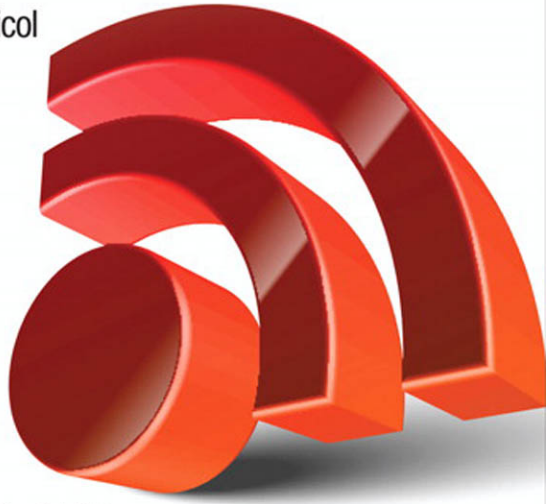
Mobile Strategy

How Your Company Can Win by Embracing Mobile Technologies

Dirk Nicol



Foreword by Bob Sutor

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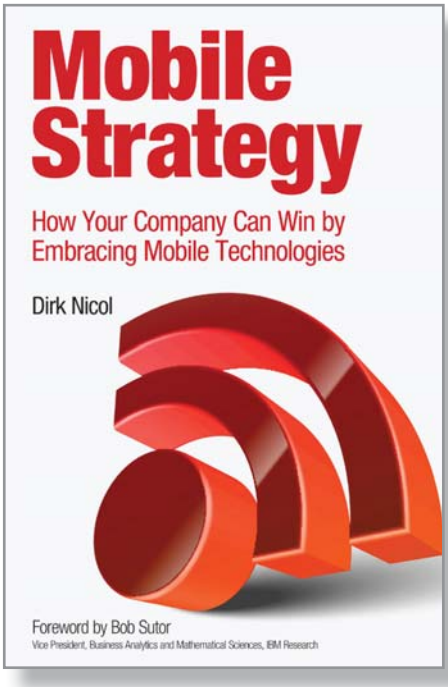

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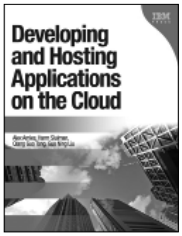

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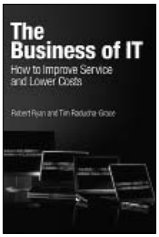

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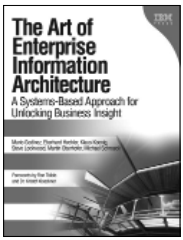

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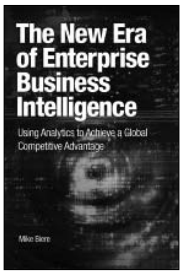

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This product-independent guide brings together start-to-finish guidance and practical checklists for every senior IT executive, planner, strategist, implementer, and the actual business users themselves.

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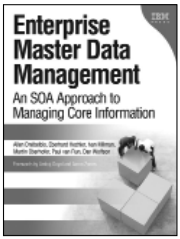

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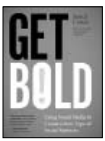

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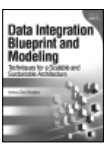

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To Phyllis and Bruce Nicol for teaching me perseverance.
And to my wife Joy and sons, Luke, Caleb, and Isaiah
for their love and support.

Contents

Foreword

"Mobile" is a topic that seems to have been with us for a very long time, yet it still seems very new. The excitement, the enthusiasm, and even the frenzy is obvious across the web, in newspapers and magazines, and in water cooler conversations in businesses. We take so much for granted now, features that didn't even exist five years ago, but we should also accept that we're only at the beginning of this revolution.

Why do I say "revolution" instead of the safer, more conservative "evolution"? Mobile is not just about the latest smartphone or tablet, or 3G vs. 4G vs. WiFi, or even how big your device's app store is compared to mine. The societal changes being driven by the significant use of highly programmable and interactive mobile devices with fast connectivity are affecting healthcare, banking, retail, mining, and almost all industries with which we engage. If you question this, just ask your local doctor or, even better, a teenager.

Many pieces had to come together to cause this great acceleration. First, of course, are the devices and their operating environments. These vary from very closed to very open depending on the provider, but they form the basis, the foundation, on which we can build.

Next are the apps. I'm not necessarily impressed with the sheer volume of the hundreds of thousands of apps that are out there because of the great redundancy and variable quality. However, they are showing us how the fundamental notion of "software application" has morphed. "Pick one thing and do it right" is not a bad motto for many app developers, at least at first. "Do something no one has ever done before" might follow, and "Change the way I live my life" might ensue. There are apps that do all this. I believe apps will change significantly over the next five years. How do you even begin to make sense of this revolutionary transformation?

Start with this book. I have worked with Dirk Nicol for many years as a colleague at IBM® and I believe he captures exceptionally well what you need to understand to do mobile right. Why do mobile at all? What value can it return to your business, your organization, your clients, or you? How do you handle security and manage those devices and apps? How do you decide how to build the best app for your intended use?

Dirk addresses all these questions and more. Use this book to quickly get yourself current on the state of the art for mobile, then start building those apps and services that will make you stand out successfully against your competitors.

—**Bob Sutor**, Vice President, Business Analytics and
Mathematical Sciences, IBM Research

Preface

For the past 20 years of my IT career, I have focused mostly on business strategy. I have played a key role in defining IBM's strategy around e-business, Java™, Web 2.0, cloud computing, Internet standards, developer communities, and most recently mobile. Over the years, I have honed my skills in strategy development and have applied these experiences to writing this book.

Of all the technology trends I have been involved in, mobile has had one of the most profound impacts on the industry and individuals. Unlike other technologies, mobile is personal. It has become part of our everyday lives. The mobile device is always with us helping get things done—helping us connect to friends and colleagues or simply entertaining us in our spare moments on the go. Because mobile technology has integrated into our daily lives, it creates a historical opportunity for businesses to interact, engage, and deliver new value to their customers and employees. As a result, mobile has become a top priority for business leaders today.

For the past several years, I have worked in the mobile arena educating customers, speaking at events, briefing analysts, and developing product strategies—almost universally, business leaders struggle with how to develop a mobile strategy. The challenge is due to the unique nature of the mobile industry. Mobile technology is in constant flux—there seems to always be a new set of technology or platforms to consider. Mobile is broad, touching almost every aspect of a business. The high-expectation for quality apps that are delivered quickly is unprecedented. Finally, security and privacy becomes a fundamental issue because the device contains a mixture of personal and corporate data. With all these challenges, the biggest strategic question I hear over and over is, "How do I get started?"

