturing

A leading manufacturer of batteries and flashlights had to manage its large distribution network with 15 branches, 40 warehouses, and more than 4,000 distributors, some of whom were in remote villages. Keeping track of inventory for timely order fulfilment was a challenge. The company also wanted to have real-time data on distributor performance, which was vital for sales planning.

The sales force wanted real-time data on various retailers' stock/product ordering patterns. The manual data gathering process was slow; it took months to get the information to the sales force, and this lag was clearly affecting the company's bottom line.

Listening to the sales managers, the company developed a mobile interface for its sales reporting system. IT integrated the primary, secondary, and forecast information into a data warehouse. The mobile application helped the sales force get real-time information about the sales history and stocking patterns of retailers and distributors. The data was secured through strong encryption and role-based access control.

On rollout of the mobile app, the company witnessed a 15% increase in accuracy in its forecasting and fewer stockout incidents in retail locations. Inventory turn increased significantly as well.

Mobility in Manufacturing Facilities

On a similar note, Facilities management can also be aided by enterprise mobility. In this case, wall-mounted cameras can deliver a live video stream to smartphones over a low-latency network such as 802.11n. Every corner of the plant facilities can be monitored without the need for expensive wiring. This facility could help organizations in the aerospace, especially those that handle defense-related government contracts. Any security discrepancy could be observed in real time.

Wireless sensors can be used both for maintenance management and asset tracking. The latter is of extreme importance in industries such as mining, especially for open cast mines. A variety of mobile assets such as dumpers, excavators, front-end loaders, and large grab buckets are spread across a very large area. GPS-enabled sensors could allow workers to track them on wireless handheld devices, allowing for faster decision making in the event of a change in mine planning. Workers' mobile devices can alert them the moment they enter a hazardous area by allowing the map applications on the mobile devices to have so-called "alert" waypoints. When a worker enters such a zone, the GPS-enabled mobile device could display a warning. Additionally, in case of an accident, a specialized application could send out a distress call to the mine engineer along with the GPS coordinates of the injured workers.

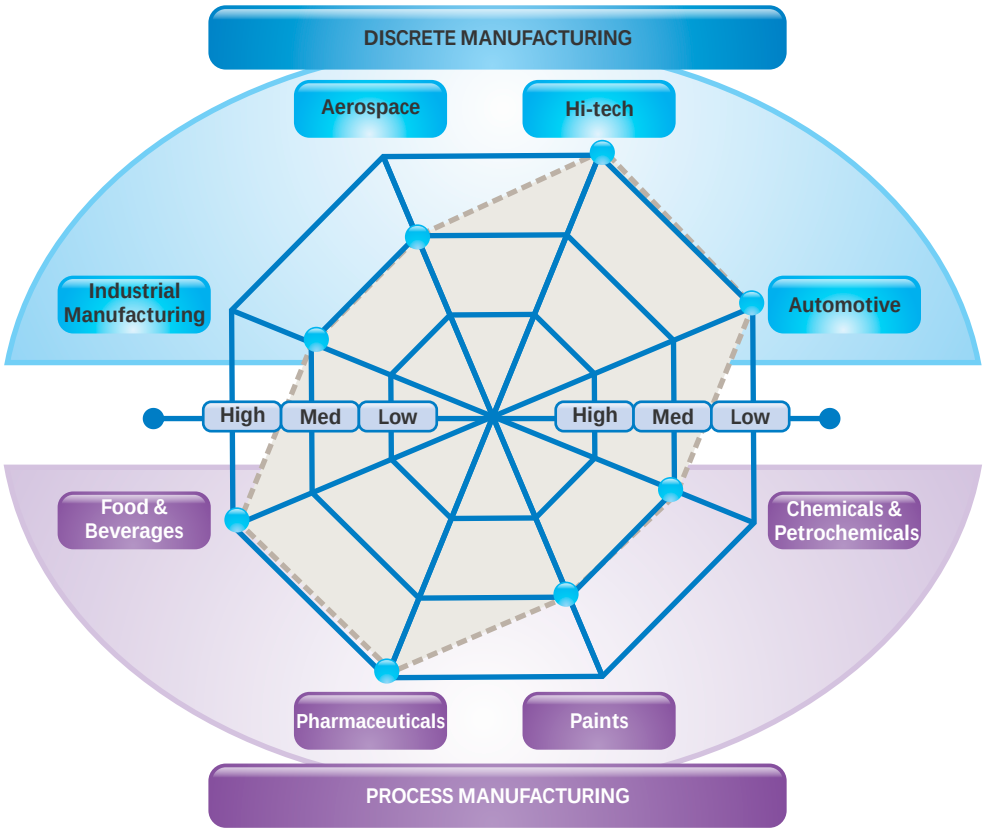
Sensors on machines in a factory can allow technicians to know when maintenance is needed. Since accelerometers have become small enough to be embedded in mobile phones, they can be incorporated in the sensors. In case a machine's sound level exceeds the set tolerance limit, the sensor connected to a WiFi network within the factory could update the controller's dashboard, thus expediting maintenance-related interventions. Augmented reality (AR) applications on the mobile device could juxtapose information about which tool to use and highlight the damaged area of the machine directly on the camera image. A large U.S. governmental organization is already using AR to train its personnel in using technical instruments.

Finally, mobility can also be used to remotely control shop floors. To a certain extent, technology similar to this already exists in the form of home networks. On a factory floor, a supervisor could wirelessly control the factories' Supervisory Control and Data Acquisition (SCADA) and Distributed Control Systems (DCS) directly from the smartphone. With improved telecommunications technologies, Remote Terminal Units (RTU) can already communicate wirelessly to control systems. Mobility can develop these wireless machine-to-machine (M2M) and human-machine interfaces (HMI), allowing designated personnel to supervise and control shop-floor activities from anywhere, directly from their mobile devices, which demonstrates ubiquitous control.

Process and Discrete Manufacturing

While at a high level mobility presents many opportunities for the Manufacturing industry, the degree to which this radical technology can be leveraged will vary at sub-industry level. Manufacturing can be split into two types of industries: process and discrete manufacturing. It is the uniqueness of their operations that will ultimately dictate the level to which mobility can actually be used (Figure 3).