This is why I wrote this book. I wanted to apply my experiences in strategy development and mobile technology to help business leaders start developing their mobile strategy. I wanted to give them the tools to help answer the key strategic questions: What are all the capabilities and technologies I need to consider? How do all the pieces fit together? How do I get my app developed? How do I manage and secure my mobile business? How do I take full advantage of mobile technologies to transform my business? How do I prepare my mobile business for the future? I have pulled together the latest thinking and concepts in the industry today to help business leaders answer these strategic questions.

I hope you enjoy the book and can apply some of the concepts to help make your mobile business better. The mobile technology era is just starting, and there will be many new exciting technologies and innovation in the future. There is much more ahead of us and much more to learn. I would love to have a conversation with you to hear what you have learned. Please join me at my blog (http://www.dirknicol.com) and my Twitter account (http://twitter.com/dirknicol).

—Dirk Nicol

How This Book Is Organized

Each chapter follows a similar structure. There is an introduction that outlines the key market situation surrounding a topic. The bulk of the chapter defines key considerations for your mobile strategy and discusses key concepts and technologies. The chapter then concludes with a summary of key concepts. The overall structure of the book is designed to outline key trends in the industry, a framework for defining a mobile strategy, and a set of strategic considerations that help you define your mobile strategy. These use cases are supported by examples.

- **Chapter 1, "Introducing the Mobile Enterprise"**: This chapter provides an introduction to the overall mobile landscape and outlines the implications to consider when developing a mobile strategy.
- **Chapter 2, "Defining Business Value"**: This chapter outlines how to define the overall goals for your mobile strategy and how to deliver business value.
- **Chapter 3, "Mobile Business Challenges"**: This chapter outlines the challenges that businesses face as they adopt mobile technologies.

- **Chapter 4, "The Mobile Framework"**: This chapter defines an overall framework for defining a comprehensive mobile strategy.
- **Chapter 5, "Mobile Development"**: This chapter outlines the key considerations for building mobile applications and connecting them to back-end systems.
- **Chapter 6, "Mobile Security and Management"**: This chapter talks about how to manage and secure your mobile applications and devices.
- **Chapter 7, "Mobile Business Transformation"**: This chapter provides insight and direction as to how you can transform your business to take advantage of mobile technology.
- **Chapter 8, "Planning a Mobile Project"**: This chapter outlines the key steps and considerations for defining an overall mobile project.
- **Chapter 9, "SoCloDaMo (Social + Cloud + Big Data + Mobile)"**: This chapter describes the emerging new platform that brings together social networks, cloud computing, data analytics, and mobile and how you can leverage it in your mobile strategy.
- **Chapter 10, "International Considerations"**: This chapter brings a worldwide perspective to your mobile strategy.
- **Chapter 11, "Case Studies and Mobile Solutions"**: This chapter provides examples that can help you understand how other companies have delivered successful mobile solutions.
- **Chapter 12, "Moving Forward"**: This chapter concludes the book with a summary of key concepts.

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I would like to thank Vijay Dheap and Chris Peppin for their assistance in reviewing the content of this book and providing great suggestions and insight. Vijay and Chris are experts in their field, so it was a privilege to have them contribute to this effort.

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I would like to thank the team at IBM Press for the opportunity to deliver this book to you. Thanks goes to Chris Cleveland, Jovana Shirley, and San Dee Phillips for their help in bringing the best possible product to our readers. Thank you to our executive editor, Mary Beth Ray, for allowing us the opportunity to create this book on a flexible schedule.

I also wanted to thank IBM's Steve Stansel, the editorial program manager for IBM Press, for giving me the opportunity to write my first book.

I would like to thank Bob Sutor and Michael Karasick for giving me the opportunity to take a leadership role in driving our mobile product strategy at IBM.

Finally, I would like to thank my family, Joy, Luke, Caleb, and Isaiah, for supporting me in the ambitious undertaking of writing my first book.

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About the Author

Dirk Nicol is the program director for IBM Mobile Strategy and Product Management at IBM. He has spent years helping IBM advance new and emerging technologies. He has held a variety of roles at IBM, which included semiconductor development, programming, hardware development, marketing, and strategy.

Dirk has worked extensively with helping to educate and build communities around new technologies. Prior to his current position, Dirk led IBM's cloud standards program and was a founder of the Cloud Standards Customer Council initiative. Dirk also conceived and led the development of the developerWorks® project—one of the largest worldwide developer communities. Dirk holds a master's degree in electrical engineering and an MBA degree in management and strategy at the University of North Carolina. He calls North Carolina his home but is often seen presenting about the latest technology trends and strategy around the world. When home, he enjoys time with his wife and three boys jogging along the North Carolina Tobacco Trail.

We are at the beginning of a new mobile era. The technology, best practices, and methodologies will continue to evolve. This book was designed to be a starting point on a journey. I would like to take that journey with you to learn and grow together. Check in from time to time to let me know what you have learned and how your mobile strategy is progressing.

Dirk's blog is at http://www.dirknicol.com

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I

Introducing Mobile Enterprise

Mobile devices, including smartphones and tablets, are transforming the way enterprises do business both inside the company and with customers and partners. The rapid growth in mobile device usage is fueled by a fundamental change in technology that has transformed the way individuals conduct their lives. People now have an always-connected, always-available computing device giving them a tool to complete their task with ease, efficiency, and effectiveness. Mobile devices have been integrated into our daily lives, making us more efficient, more social, and entertained whenever and wherever we want. This change in the interaction model creates both opportunity and risks for businesses. Enterprises see the tremendous opportunities in making their employees more productive, reaching new customers and improving customer satisfaction. This in turn leads to improving the bottom line and generating new business models never conceived of before. At the same time, mobile devices have expanded the power of the individual. In every interaction between you and your customer, the customer is armed with unprecedented computing power, information, and social and contextual insight at their fingertips. This power shift forces enterprises to rethink how they interact with their customers and empowers their employees to take better action in context of their task at hand.

Those companies that fail to change the way they operate run the risk of losing to their competitors. As a result, enterprises need a comprehensive mobile strategy.

Mobile Landscape

Although the mobile enterprise isn't a new concept, it has been transformed in recent years by significant change in technology. Mobile devices are more portable, more powerful, easier to use, and significantly less expensive. This has led to unprecedented levels of adoption, and today it is not uncommon to own multiple mobile devices, each tailored to a specific use.

Mobile technologies have transformed the way you live, which will continue for the foreseeable future. The mobile industry is at its early stages, with much more change ahead. It will be just as big of a trend as mainframes, PC, or even the Internet era (see Figure 1.1). In some respects, mobile is an evolution of technology that has been developing over time.

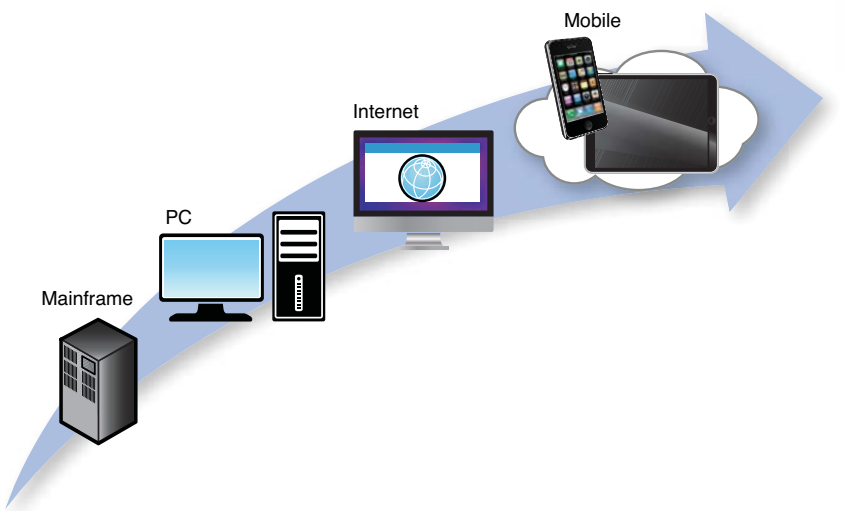

Figure 1.1 Mobile is the next era of computing.

The mainframe era brought computing power and intelligence to businesses to help them automate tasks such as bookkeeping and logistics. The

mainframe enabled businesses to scale and free up individuals from performing manual tasks to perform more interesting and valuable services. This in turn enabled business to expand and become more profitable.

The PC era enabled computing power to enter into the homes and offices of businesses. Computing power was no longer confined to a data center where a select few had access—as it was in the mainframe era. When PCs entered into homes and offices, it began to impact your daily life—making you more productive, effective, and even entertained. The desktop PC also began to consolidate tasks and physical technology. Documents written on a typewriter or tasks performed on an adding machine were now done on the PC. Filing cabinets of documents were replaced by PC storage. The PC helped people to get tasks done and become more efficient while consolidating other tools into a single platform.

With the PC era, computing became accessible to the masses. With the Internet, information and connectivity became ubiquitous. You could send email, chat, join online communities, watch movies, and connect with anyone in the world. With an Internet accessible PC in everyone's home or office, the world could share information and store it in one place (the Internet). This provided a collection of information and knowledge that was easily accessible to anyone. The consolidation of the physical technology continued. Email replaced the interoffice memo and reduced the need to send physical mail through the post office. Blogs and online articles began to replace the magazine and newspaper. Music became digitized and distributed on the Internet replacing the CD and even record stores. Online stores replace traditional brick-and-mortar stores such as the bookstore, the toy store, the movie rental store, and the magazine store. The Internet continued the trend of the mainframe and PC eras of simplifying tasks making computing power accessible while consolidating real-world tools into software and hardware to help people be more productive.

The mobile era continues several trends of the past such as easy access to computing power and information—as you saw with the mainframe, PC, and Internet era. Mobile, however, is a fundamental shift in how people interact with businesses and each other. The mobile device enables people to perform tasks they could never do before or complete tasks more efficiently. Individuals now carry with them computing powers approaching that of a PC, including access to the Internet and connection to traditional systems, their social network, and other contextual services. Just as the PC made people more productive at home and work, the mobile device makes them productive at every other moment of their lives. As a result, they have

ubiquitous and unprecedented information and resources in their pockets to help them at their moment of need. This is a fundamental shift in how computer technology and software interacts with your daily life and as a result is a shift of power to individuals.

At the same time, mobile is not just a turn of the crank. Mobile computing is fundamentally different in many respects. You carry it around with you, the location is relevant, and it is not quite the same as the '90s PC. The devices have new technologies that drive context. Location information is available via GPS and orientation via the accelerometer; and many include a compass for directional information. Mobile devices have both a camera and microphone, available for capturing and recording the environment around you.

Mobile technology is delivered in a much shorter technology cycle time. Many get new phones each year, upgrade the operating system monthly to take advantage of new features, and upgrade applications on a weekly basis. As a result, market leaders can change dramatically in the span of a 2-year phone contract. For example, in late 2009, Android had less than 10 percent of the U.S. mobile market, according to IDC. One year later, it was 45 percent. During the same period, BlackBerry's share dropped from approximately 45 percent to 25 percent.[1] It takes only a few years to completely change out the leading technology. With so many different mobile device platforms and leaders coming and going, the mobile ecosystem is complex and the technology is much harder to manage. You will have a hard time controlling which device your customer or employee will be using. As a result, supporting native applications (those mobile applications that are written for a specific device) across a wide variety of platforms can be expensive. In addition, the app store introduces a new distribution model that is much different than simply hosting a web page on a server. There are also concerns with security given new threats, lost or stolen devices, and the challenges of managing mobile devices originally designed for the consumer market and not the enterprise. As such, many enterprises are moving toward mobile middleware. *Mobile middleware* (or sometimes referred to as a Mobile Enterprise Application platform [MEAP]) is a set of capabilities that sit between the client device and traditional back-end or cloud systems. The Mobile middleware approach can help deliver cross-platform support and manage the complexity of a fragmented and rapidly changing technology landscape and help to connect to back-end systems.

Mobile is also a unifying technology to other major trends in the industry today. Cloud, social, and big data are all driving profound changes in the IT

industry. Mobile, in many respects, is a unifying technology that provides the entry point and a user experience that brings these technologies together (also called SoCloDaMo—Social, Cloud, Big Data, and Mobile). This complementary set of technologies come together to deliver new value in the context of an engaging system. A mobile solution leverages the cloud for ubiquitous computing power, social for sentiment and peer insight, and big data to analyze and interpret the data in the context of the mobile experience based on time, location, and environment. Tying these trends to existing business processes and systems (systems of record) can deliver a differentiating mobile enterprise solution.

Mobile devices have already had a profound impact on the IT industry and will continue to do so for many years. This is just the beginning with tremendous opportunities for businesses to deliver significant value to customers and expand the bottom line. To capture this value, you need to consider how these smartphones and tablets have changed and delivered a disrupting influence on the industry.