Figure 3: Level of Opportunity for Mobility in Discrete and Process Manufacturing



Source: TCS Global Consulting Practice – Research Desk

These opportunities may be specific to individual organizations. The methods that may be employed for multiple aspects of mobility - platforms, devices, applications and data - are covered in earlier sections. To support near-term needs, some manufacturing organizations are already focusing on defining their mobile strategies with basic standards and support, using tactical enabling technologies, shared development and testing tools. Though the market is still fragmented in terms of development platforms and devices, the future could well belong to device-independent access to a secure, unified, global enterprise by leveraging Web 2.0 technologies. The CIO should decide upon an adoption plan after filtering these opportunities for mobility based on the enterprise's unique needs, which also needs to factor in a phaseout plan for existing technology.

Mobility is part of new business models that will help organizations better manage complexity in an uncertain economy by incorporating mobile applications and turning them into a competitive advantage. Mobility will also open up new channels for collecting customer data and allow organizations to better interact with them. It will improve efficiency by enabling better decision making by providing data on mobile devices, allowing managers to drill into dashboards and KPIs and initiate transactions from anywhere. Clearly, decision making will reach different business levels – strategic, tactical and operational. Ultimately, the goal of a manufacturing organization should be to ensure that any technology adopted is agile enough to build upon future technologies.

Vertical Snapshot

Mobility in Retail

Cheenttan J Voraa
Mobility SME - Retail & CPG

Customer requirements can drive new mobile applications to reach and retain retail customers

Abstract

In retail, smartphones have brought new life into an already complex web of multichannel retailing. Mobility can be a boon for the retailer as much as for the customer. For the customer, benefits accrue from discounts that come from personalized marketing derived from strong analytics. For the retailer, mobility provides the ability to deliver relevant applications at each customer touchpoint in conjunction with the overall strategy for channel management. The challenge for the retailer is to target the customer with compelling promotions based on whether they are in the store, on the road, or at home. A good solution may be to create a uniform customer engagement platform that helps filter technology based on customer sentiment and behavior.

Knowing Your Customers Is Key

Mobile retailing, or "m-retailing," is on the fast track. According to The Yankee Group, over 50% of 13 to 17-year-olds own mobile phones and approximately 60% of all American children have them. Additionally, according to the Kaiser Family Foundation, 8 to 18-year-olds, a demographic whose market penetration of mobile devices rose from 39% in 2004 to 66% in 2009, spend about 20% of their media consumption time on a mobile device. Further, estimates show that nearly 40% of smartphone users have purchased an item using a mobile device in the last six months, across categories such as books, DVDs, and movie tickets. This trend is likely to continue into the future. Gartner estimates that by 2014, three billion adults around the world will be able to conduct transactions via mobile or Internet technology.

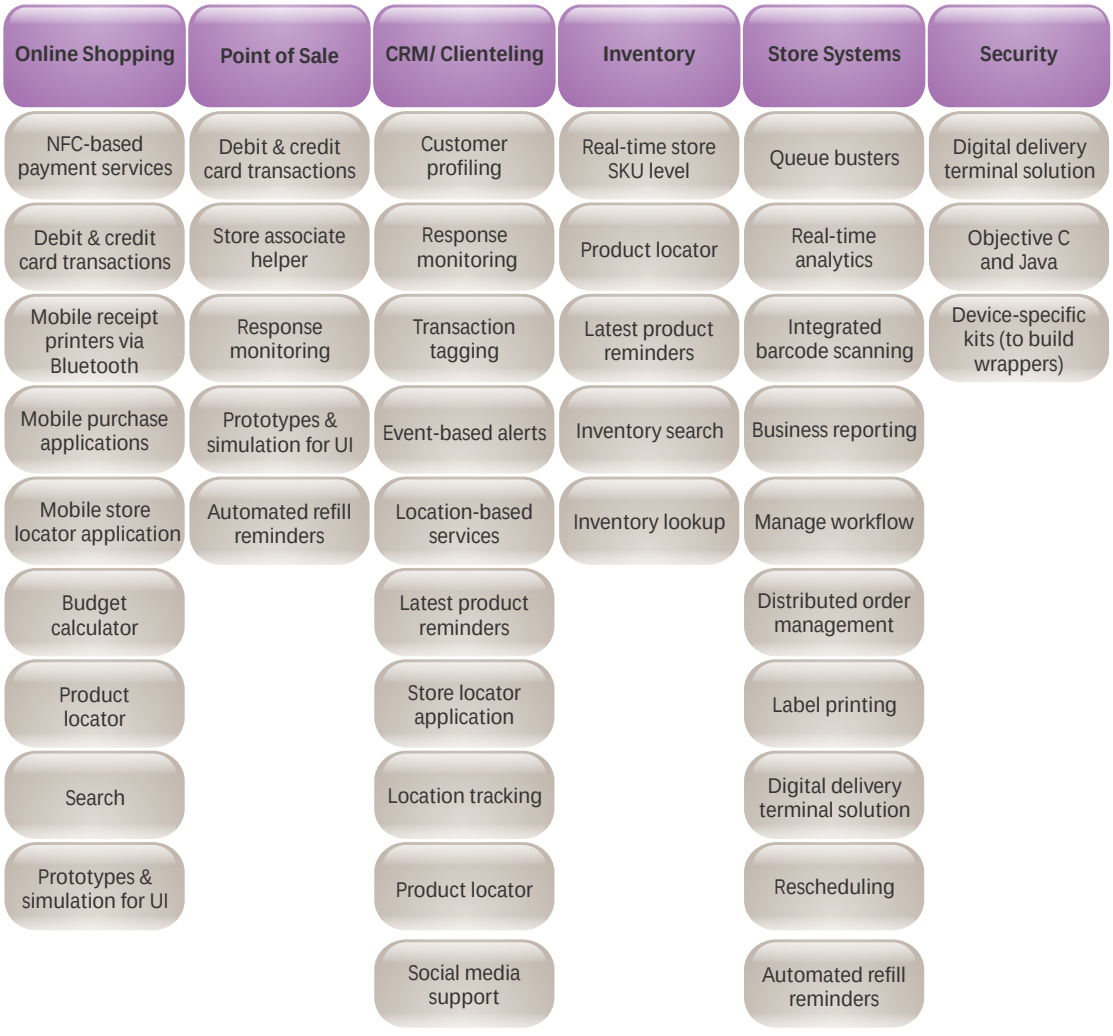
An increase in mobility affects the way services are offered to customers. Without supporting infrastructure, any new technology initiative may be fruitless. No matter how sophisticated their smartphones are, if retail customers fear that their personal information could be compromised during a mobile phone transaction, they will refrain from purchasing via their devices. The takeaway for retailers? Security complements mobility. This is also true in terms of strategic offerings. For example, as soon as a customer creates a mobile cart or a shopping list, a message could be forwarded to their mobile device via SMS. This message could contain a link to a personalized mobile shopping list where shoppers can quickly reference product information, stock keeping units, pricing, and store locations, creating a seamless and profitable multichannel experience. Bringing this vision to reality requires that the customer and retailers engage in a one-to-one relationship through mobile devices.

Retailers have very little control over the mobile device landscape. They can, however, try to bridge the digital divide by building a unified customer engagement platform independent of the customer's device preference. The platform that the retailer offers to this "omni-shopper" should provide the right mix of usability, functionality, localization, personalization, user experience, content, safety, and infrastructure. For example, the most common mistake retailers make is simply creating a mobile version or WAP-enabled extension of their existing website. Whether you consider at navigation, display, or viewing, an ecommerce experience on a 14-inch screen cannot be replicated on a 2-inch mobile device screen. Furthermore, too many retailers settle for basic functionality and don't create breakthrough applications. Basic store locators and inventory searches are non-differentiating. Retail chains need to define their user audience, identify specific objectives to accomplish through the m-retailing channel, and establish a clear understanding of the necessary integration points within existing enterprise systems.

Understanding Customers' Wants and Needs

Despite the many differences in user experience, "m-retailing" is simply a new channel within the realm of multichannel retailing. The features offered in this new channel should be personalized enough to please users and offer differentiation from the competition. The new channel should not attempt to establish differentiated pricing for the retailer but rather provide a competitive advantage though improved user experience enabled by the right combination of features.

Figure 1: Snapshot of Retail Mobility Applications



Source: TCS Global Consulting Practice – Research Desk

In their quest to acquire new customers, retailers often ignore existing customers. Research from Harvard Business School showed that it costs 5 to 10 times more to win a new customer than it does to retain a customer, and that a 5% increase in customer loyalty translates to a 75% increase in profitability. It is very important to reach out to existing customers, as they are usually more accommodating, having experienced several service lifecycles. They are likely to prefer personalized solutions with a strong product mix, reward points, and coupons, as well as detailed product information to

support better decision making. The mobile application required for this customer group should at minimum offer a combination of capabilities, including automatic product locator, prototyping and simulation features, event-based alerts, new product alerts, an SMS-based platform to support text interactions when the customer enters a store or makes a purchase, and limited-time promotional codes. However, in the end, customers, through their responses, will help guide retailers in offering the best mix of features. Through an analysis and understanding of loyalty shoppers' purchase patterns and preferred merchandise and categories, retailers should deliver merchandise and services to shoppers locally.

Mobile applications present the retailer with a host of opportunities and offer customers an array of incentives. An analysis of history, location, and contextual information can help retailers encourage sales. Let's take the example of Jack, who walks into a mall. His buying pattern suggests that he prefers a particular brand of jeans. The mall, in conjunction with the retailers operating there, immediately send Jack an m-coupon from a store where clothes are on sale. It is Jack's birthday and around lunchtime, he is driving within one mile of his favorite restaurant. For his loyalty to the restaurant, he receives an m-coupon, which offers him free dinner. These well orchestrated and personalized gestures help build and strengthen brand loyalty.

Tata Consulting Services' M-retail Strategy: Critical Aspects

"M-retailing" should not be treated as a differentiator but as a complementary strategy.

The platform the retailer offers should provide the right mix of usability, functionality, localization, personalization, user experience, content, security, and infrastructure.

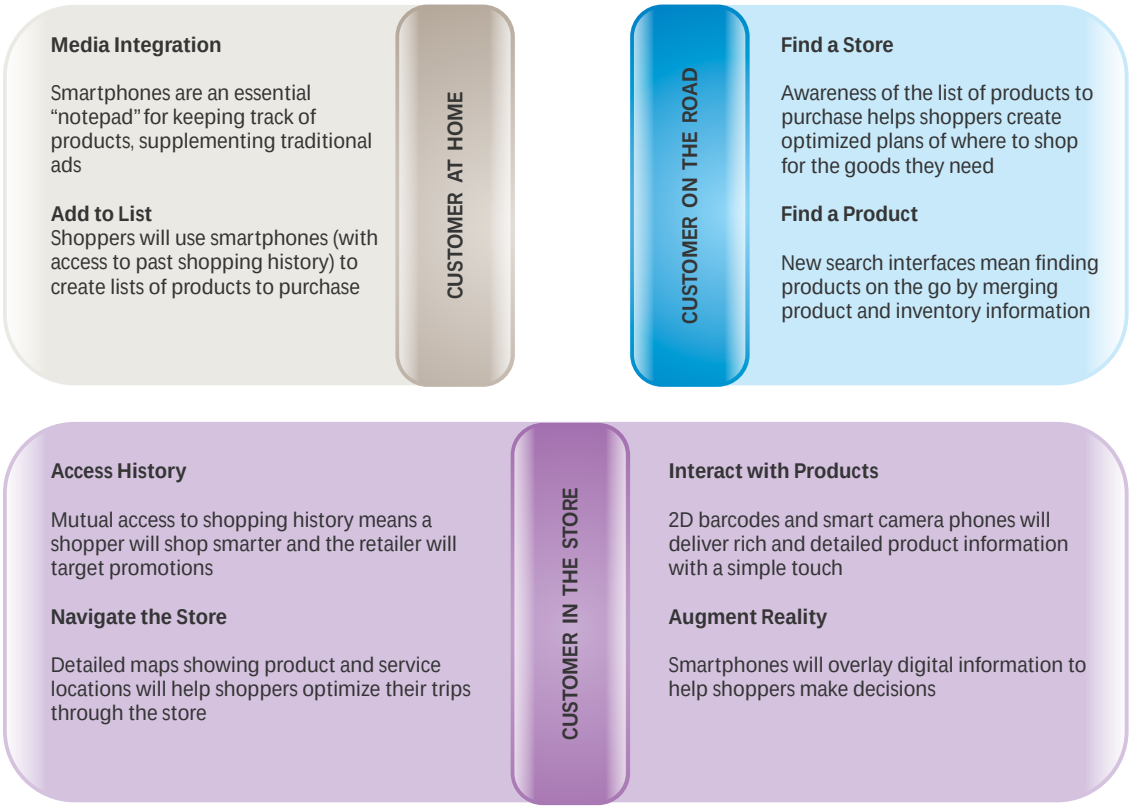
Retails should build a unified customer engagement platform independent of customers' device preferences...