The Disruption of Smartphones and Tablets

The mobile device has become a part of daily lives like no other technology in human history. In a *Time* magazine poll, 66 percent would rather take their mobile phone to work rather than their lunch, and 51 percent of all respondents said their mobile phone was more important than their PC or their laptop.[2] In addition, 20 percent said they check their mobile device every 10 minutes, and 30 percent said that being without their mobile device for even short periods leaves them feeling anxious. On a global basis, more people have mobile subscriptions than have clean water or electricity.[3] This makes the mobile device one of the most pervasive technologies in history.[4]

These statistics show that mobile devices are not just another technology trend but are truly shifting the way people live their daily lives, interact with each other, and get things done.

Catalysts for Disruption

What caused such a radical change in the industry and what were some of the key features of the smartphone and tablets that have had such a profound impact on the industry? There are a set of key features that drove their success and continue to drive the industry. These features enabled mobile

devices to enter into your life, helping you solve problems at the right time (not just when you are behind a PC) by engaging you with contextual information and computing intelligence:

- **Engaging user experience:** The user experience is a critical element of smart mobile devices. The smartphone and tablets revolutionized the way people interact with the mobile device through multitouch and gesture interaction. This new interface enabled the end user to have a much more sophisticated interaction with the device. There was no need for a built-in keyboard, thus saving hardware space and enabling a larger screen size so that end users can select links and apps with just a touch of the screen. The ability to zoom in and zoom out, with just a pinch of the screen, enabled end users to view large content elements with a small screen. This opened up the entire World Wide Web to the mobile device in its original form.

  The responsiveness of the interaction was another critical element of the user experience. The transitions between screens, application responsiveness, and the startup of the device were extremely quick. The perception of instantaneous interaction and responsiveness further set these devices apart from traditional PCs and mobile phones.

  The user interface is also different from traditional mobile phones and PCs in that the interfaces are beautifully designed for simplicity and aesthetics. The interaction is extremely intuitive and simple. All the extra steps and options that you might see with a PC user experience have been removed. Given the small screen real-estate, only the essential interaction steps are available. This dramatically expands the adoption and use of the device, increases productivity, and simply makes it a joy to use. How many people have been startled to see 3 year olds become productive using a smartphone or tablet as they navigate through a set of screens to get to their favorite video or game?
- **Speed of innovation:** The smartphone and tablet industry delivers mobile devices at a dizzying speed. Entire new platforms are introduced every few months instead of over a period of years. This keeps new innovation and features entering the market at lightning speed, keeping customers coming back to buy new versions of the devices every few months or upgrading at the end of each carrier plan.
- **Feature integration:** The capabilities of the mobile device are highly integrated and provide a rich set of utilities. The mobile device provides

a seamless user experience integrating web and native features onto the same device. Cloud-based apps such as Google G-Mail are integrated and provide a seamless experience. This greatly expands the scope of applications and utilities available to the mobile device.

- **Social interaction**: Because the devices are with you and easy to transport, they enable you to extend your personal interaction with others within the context of where you are. Social networks such as Facebook were popular before the advent of the smartphone and tablet; however, the smartphone and tablet have revolutionized social networks. Now you can send a text, take a picture, or share an experience in the moment instead of waiting to get back to your computer.
- **Battery life:** Advancements in lithium-ion polymer batteries enabled mobile devices to maintain their charge for an extended period of time. You can also recharge a lithium-ion polymer battery whenever convenient, unlike older technologies in which you had to completely discharge the battery. You can charge a smartphone once and have it last at least a full day or longer depending on use. Unlike the PC or laptop that keeps you tied to a power plug, the long battery life enables the mobile device to bring computing power with you wherever you go.
- **Instant on:** The smartphone and tablet turn on instantly. Unlike the PC where you wait for bootup, the mobile device is ready to assist you whenever you need it.
- **Always connected:** The mobile device is always connected to a network whether through a carrier cell network or a Wi-Fi connection. With a data plan, the mobile device delivers constant access to the Internet enabling continuous access to information and resources and tools to solve problems in context of a task.
- **Sensors and context:** The mobile device can sense the world providing contextual information and information to help people with their task at hand. Built-in GPS (Geo Positioning System) provides access to location information providing context. Knowing where an individual is located provides a wealth of information about the context of an engagement or navigation. An individual's task gets augmented by knowing where the individual is located. Bringing together the GPS with information about the nearest resource that may help with a task becomes critical. Is there a friend nearby or a resource that can help? If a construction worker is supposed to inspect a house, was he actually in the building? Perhaps security is enhanced or decreased as they enter or leave a particular

region. The notion of triggering an event based on someone's location is referred to as *Geofencing*. Geofencing is a capability that uses the global positioning system (GPS) to define geographical boundaries. A geofence is a virtual barrier that allows the administrators to set up triggers so when a device enters or exits a geofence boundary an event is triggered such as a notification, email, or change in security level. The accelerometer provides a new way to input information. The accelerometer can allow the device to determine orientation or motion. This ability not only enables simple actions such as changing the screen from landscape to vertical, but also makes various business applications possible. You can "bump" a device to exchange money. Or perhaps shaking the device can signify a specific event such as erasing the previous data entry. You can even point the phone at the night sky, and with augmented reality, see the names of the starts overlaid on top of the image of the star in front of you. The compass enables information about orientation. This becomes important for navigation and knowing which direction the individual is facing. This may be useful for applications that require hiking or navigating across unfamiliar territory.

- **The mobile app:** The mobile app is a simple, easy-to-use, task-specific application. Most are free, whereas some apps cost just a few dollars. They are easy to access from an app store and install themselves. The mobile app helps you perform the task at hand or can change your device into any tool you need. In the same way that the PC replaced the typewriter and the adding machine, the mobile device is consolidating all sorts of other devices. The app can transform your mobile device into a calculator, compass, book, magazine, radio, flashlight, GPS, picture frame, camera, wallet, answering machine, alarm clock, calendar, to-do list, pedometer, musical instrument, and even a PC.
- **The app store:** The distribution model is also different, with the advent of the app store; individuals can go to a central location to download apps with just a few clicks. Updates to the app are provided directly from the app store. No need to search the Internet and hope for a download that is virus-free. For Apple's App Store, the submission of apps is reviewed to ensure the app is reliable and performs as expected. In addition, apps have star ratings and user comments—making it plain to see which apps are worth downloading. In addition, when an app needs to be updated, you are notified to return to the App Store to get a new version.