Detailed customer information comes at a cost. The retailer's primary investment in technology is a robust business intelligence backbone covering a range of capabilities. This includes digital dashboards for mobile data collection, metrics, performance reporting, enhanced content management systems that can deal with mobile content uploads, mobile customer relationship management, mobile messaging gateway solutions, and text messaging. Retailers should invite shoppers to share their cell phone numbers, category and merchandise preferences, and in some cases, their loyalty card account numbers in order to create and push promotions, event alerts, and other marketing initiatives to shoppers both prior to entering the store and during their visit.

Creating a Unified Customer Engagement Platform

As retailers move into the world of m-retail, they need to understand a fundamental rule that states that a customer-centric strategy demands looking at the customer profile and their needs hierarchy. A starting point may be separating at home, on the road, and in the store customers.

Figure 2: Types of Retail Customers and Their Requirements



At home customers use mobility for online shopping whereas on the road and in the store customers typically use mobile applications for information gathering. This classification is important when formulating a mobile strategy for each group. It may be important to first gauge their level of technological sophistication and readiness for a personalized relationship with a retail chain. A lack of clarity may result in annoying customers with irrelevant banner ads and ad-hoc surveys, potentially damaging the client relationship.

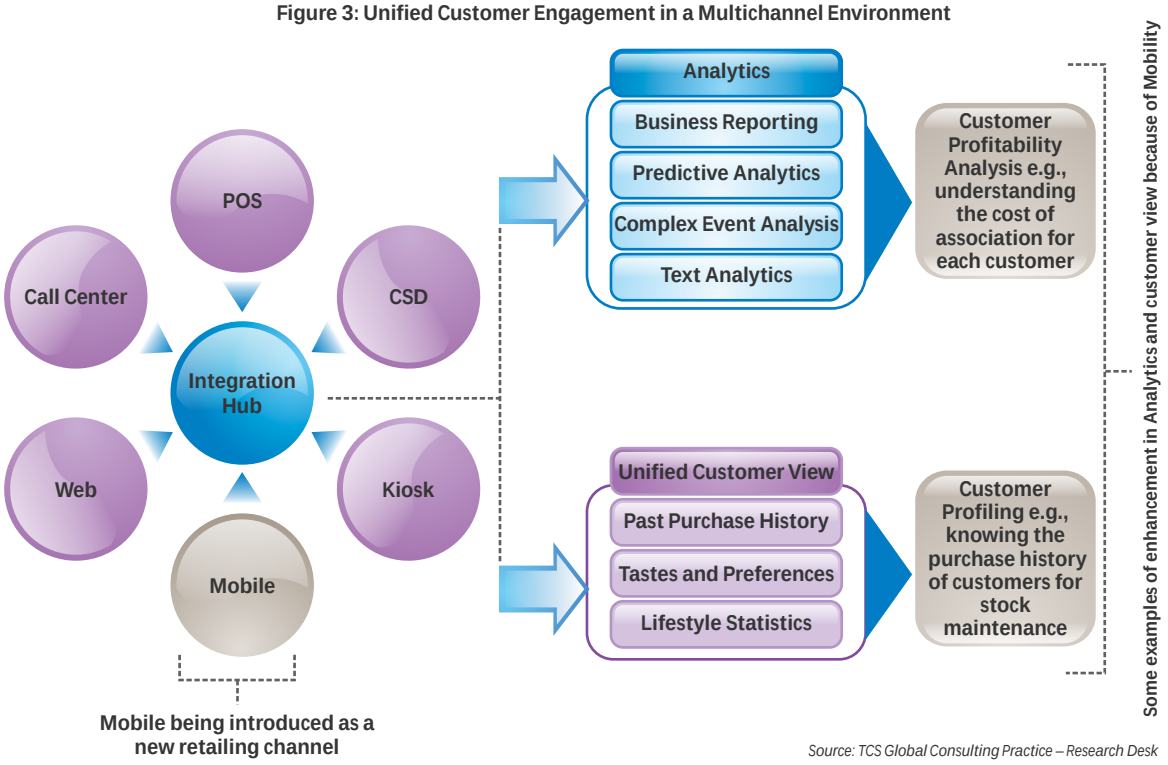
Tata Consultancy Services' Single Technology Infrastructure

"Adopting a common architectural framework with core functionality may offer more efficient and richer experiences for all customer segments."

"Integrating customer data with the rest of the enterprise's data and making it available across channels may produce a wide range of benefits."

However, it may not be practical to maintain parallel technology infrastructures for each customer group across different channels. Adopting a common architectural framework with core functionality may offer more efficient and richer experiences for all customer segments. It is worthwhile to consider cross-channel retailing by means of a unified customer engagement platform because customer sentiment and behavior (the outputs of the platform) may reveal insights that retailers can use to enhance customer satisfaction. Integrating customer data with the rest of the enterprise's data and making it available across channels may produce a wide range of benefits.

Figure 3: Unified Customer Engagement in a Multichannel Environment



Source: TCS Global Consulting Practice – Research Desk

A unified customer engagement platform also reduces application clutter by recognizing channel-agnostic applications such as store directories, product searches, barcode scanning, inventory lookup, and eventually, mobile payments. For WAP/Mobile Web, a retailer's WAP site should recognize the form factors that define how a customer is accessing the site and display the site accordingly. Retail chains also need to use the right rich media, such as HTML 5 versus Flash media. For native applications, retailers must be able to support all the leading mobile operating systems, such as IOS, RIM, Windows, and Android. To ensure that no user is alienated, retailers must be mindful to incorporate Objective C and Java as core base applications and device-specific kits to build a wrapper that utilizes the benefits and security features of each device. With these tools in place, retailers must create a user interface that works with specific handheld devices. This includes middleware that can detect online traffic patterns and the browsers they use to access a retailer's mobile or ecommerce site. The solution is programmed to serve up and display information in a mobile-friendly format. Savvy

chains should move one step further and implement optimization solutions that can determine specific handsets, and as such, specific screen sizes and resolutions. Channel-specific functionality is likely to impress shoppers using mobile phones. For example, drug chains could offer flexible spending account tracking solutions, prescription refill alerts, recall or epidemic updates, or applications to research medical conditions. One area that retailers should emphasize is location-based messaging. It is a must-have for on the road and in the store customers. There is enough evidence that points to location-based messaging being one of the ways that retailers can bridge the gap between mobile devices and the physical store location. The technology requires augmenting store location proximity to the Short Messaging Service (SMS) with Global Positioning System (GPS) and other wireless network tools to deliver real-time messages on the customer's mobile phone while they are in the store.

Case in Point–Inventory Management

We created a mobile POS app for a large electronics retailer. The project was phased in a four-week pilot and used agile methodology. Major work included in-store server design, QA services through an offshore POS lab, high-end tolerance with zero downtime, 128-bit RSA encryption, and real-time transaction data publishing for SAP, DS, and CRM. Our solution included prototypes and simulation for the user interface, screen flows and navigation, the server communication layer, server engine, and email receipts.

In Conclusion

Clearly, the time is right to dive into mobile retailing. However, before embarking on this important project, retailers must develop a clear strategy and solid infrastructure to support it. The analysis derived from multiple sales channels can be used to increase sales and to improve customer relationships. Guiding and encouraging shoppers to move to a digital platform also reduces costs. Mobile technology thus creates a win-win situation, which helps retailers improve sales while cutting costs.

Mobile retailing is the “shiny new toy” in the room, and everyone wants a turn. With so many players eager to try their hand at mobile retailing, differentiation is the name of the game. Find a way to make your mobile channel stand out and not only attract shoppers but create a closer relationship with them.

What the Future Holds

Ubiquitous Computing

Beyond Mobility: Everywhere and Every Thing

K Ananth Krishnan
Vice President and Chief Technology Officer

The connectivity paradigm of the future is ubiquitous computing, in which computers are deeply woven into the fabric of our lives.

Abstract

Ubiquitous computing, though evolving, is promising and cannot be ignored. This next wave in technology will forever change the way we interact with machines. Not only will we be connected always, from everywhere, but we are approaching a time where smart devices will take actions by predicting user inputs.

This makes it imperative to learn how ubiquitous computing works. Only then will we be able to identify opportunities ubiquitous computing offers in a variety of verticals.

Though there are a few hurdles to ubiquitous computing, they are fewer than you may think. Continued research will clear the obstacles, and the era of the smart environment, which has already begun, will gain prominence.

Ubiquitous Computing – Intelligent and Pervasive Mobility

It is a short distance from mobility to ubiquitous computing. Mobility sets you free to connect and use smart devices while on the move. Ubiquitous computing lets the environment connect to you in many unobtrusive ways. Mobility took computers from the desktop and put them on your lap and in your palm and pocket. Ubiquitous computing sends information seamlessly into your environment, where numerous tiny devices monitor you, connect with you, and even think for you. While current mobility patterns are based on menu-driven, GUI-based tools (however small), ubiquitous computing holds the promise of understanding natural human interactions such as presence, movement, or speech.

Some of this is already happening. When I enter my office, the lights come on automatically. When I leave, they go off. In the near future, several actions may be triggered as I set out to work: my smart car will suggest the optimal route by assessing the traffic along a smart city network. As I swipe my card at the portal, my assistant will receive an alert and my office temperature will adjust to my preference. A touchscreen on my desk will show today's high priority tasks. My scheduler will prepare visitor passes for my guests. The cafeteria will receive a request for our preferred beverages. When I connect automatically to a video conference, the wall color and lighting in my room will change to match my clothes, and translation services based on the geography of my customer will be launched. Many smart devices (calendar/camera/video/telephone etc.) will connect to automate and act in a context-aware manner.

When many smart devices connect, you have an intelligent environment. Welcome to the world of ubiquitous computing!

Concepts of a Ubiquitous Environment

The term "ubiquitous computing" was first introduced by Mark Weiser, a researcher at Xerox's Palo Alto Research Center (PARC). In an article in Scientific American in 1991, he said, "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it." Beyond mobility, today we have entered the era of pervasive computing, where scalability and localization have been added to mobility. We are moving toward integrating these technologies with context awareness and adaptability, resulting in smarter devices—and leading to ubiquitous computing. Mark Weiser's thoughts ring true as we see more and more smart devices integrating with each other in the background and behaving as one.

For these devices to usher in true ubiquitous computing, two closely linked concepts must be understood: the Internet of Things (IoT) and Machine-to-Machine (M2M) communication. The IoT involves connecting ordinary things, equipped with sensors, to the Internet. The IoT can be seen as an implementation framework for ubiquitous computing. For instance, your dog's collar could have an IP address that allows you to track the dog fetching a newspaper from a newsstand at the end of your street. Such specific object-identification, addressing, sensor, and connection capability will serve as

the basis for the development of independent and federated services and applications. M2M communication is a specific subset of the IoT, where two machines talk to each other, mostly over the Internet, and exchange data. The IoT creates a horizontal system for connecting devices, networks, service enablers, and applications. Together these two concepts lay the foundation for deploying heterogeneous devices and integrating them across a homogeneous network and service infrastructure. Let's take a look at how this works.

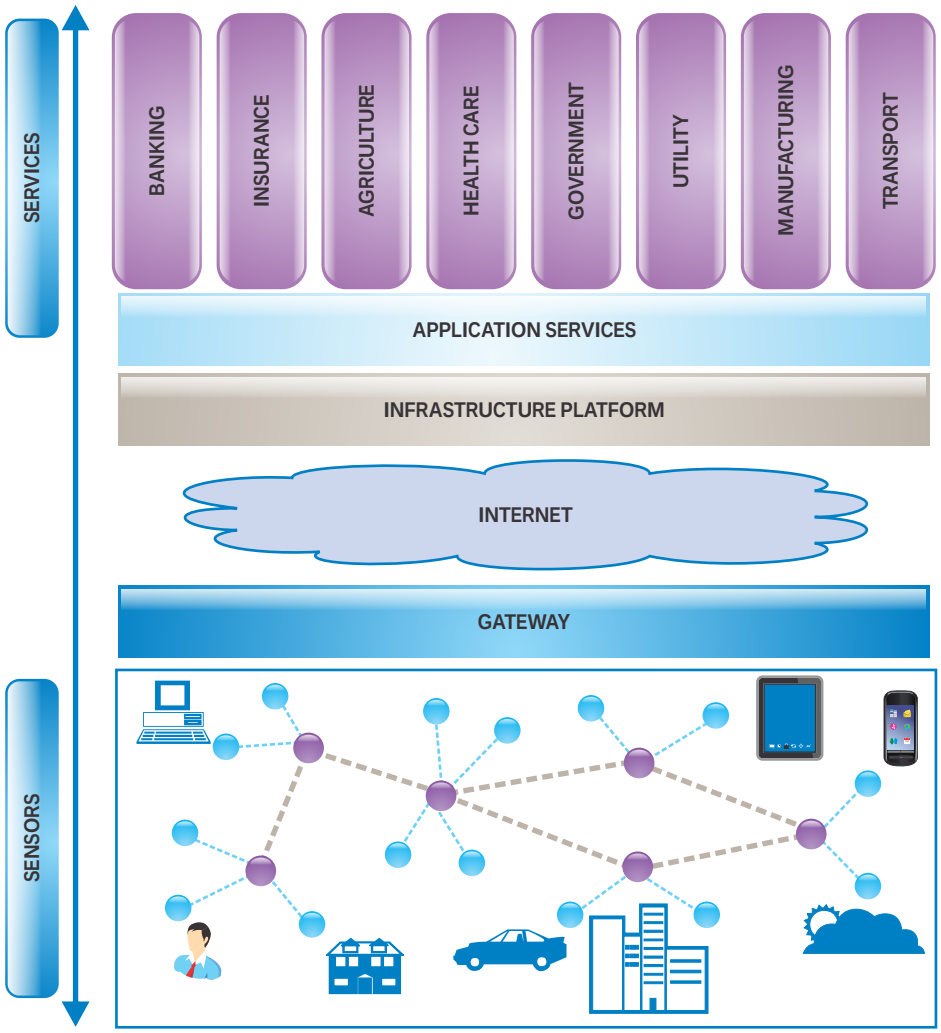
Case in Point – Ubiquitous Computing at a University