Finally, these factors all contributed to a mobile revolution that profoundly changed the personal lives of millions of individuals. They gave people tremendous amounts of productivity, fun, and enjoyment. This consumer revolution has now spread to the IT industry.

Implications of the Consumerization of IT

Consumerization of Information Technology (or IT) refers to the introduction of consumer technology and culture into the enterprise. In the past, driven by the high cost of technology and centralized control, enterprise dictated the tools and technologies that employees would use to do their jobs. Today, with the pervasive nature of mobile devices and cloud services, employees are taking more control and driving IT change such as Bring Your Own Device (BYOD) programs.

Historically, technology innovation originated in large companies and governments. Only large organizations had the R&D budget to finance new technology breakthroughs. They invented new products such as calculators, fax machines, or PCs. Over time, as these products sold to more people, the price dropped due to higher volume of sales. As the prices per unit dropped, it became possible for the products to be sold to the consumer market, often opening up a new market for the product.

With the advent of the Internet and the World Wide Web, a new pattern emerged. Companies such as Google began to offer free advertising-supported, cloud-based consumer applications such as Gmail for email and Google Docs for word processing, spreadsheets, and presentations. These applications became good enough to compete with traditional software such as Microsoft Outlook or Microsoft Office that had to be purchased and installed on a PC.

The mobile revolution took a giant leap forward in 2007 with the release of the Apple iPhone. Although smartphones had been around for more than a decade, Apple delivered on the promise of transforming the cell phone into a handheld computer. The release of the Apple App Store and the first Google Android smartphone in 2008 further accelerated mobile adoption into the consumer marketplace along with the rapid growth of cloud services. The result is that end users are no longer ignorant about technology. The simplicity and power of consumer devices and application technology has enabled a tech savvy and knowledgeable society. The expectations are high as consumer technology can be even more robust than business technology. They see

unprecedented productivity at home and expect the same at work. They experience beautiful and elegant user experience with their consumer solutions and expect the same of their business technology. The productivity they experience with their mobile device leads to a desire to continue that same productivity at work.

The first reaction from IT might be to fight the creep of consumer technologies into the enterprise, driven by security concerns. The reality is that the trend toward consumerization of IT will not go away and will likely increase. This new reality for IT means a change in strategy and approach. The security requirements to protect corporate assets and manage authentication as well as improve worker productivity and improve the bottom line is still there. These accomplishments, however, are now carried out by technologies that were not originally designed for corporate infrastructure, management, and security.

User experience is critical. Gone are the days in which IT can provide great functionality for their employees with user experience as a distant afterthought. The bar is high for IT now where users expect a high-quality, simple user experience. Therefore, IT must build expertise in user experience and interface design.

Consumerization of IT requires forming a partnership between line of business (line of business refers to roles within the organization focused on business related tasks such as marketing, sales, and accounting), IT, and employees. A trust relationship must be formed. IT must understand the passion and interest of end users, whereas employees must understand the importance of security and management. Trade-offs will be needed on both sides. In the end, it will require a thoughtful approach in which risk is managed in context of end user productivity. If IT fails to adapt to consumerization of IT, the implications can be severe. Employees may secretly drift outside of the corporate firewalls to utilize simpler and more powerful applications creating security and management issues. Line of business may bypass IT all together and outsource the mobile solution to a low-cost, alternative out on the web. With a few clicks and a credit card number, a rogue department could easily set up a sophisticated IT solution that might initially meet its needs without consideration for the implications of security, management, and corporate policy. The "act now and ask forgiveness later" mentality can be enticing to line of business if the IT department fails to build the trust and partnership needed. In the end, the mobile application will likely need to come back to IT, and as such, it probably makes most sense to embrace

consumerization of IT and form a partnership with employees and line of business to deliver the best solution from the start. Most important, consumerization of IT is an industrywide phenomenon, and if a company cannot figure out how to manage it, its competition will.

BYOD: Bring Your Own Device to Work

Bring your own device (BYOD) is a corporate policy that enables employees to use their personally owned devices for business use. Depending on the policy, the employee may be permitted to access corporate email, corporate applications, and data systems, in addition to personal applications and data. BYOD has become increasingly popular in recent years, particularly with employees, as it enables greater flexibility to get work done from a greater range of devices (for example, smartphone, tablet, and laptop) and not just the device that the company has provided. This is the opposite of a corporate liable model in which the business purchases a mobile device and issues it to an employee. In both models, the enterprise is likely to impose some level of control over the device and data to minimize security exposures.

From a corporate standpoint, allowing employees to use their own device for corporate use saves the cost of purchasing and maintaining a set of mobile devices for its employees. However, this is a small fraction of the overall IT cost, which includes voice, data, middleware, network, and support—just to name a few. The fast pace of the mobile technology space lends itself to frequent updates. Companies have a hard time keeping up with rapid change. Allowing employees to bring their own device may allow companies to have the up to date hardware because employees are more likely to get the latest gadget. In addition, employees may take better care of the mobile device because they own it and would be responsible for maintenance and repair.

From an employee standpoint, BYOD typically provides employees a choice of devices—for example, Apple iPhone, iPad, Google Android, BlackBerry, or Windows® Phone. Because employees use the device all the time, they are most productive with their own device. This in turn can improve morale and give the employee a sense of control. The productivity also extends into personal time. Because the corporate applications and access are on the same device, the employee can break up tasks in which they start to do work activities during nonworking hours and personal tasks during working hours. This further increases productivity and can also help foster better work life balance.

The biggest issue with BYOD is security. Out-of-the-box, most mobile devices don't provide the level of security that enterprises need to safeguard corporate data and to ensure that devices connected to the corporate network are properly managed. Access to corporate data may lead to issues of data leakage in which corporate data may move (or get copied) from the secure back end to the mobile device. As a result, the data may then fall into the wrong hands because mobile devices are more likely to be shared than traditional PCs. If the employee's device is infected with malware, a virus may seep into the corporate network from the employee's device. Lost or stolen devices can lead to loss of data and potentially to unauthorized access. Finally, as corporations allow employees to bring mobile devices into the office, there is no single type of device the corporation will have to manage. There will be a wide variety of devices it will have to contend with, which leads to more complexity.

As a result, the employer might need to add additional technology to the personal device to protect corporate assets. Technology solutions such as application wrappers, containers, and virtualization can help with data leakage protection. Network protection using VPNs can protect access. Antivirus software is important to protect against malware. Other supporting technology solutions are also necessary. Mobile Device Management (MDM) is critical for device management and similarly Mobile Application Management (MAM) for application management.