A university integrated various wireless sensor networks with its IT systems using web services. The web services provide Internet of Things capabilities in three service categories: office automation, teaching, and guest services. Office automation and teaching require strong security support for access control and authentication, so they require a more reliable network such as Ethernet. On the other hand, guest services can be handled using low power radio interfaces. The web services communicate using IPv6/UDP, enabling users to manage the nodes over the Internet.

How Ubiquitous Computing Works

The success of ubiquitous computing rests with the proper integration of various components that talk to each other and behave as one. Figure 1 shows such a ubiquitous computing stack. At the bottom of the stack is a "physical" layer. Tiny sensors are attached (carried, worn, or embedded) to people, animals, machines, homes, cars, buildings, campuses, and fields. Today, some smartphones come with a host of sensors that capture various bits of information from the immediate surroundings. Beyond the microphone and camera, they integrate multiple sensors such as GPS, accelerometer, compass, and so on.

Figure 1: Ubiquitous Computing Stack

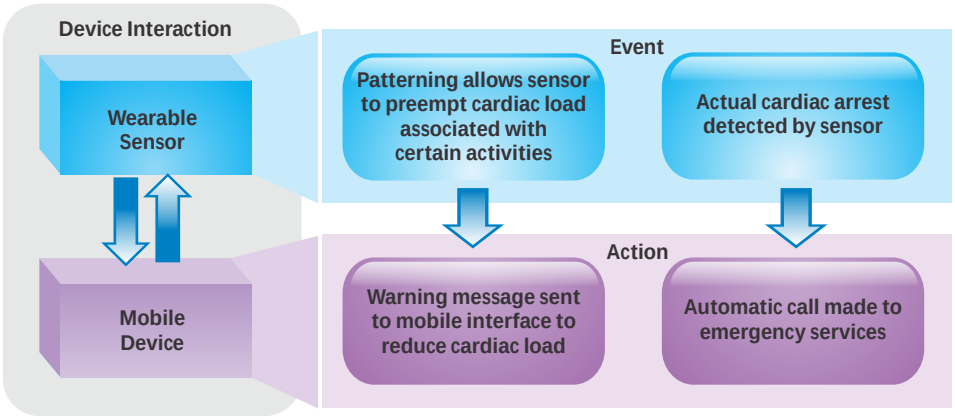


Above the sensors lies the wireless communication infrastructure, which can be provided by the 802.11 family of networks. Newer standards such as 802.11n have lower latency. Together with mesh networks, such standards ensure the connectivity of sensors and devices. Another technology called ZigBee is a low-cost alternative for keeping multiple devices connected, allowing parent devices to wirelessly control child sensors. Near field communication (NFC) is yet another technology standard that leverages RFID and can be used for ubiquitous computing, especially in scenarios where non-battery-operated passive points are concerned. NFC-powered devices can also interact with one another.

The next level includes a range of application services. The data from the sensors and handheld devices is gathered, mined, and analyzed for patterns. The patterns help provide options to smart applications that proactively make changes to environments through smartphones, tablets, netbooks, notebooks, handhelds, or other smart devices.

The smartphone, for instance, can transform itself into a barcode or quick response (QR) code reader to identify and get details of a product from a retail store, or display the barcode of your airline ticket so that the barcode code reader at the check-in kiosk can read it and issue a boarding pass. Another example could be that of a cardiac patient wearing a tiny monitor connected to a mobile device. An irregular ECG will trigger the mobile to alert the patient's doctor and emergency services. An example of how this can happen has been depicted in Figure 2.

Figure 2: Example of Smart Device Interactions



Source: TCS Global Consulting Practice – Research Desk

To create ubiquitous environments, a variety of components are required—smart devices, communications frameworks, software, the web, social networks—together with process and information modeling. These can operate across different materials, platforms, protocols, and environments. A scenario such as this makes a good case for collaborative innovation. In developing a vision for ubiquitous computing, it's important to look at areas where the stage is already being set.

Anticipating Ubiquitous Computing

The world is reaching a point where it is ready for ubiquitous computing. A generation of tech-savvy young people can be found in offices, customer

Case in Point: Smart Remote Control

The research division of a global semiconductor giant demonstrated a context-aware television remote control. It detects who is using the device by assessing the way it is held by each person who uses it. This smart device also has the capability to 'learn' the users' entertainment preferences.

Case in Point: Vacation Planning

The same global semiconductor giant has collaborated with a travel enterprise to develop a smart application for Internet-enabled mobile phones that takes in context information such as calendar, location, and the preferences of the user to provide real-time travel and vacation suggestions to the users.

communities, and universities. These individuals are "Digital Natives" and they do not shy away from experimenting with new technology. They were born in a connected world and expect to stay connected. They operate multiple gadgets, prefer seamless transfer of data, and are willing to share a large amount of personal information.

Markets have also become very personalized. Listening to the voice of the customer across channels has become important for businesses. Trusted information becomes essential. Proactive, user preference-centric advertising and sales can give businesses a competitive advantage. Analysts such as Gartner feel that context-aware computing will drive $140 billion of new consumer demand by 2015. Advancements in sensors, networks, embedded devices, social computing, IoT, service-oriented architecture, and unified communications are taking us closer to ubiquitous computing goals.

On the content front, there is already a lot of information available. Smartphones, smart cards, vehicle GPS systems, social networks, and domain-specific digital devices that store personal information can be invaluable both to service providers and market researchers studying demographics. Every domain has the potential for ubiquitous computing deployments. Figure 3 shows how enterprises can serve end customers better through gradual adaptation of smart devices and connected networks.

Figure 3: Use of Smart Devices – Industry Specific Examples

Industry	Offering	Sensor	Analytics	Rendering	Outcome
Utilities (Energy, Water, Gas)	• Real-time collection of usage data, supply-demand prediction, load balancing, and dynamic tariff control.	• Energy / Water / Gas Meters	• Historical usage analysis, usage prediction, supply-demand prediction	• On any Internet-connected device	• Cost and resource savings for consumers connected to smart networks
Manufacturing	• Automation of production line • Equipment handling and diagnostics through sensors located on the production floor • Remote expert diagnostics in case of failures	• Cameras • Microphones • Equipment – Body-mounted sensors	• Anomaly detection in equipment functioning • Automatic quality monitoring in production line	• Mainly on central consoles • Can connect to experts on mobile devices for remote consultation	• Optimal scheduling of production line taking into account peak power rates, productivity of each division, and worker availability • Anomaly detection and emission detection • Improvement in quality and sustainability
Healthcare	• Body sensor-based diagnostics reporting • Remote specialist consultation	• Medical sensors either located on human bodies or connected to them	• Anomaly detection in recorded medical data • Historical correlation	• Remote teleconsultation via medical super-specialist mobile computers with aid of clinical decision support systems	• Continuous monitoring of patient's vital signs through wearable sensors, leading to faster medical response in case of emergency
Banking	• Remote payment mechanisms through near field communication (NFC) and mobile wallets	• NFC • Biometric sensors	• Personalized analytics on financial data	• Automated secure payment / transaction system on mobile Internet devices and expert financial advice	• Convenient contactless initiation of fast, secure transactions through mobile devices
Insurance	• Collection of user data (like condition of home devices for home insurance, driving habits for car insurance)	• Different sensors that monitor the condition and usage of the insured entity	• Usage pattern detection • Anomaly detection	• Value-added usage based insurance applications on end-user mobile devices	• Creation of newer Insurance models such as dynamic premium pricing based on condition, premium pricing based on usage
Consumer Industry including Retail	• Real-time knowledge of the consumer's context (presence, location, preferences)	• Any sensor that can capture end-user context such as location, presence, surroundings, specialized devices that capture user viewership data	• Context-aided real-time user profiling • Analytics to extract context from raw sensor data	• Suggestions and recommendations from user devices • Target advertisement on user's mobile device	• Creation of novel value-added applications for the consumer like alerts on expiration dates, avatars to check products virtually • Targeted advertising
Education	• Dissemination of focused education content to the desired audience along with availability of expert consultations	• Camera, audio and video sensing	• Audio and video analytics	• Interactivity on pervasive devices like television, education kiosks, tablets with experts	• Interactive distance education applications on televisions and low-cost tablets
Telecom	• Telecom will become more of a horizontal infrastructure provider as compared to a separate industry vertical as it is today	• M2M communication	• Industry vertical specific	• Any pervasive / mobile Internet device	• Will be an enabler of ubiquitous computing services for verticals

On a larger scale, technology companies are collaborating toward a smarter and more connected globe. For instance, IBM and Cisco are helping a Dutch utility company and the city of Amsterdam make smarter use of energy by enabling consumers to make more informed decisions about their energy consumption. Several cities—in China, South Korea, Australia, the US, and Singapore—are developing smart infrastructure that involves traffic management, power and fuel consumption, and tourist support. One example is the city of Songdo in South Korea, which deploys video networking technology and energy management software tools citywide to unify municipal systems such as education, healthcare, transportation, and hospitality into a common network. Leading software service providers have been invited to discuss such smart city initiatives.

The role of ubiquitous computing is not restricted to urban areas. For developing countries, one of the biggest benefits of ubiquitous computing can come from bridging the digital divide and creating value-added applications that touch the lives of the masses. Ubiquitous computing as a technology will allow affordable, easy-to-use, smart computing that can be leveraged to create applications in agriculture, rural healthcare, and conservation of resources such as power and water. For healthcare, it would mean the creation of affordable telemedicine solutions in rural health centers and homes. Conservation of resources such as energy and water can be done through real-time sensing, monitoring, and analytics of resource distribution and usage. When such applications are deployed, we can envisage moving toward a "smarter society," where basic societal needs are addressed through the innovative use of ubiquitous computing.

Case in Point: Ubiquitous Computing in Agriculture

We are currently conducting several experiments using sensors, networks, and intelligence for the betterment of agriculture. Soil, plant, and atmospheric sensors will predict pest attacks, recommend preventive measures, fertilizers and watering level; and automatically alert farmers about the weather and communicate the best options for their land. Our goal is to preserve soil fertility, save water, limit fertilizer use, grow better produce, and save costs. Similar networks for dairy and poultry farms can also be enabled.

Paving the Way for Ubiquitous Computing

It is clear that ubiquitous computing can create smart environments that are intuitive about our needs. But there are some challenges as well. Since the user information gathered will be very detailed, ethical issues will arise related to the use of such information. Another challenge lies with device heterogeneity as a variety of appliances, networks, applications, context-specific content, and decision support algorithms have to be connected together. Several organizations are working on standards in this area. The Global ICT Standardization Forum for India (GISFI) is an Indian standardization body active in the area of information and communication technologies (ICT) and related application areas. GISFI has taken up areas such as service-oriented networks, green ICT, and the Internet of Things for major standardization efforts.

The next challenge relates to privacy and security. When such a vast number of entities are connected, their interactions and communications are examined more carefully. First, data from one person's device must be distinguished from data from another's. Second, it is necessary to ensure that false data is not intentionally injected by some other device, masquerading as a bonafide source for that information. And finally, it must be rendered difficult or impossible to steal someone else's data. Researchers are currently working on solving each of these problems in an effort to secure mesh networks.

The potential that ubiquitous computing holds is compelling. Many scientists and technical consultants are involved in research to advance this exciting technology area. This research has helped to add to the body of knowledge for researchers and scientists who have been working with RFID technologies, experimenting with object identification, tracking, and tracing in different application domains. This experience has helped technology providers understand the issues around ROI, the limitations of technology, and the realities of deployment of such technologies, enabling better planning toward the maturity of similar technology. While the uptake of RFID has not been as dramatic as expected, it has not stopped customers in almost every domain from looking forward to seamless and smart services. To meet expectations and leverage the advantages ubiquitous computing offers, every industry should attempt a pilot to test the waters.