Employers then need to apply the appropriate policy management to the devices. For corporate issued devices, if the device is lost or stolen, the solution might involve a remote wipe of all corporate data on the device, assuming the device is powered on and connected to the network. This is fine for corporate-issued devices but can become a challenge for a personal device. Employees could become unhappy if their employer performs a remote wipe of their device, deleting all their family photos or other personal data. If the appropriate policies are not agreed upon between employees and employer, this can lead to not only dissatisfied employees, but also potential litigation between employees and the employer. On the other hand, if the employer issues stringent security policies, (such as long passwords) the employee may abandon the BYOD program or worse go around it.

In the end, BYOD offers tremendous opportunity for greater employee productivity and improved morale. It may offer some cost-savings for the employer, but IT costs such as applications, network, and security also need to be taken into account. The employee and employer have to work together to ensure the appropriate security and management structure is in place to drive success.

A Preview of Enterprise Mobility Strategy

As you look at the market dynamics of mobile and its impact on the IT industry, it leads to a set of implications for creating an enterprise mobile strategy for the organization. Developing an enterprise mobile strategy requires input from the line of business within an organization (such as marketing, sales, and accounting), IT (CTO, development manager, IT director), Human Resources, Security, and Legal—just to name a few. What is clear is that mobile is different in many ways and will likely have one of the most profound impacts on your business over the next decade. Speed and agility will be critical in a fledgling market that is constantly changing. This means the entire organization needs to come together to help drive the appropriate strategy, move quickly, learn from your customers as you go, and then adjust. A mobile strategy must be an ongoing process that constantly adjusts and grows over time. But it can't be a free-for-all either. There needs to be a framework that defines an overall strategy structure while enabling underlying elements to adjust as the market changes and matures.

As a result, a mobile strategy framework must be structured in a way that is comprehensive but flexible. A strategy framework should focus on major themes that can help set overall direction, yet at the same time, the framework should be flexible enough to allow for new innovation and technology changes when needed. Issues of consumerization of IT and BYOD, speed of execution, device fragmentation, and user experience are just some of the considerations that a mobile strategy framework should account for. The framework also must be relevant to key enterprise stakeholders: the *IT team* that may build the mobile solutions and connect them to back-end systems, the *line of business* who may have the direct relationship with customers trying to transform their business, and the *operational* organizations that need to manage and secure the mobile solution.

The mobile strategy needs to focus on a set of core goals and aspirations. These include:

- Transform your business by extending traditional systems through mobile context, engagement, and intelligence to deliver new value.
- Develop mobile applications that engage individuals at their moment of need.
- Manage and secure mobile applications, devices, and networks.

These core goals are the guiding principles and structure for an overall mobile strategy. The rest of the book defines key technologies and trends in each of these categories so that you can define a foundational mobile strategy. Then the core strategic consideration is outlined for each of these categories so that you can make decisions on which technology to choose and as such develop a strategy that is unique to your business.

Summary

Mobile is a major milestone in the history of computing on the same order of magnitude as the mainframe, PC, or Internet. Although BlackBerry pioneered the smartphone inside the enterprise, it wasn't until the release of Apple iPhone and Google Android that the smartphone went mainstream in the consumer marketplace. The mobile technology era builds on top of all the previous computing eras and can extend existing back-end systems that were built leveraging mainframes, PCs, and the Internet. It also is the unifying element of other key technology trends around cloud computing, big data, and social computing. In the end, the mobile era is nascent and is in flux. The advantage goes to those companies that can execute on a strategy that takes advantage of the opportunities around mobile while managing the rapid change of the market.

The excitement and energy around mobile has shifted from the consumer market to the enterprise. Also known as the consumerization of IT, the ease of use, simplicity, lower cost and high productivity of mobile technology has raised the bar on IT. Employees want to bring their devices (BYOD) to work to get the same level of productivity at work that they have at home. While businesses should be open to BYOD to reduce costs, they will need to manage the complexity of device management and security.

Many have already dipped their toes into the mobile technology space. They were pressured by the competition to "get an app out." So, they built an app either in-house or contracted a 'boutique' design shop to pull an app together for them. Perhaps it was commissioned by the line of business without IT even being aware of it. Or perhaps it was an IT lead project. After the app got out, everyone was happy and excited that they got their first app in the app store or deployed it across the business.

However, after it got out they noticed that the star rating in the app store was not what was expected—unlike the web where feedback comes back through a feedback link on the home page and all the comments get routed

to the web master to address (or choose not to address). In the mobile era, feedback is in real time in the app store, and the comments are available for everyone to see. Quickly, the excitement about their first app turned into horror as they were confident they would have a five-star rating and instead ended up with a one- or two-star rating. The excitement about "extending their brand" to mobile turned into a disaster.

Perhaps there is a different story. You put your first app out and it is an absolute success. People love it, you have a five-star app and your customers (and boss) want more. The press is writing about your app, your competition is scared, and the marketing team wants more versions to reinforce the brand equity you have created. You need to create a new version quickly with more features and function. Also, you need to cover more platforms quickly. Your iOS app is great, but you will also need an Android version. By the way, what about Blackberry, Windows, and being ready for the next OS you never heard of before? Now your head is swimming with the thought of multiple development teams, scarce skills, testing across dozens of devices, and a never-ending set of management and maintenance tasks.

Conversely, your successful app gets downloaded by thousands and exceeds all expectations of adoption. However, you later discover a security flaw in your app. How do you get all those people who downloaded the app to upgrade and have the latest release? Unlike the web, where you can upgrade the web app overnight and everyone has the latest features automatically—after people download an app, they must take an action to upgrade (even if they turned on auto-update features). How do you disable or force an update of an app short of sending a letter to everyone who downloaded the app and begging them to go back to the app store and update?

In the end, you need a comprehensive strategy that addresses the challenges for a mobile enterprise that has its origins in the consumer market. Perhaps it does not completely fit into the way an enterprise develops applications and solutions. There are many unknowns, and perhaps you have made the mistakes already and are ready for a new approach. Perhaps you have been asked to create a mobile strategy and this is your company's chance to do it right. Perhaps you do not know where to start or even the context for how to make decisions. The intent of this book is to help with the process of building a mobile enterprise strategy.

To understand the context for a mobile strategy, the first step is to understand the opportunities and challenges around a mobile enterprise strategy. Chapter 2, "Defining Business Value," and Chapter 3, "Business Challenges," cover these aspects in more detail.