Acknowledgments

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Interview

An Insider's Perspective on the Changing Landscape of Mobility

Ken Dulaney
Vice president and Analyst, Gartner Research

Profile

Ken Dulaney is a vice president and distinguished analyst in Gartner Research, where his research areas include smartphones, tablet computers, notebook computers, industrial handhelds, wireless communications, mobile software and device management strategies. Mr. Dulaney is also the lead analyst for Intel. He has been recognized by Adweek magazine as one of the top 20 technology industry analysts.

Prior to joining Gartner, Mr. Dulaney worked at GRiD Systems, where he served as director of marketing, portable computing. He was a key participant in the development of the first tablet computer, for which he received several patents.

J Rajagopal, EVP and Head, TCS' Global Consulting Practice interviewed him.

On Adoption in the Enterprise

How are some companies being innovative using mobility? What benefits do they see in the process?

While mobile computers have been a cornerstone of enterprise use for years, end users have become the real drivers for its expanded use today. In a number of cases, end users are driving the increased use of mobility through individually purchased devices where IT policies have restricted both choice and usage. The most innovative companies are the ones that have figured out how to meet IT goals and satisfy the end user.

Do you see some industry verticals or geographies moving faster than others? What are the chief enablers here?

Geographical differences in mobile device use are often shaped by the funds that companies and individuals have to invest in technologies. Certainly in the US and in North America there's faster adoption of sophisticated technology, more than in any other part of the world. Many vertical applications are emerging worldwide. Geographic vertical market differences are shaped mainly by the applications which are used for the core business processes within their respective key industries.

When adopting mobility into the enterprise, marketing and customer service seem to be focus areas. Are there other processes that lend themselves to mobile enablement?

Aside from the application focus, there is the use case focus. An analogy I like to use when I talk with clients is describing how one would work while standing or walking. When you need to collect or use data, if you are standing or walking, you really can't use a notebook and be productive as it's difficult to enter and view data. Consider building inspection. A building inspector will have a difficult time walking around and recording his/her observations with a notebook versus a handheld device optimized for data collection. Using mobile devices to replace paper documents is another emerging use case that is catching on in a number of industries. For example, I was in a restaurant the other day, and after being seated, the waiter gave me an iPad to review the menu. The iPad had an application to suggest wines to complement my entrée selection. If entrées change on a daily basis, think of how much additional cost the restaurant would incur by printing updated menus with appropriate wine suggestions. Now all they have to do is change what entrées are available each day and the appropriate wines are suggested from the data contained in the application database. In the airline industry, Alaska Airlines and Delta Airlines are replacing hardcopy flight manuals with the iPad for documentation. As the world becomes even more digital than it is today, mobility enabled devices will become an important platform for rethinking how information and associated processes are gathered, disseminated, and implemented.

One of the biggest impacts of Enterprise Mobility will fall on the organization's workforce. What are the top challenges that enterprises in the industry face in this regard?

Technology investments generally reduce the need for people because users become more productive, but that may not happen immediately after the adoption of technology. It usually happens later, often after an external event that affects the company's business, (e.g., a stock market decline), where the company has to take action through measures such as layoffs to reduce its costs and improve its financial position.

Technology is thus only indirectly related to staff reductions whereas productivity is the primary driver. Unfortunately, productivity improvement is often difficult to quantify so those involved with the use of mobile devices must remind themselves that investment in productivity will usually result in more work with fewer people, but that those benefits may not happen sequentially. Ask yourself a question. Thirty years ago, everybody had a secretary; now there is probably one secretary for 30 or 40 people. Because of the adoption of technology in today's environment, business efficiency is impacted less due to staff reductions during a downturn than it was in the past. Conversely, the adoption of technology provides a platform for rapid recovery when the business climate improves. Enterprise mobility is just another example of technology adoption that will drive productivity improvement.

There is a lot of talk about using the mobile phone for payments. Do you think that will happen?

Mobile payments are not a technology issue, but a policy and market competition issue. Organizations involved with mobile payments continue to fight among themselves for dominance and as a result, they delay the adoption of mobile payment technology.Certainly in Japan and Korea where there is great cooperation among mobile payment players, people make mobile payments every day for things such as parking, but elsewhere the various stakeholders needed to introduce mobile payments have not yet cooperated.

Mobile payments have made an important start in some other countries as well, but the technology probably won't take off en masse until 2015. However, there are some interesting things happening, especially in the banking industry. For example, if you are a customer of Chase Bank, you can make a deposit by simply taking a picture of the check and sending it to the bank using an application on your mobile device, eliminating the need to visit the bank and deposit the cheque. As more and more consumers realize the benefits of saving time through mobile payments, they will bring more and more pressure to bear upon both oversight authorities and technology providers to cooperate and offer applications and services that address this trend.

View of the Future

Networks, Semi-conductors and Software – the cumulative advancement of these three technologies has resulted in enormous progress in telecommunications. Which of these do you feel will drive the evolution of telecom technology to the next level?

With respect to networks, the emergence of 4G provides increased capacity and speed which in turn, when coupled with the proliferation of smartphones and tablet PCs, will significantly speed the evolution of mobile networks. As this evolution continues, the demand for increased use of graphics and video in mobile applications will spur more highly capable graphics processors and chips sets as users will expect no interruption of data delivery and presentation. The increased sophistication and speed of the new networks will also challenge the way software is created, packaged, and consumed. Software developers now have access to new delivery models for their applications, resulting in a plethora of choices for end users about how best to optimize their computing infrastructure to meet their business requirements.

What does the future hold for mobility? In a recent Gartner article, you mentioned we could see hybrid products and remote controls based on smartphones and tablets.

Devices like audio receivers, cars, and refrigerators, which had fixed functions earlier, are starting to exhibit smartphone capabilities as more and more chips are embedded into these products. Functions such as remote diagnostics and remote keyless start via the Internet are examples of such technology. Another development is the use of smartphones and tablets to remotely control other devices, creating a new class of hybrid devices.

One example of this new class of device is the creation of a robot which utilizes an iPad as its "head" or "intelligence" to control other robotic features such as the movement of a robotic arm or other type of sensor. A company named iRobot builds robots that use an iPad clone running Android software as the control head of the mechanical body of the robot. With higher broadband availability, we are also likely to see broadcast media and Internet media come together in the future. This might mean that all of the radio stations in your car are Internet radio, not broadcast radio. You will be able to receive any broadcast from anywhere in the world, regardless of the station's location.

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TCS' Global Consulting Practice (GCP) is a key component in how TCS delivers additional value to clients. Using our collective industry insight, technology expertise, and consulting know-how, we partner with enterprises worldwide to deliver integrated end-to-end IT enabled business transformation services.

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