Endnotes

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Defining Business Value

It seems that mobile is at the center of almost all business conversations today. The entire industry is abuzz about the latest device, technology, and capability associated with mobile devices. Boardrooms have established mobility as a top priority and have rallied their companies around this trend. Much like the early '90s and the start of the Internet, businesses are investing in a mobile technology just so they keep up with the latest trend. Often, the investments in mobile technology are done without an understanding of the strategic value. Companies are invested just so they can stay relevant in the midst of this new technology shift with fear that if they move too slowly the competition will have an advantage. Companies are quickly building apps and bringing devices into the enterprise; however, the rush to "keep up" and stay current or even ahead of the competition can sometimes lead to a failure to capture value.

Business leaders certainly see the potential value in mobility. Executives see the productivity enhancements in their daily lives and want to see the same productivity gains at work. Executives feel engaged and productive using great consumer apps and feel a sense of loyalty to the brand associated with the app. They want to establish the same connection with their customers and employees. The challenge: How do you apply a potential opportunity from the consumer space to the business

world? Defining the specific value that mobile technology brings to the enterprise can help form the basis of an overall mobile strategy. By outlining the core business opportunity for a mobile investment, you can then set specific goals. In doing so, you move from reaction to a strategic vision.

In the end, mobile technology can transform businesses in untold ways; however, the potential value can be lost if you do not execute correctly. High expectations for user experience and fast cycle times with unfamiliar technology put pressure on businesses as they try to keep up. As many of the mobile technologies originated in the consumer market, you cannot take the perceived value in the consumer space and apply it directly to businesses. You need to rethink mobile value within the context of business needs and the ability to execute. You need to think in terms of setting goals that deliver value to your customers, value to your business, and at the same time, fit within budget. In other words, making sure you have a positive return on investment (ROI). This paradigm drives focus and clarity around a mobile strategy. It keeps the business from getting buffeted by the latest trend and instead focusing on value.

A Brief History of the Smartphone: The Power of Context, Intelligence, and Engagement

It is clear that the smartphone has had a profound impact on business and society as a whole. If you want to build a mobile strategy that derives value for your business, it is worth taking the time to analyze what gives the smartphone so much impact. Wherever you go, you see people using their smartphone during every free moment they have. They use it throughout their day completing tasks, making phone calls, checking the news, texting friends or colleagues, and posting to their social network. What is it about the smartphone that makes it so integral to our daily lives? If you step back and consider the historical evolution of the smartphone and look at the major products that had a significant impact, you will find three major capabilities that when brought together become transformational:

- **Contextual interacting:** Enabling technologies that allow you to interact with other people, the environment, and behavioral data in a particular moment
- **Mobile intelligence:** Having powerful computational resources when you need them

- **Engagement:** Delivering an easy and helpful user experience that weaves into your daily life

As you look at the evolution of the mobile smartphone, you can see again and again the attempt to bring together these capabilities into a single converged product delivering contextual interaction, mobile intelligence, and user engagement. In many respects, the earliest attempts to bring together contextual interaction (through a mobile phone) and portable intelligence was the IBM Simon. The Simon was released in 1993[1] and brought together the capabilities of a mobile phone with many of the features of a personal digital assistant (PDA), such as address book, calendar, and appointment scheduler. In addition, it also sent and received facsimiles, email, and pages utilizing its touch screen interface. In many respects, the Simon had many of the key attributes of a smartphone, but it was not until 14 years later with the release of the Apple iPhone, that a true breakthrough in personal productivity occurred.

After the Simon, the next major breakthrough was with the PDA. Although in 1996 when the Palm Pilot 1000 was released, it did not include the capability to make phone calls, it truly revolutionized the personal computing market.[2] The Palm Pilot delivered a simple and usable experience that helped people become much more productive by enabling them to bring some of the features they normally had on their PCs with them on the go. At the time, the Pilot delivered a rich set of personal productivity capability for enterprise users that provided applications to help people perform tasks more efficiently when they need to—in other words, mobile intelligence. They could look up a contact, check a calendar appointment, take a note, and synchronize with corporate email and calendar systems. Later, Palm eventually brought together mobile phone functionality and PDA capabilities with the release of the Treo 600 in 2003.[3]

In 2002, Research In Motion (RIM) entered the mobile phone market with the BlackBerry 5810.[4] The 5810 gave business professionals access to emails, schedules, the ability to make phone calls, and surf the web. RIM's focus on security and corporate requirements made it popular in the enterprise, but over time its ease of use made many of its later models such as the BlackBerry 6210 (released in 2004) popular with a broader audience.[5] RIM was successful by bringing together contextual interaction, mobile intelligence, and in many respects user engagement.

The major breakthrough in the evolution of the smartphone occurred in 2007 when Apple released the iPhone. By no means the first smartphone to

enter the market, but without a doubt the iPhone has had the most impact on the industry to date. Not only did the iPhone bring together the contextual interaction (phone, GPS, accelerometer, and compass) and the mobile intelligence of several PDA-like utilities (contact lists, voice recorder, calendar, alarm clock, and more)—what set the iPhone apart was that it truly delivered an engaging experience. It revolutionized the entire user interaction from how you bought the device through Apple's retail stores, to how you used the device, to how you obtained apps through the Apple App Store. With an integrated multitouch touch screen, a comprehensive web-browsing experience, and a beautiful design, the iPhone became a revolutionary device. The iPhone was so simple a child could use it. It also masterfully integrated third-party applications and services such as Google's Gmail, Google Maps, and YouTube. Soon after the iPhone, the Apple iPad tablet was introduced, utilizing much of the same compelling capabilities with a larger form factor.

One of the most groundbreaking elements of the iPhone was the mobile app. Productivity applications had been around since the Palm Pilot or even the Simon; however, Apple made the apps engaging by bringing together the latest capabilities of phone and Internet services into an easy-to-use, task-oriented application. It simplified the distribution model through the Apple App Store. Through a link from the home screen of the iPhone, the end user could get an app in just a few clicks for free or for a few dollars. Apple had to approve each app in the Apple App Store, which made people comfortable that the app was safe to use. The built-in ecosystem of third-party developers, enabled with a powerful software development tool (Xcode) and supporting developer program, rapidly increased the number of third-party apps. The app enabled the smartphone to be turned into a tool needed for a particular task. It became the modern day Swiss Army knife, transforming the phone into the appropriate tool at the moment of need. The iPhone brought together contextual information, mobile intelligence, and an engaging experience in an entirely new way that allowed the device and the application to become part of your daily life—filling your spare moments with a productive tool to help you get things done.

Soon after the release of the iPhone in 2008, the first Google Android device was released with similar capabilities as the iPhone. The one major difference was the Google Android operating system was developed as an open source project. Instead of developing their own operating system, device manufacturers could ship the Android operating system at a much lower cost. This further accelerated worldwide distribution and adoption of the smartphone, ushering in a new era of computing.

App Revolution: Bringing Together Context, Intelligence, and Engagement While Driving End User Value

Historically, the evolution of the smartphone has been marked by the convergence of technology that enables individuals to interact with each other and their environment (context), have greater computing power and tools to help them perform their task at hand (intelligence), and have an engaging experience that weaves into their daily lives (engagement). Time and time again, you see that when a product successfully brings these three elements together, they tend to have a significant impact on the market. The mobile app becomes the essential element that brings together the context, intelligence, and engagement into a simple task-oriented application. The mobile app transforms the mobile device into the particular tool individuals need to simplify their lives by reducing the steps in their task or streamlining their task all together. As you build your mobile strategy, you need to consider how you can leverage the attributes of context, intelligence, and engagement to deliver value to your customer or employee.

Contextual Information: Key Ingredient to Improving Outcomes

Mobile puts real-time information in your pocket enabling you to magnify your knowledge in the moment. Executives can make better and smarter decisions with a dashboard on their tablet providing the latest sales stats. Shoppers can make better buying decisions by comparing prices and ratings at the time of purchase. The mobile worker can process an insurance claim in front of the client instead of heading to the office. Customers can self serve themselves instead of calling a call center. Mobile technology, along with contextual information, can help people to organize and become empowered. In many respects, mobility has introduced a new phenomenon—a shift of power to the individual.

You saw this with the Arab Spring in 2011. Despite the best efforts of the governments in Egypt and Libya, individuals shared information, virtually assembled, and organized protests via their mobile devices and social networks. The end result was the overthrow of long-standing governments. Access to information in real time not only empowers individuals, but also can help organize large groups of people.

As a business leader, you need to understand that these forces can be harnessed to help or hurt your company. They can be used to have a deeper relationship with your customer, grow your brand, and deliver better services. Or they can be used to easily find alternatives to your product and switch to a competitor. By engaging your customers through mobile technology, you build a deeper understanding of their needs and can deliver better services.

Retailers are on the frontlines of the shift in power from institutions to individuals. In recent years, a phenomenon known as show rooming has sent shockwaves through traditional retailer stores. *Show rooming* is when consumers use their mobile phones in-store to compare prices with competing retailers. They can look at the product in the store, test it out, and ask advice of the store associates. Then armed with their mobile devices, customers can now scan the bar code on a product, find the best price, and make a purchase at a different retailer. This leaves the brick-and-mortar retailers with the cost of displaying the product and managing the inventory—without the benefit of getting the customer business. It is estimated that 80 percent of retailers will be affected by show rooming—particularly those selling electronics and appliances.[6] Retailers need to rethink their strategy in how to engage with their customers such as price-matching, loyalty programs, improved cross-channel integration, and a compelling in-store experience.

Mobile Intelligence: Ubiquitous Computing and Decision Making

Mobile devices contain the computing power of traditional PCs of a few years ago, yet they are small enough to be carried around wherever you go. This gives you 24/7 access to computing power and software applications in your moment of need. The mobile app specifically delivers an inexpensive and effective way to transform your device into the tool needed to complete a task. In many respects, the app and the smartphone together begin to replace existing applications or even physical products. If you stop and think about it, you will be surprised at how many real-world items have converged into a mobile device as a single all-purpose, universal product—for example, the cell phone, MP3 player, camera, GPS navigation system, and the electronic picture frame. Physical items, such as music, newspapers, magazines, books, television, and movies, are now digitized and delivered through the mobile device. The app can also transform a mobile device into new replicated physical assets. There are apps that can make the phone turn into a flashlight,

musical instrument, television remote control, wallet, cash register, and more. The mobile phone can transform into the tool you need to get the job done.

Mobile intelligence also empowers you to analyze situations to determine the best outcome. Computing power at the device, working in conjunction with connected systems (such as the cloud or corporate data centers), can assist in making the right decision at the right time. As you use the mobile app, there is new information about context and past behavior. This information can be analyzed to help you decide the next best action for a particular task. Analytical computing power at your fingertips can deliver real-time insight and advice to help you complete a task.

Engagement: Weaving into Daily Life

Although mobile technology had been available for some time, it was not until the smartphone entered the market (mostly defined by the Apple iPhone) that the contextual information and computing power converged and was delivered with an engaging experience. The multitouch interface, intuitive design, and simplicity made the smartphone accessible to almost anyone and enabled the device to enter into your daily life. From the 3 year old watching a video on Netflix, to the middle school student doing trigonometry homework, to the executive looking at the latest sales figures in a mobile dashboard, to the grandparents watching their grandchild take their first steps through their Skype-enabled tablet—mobile devices are changing the lives of individuals.

As the mobile device enters into your daily life, it can create an opportunity and a challenge for businesses. Companies now have the chance to embed their software or app directly into the daily activities of their customers, consequently providing a much deeper and intimate interaction with customers than was ever conceived with a PC. This insertion of software in the form of a task-oriented app can open a new front in the battle for the attention of your customers. The mobile app can enable you to better serve your customers, gain a much deeper knowledge of their likes, dislikes, and preferences, and as a result serve them better and deliver new services based on their needs. This direct relationship can shorten the cycle time between the creator of the service and the actual delivery to the end user—cutting out the middleman as a result. As you learn about your customer, you can understand which processes are important and which ones are not. As a result, you

can make your business processes more efficient, saving cost while learning more about your customers. Companies can gain the upper hand if they deliver the most useful app to the customers. Gaining an app icon on the home screen of your customer's mobile device can be essential for capturing their attention and loyalty.

How the Mobile App Enters into Lives to Add Value

In the past, there was always a separation between your daily life and the actions needed to complete a task. You would go about your life, stop to get to a computer to do some activity, and then go back to the task. For example, walk through the steps of making a TV purchase. In the past, you might do research on a product by surfing the web on your home computer. Perhaps you would print out some information or you might go to a bookstore to purchase a magazine with product reviews. Then you would go to the store and look at the products in the store. You might then go back home and do more research only to make the final purchase at the store. The task (buy a TV) and the steps to complete the task were often disjointed and spread over time. The mobile device enables a much richer and seamless experience that reduces friction between the task steps or even eliminates task steps altogether. In many respects, the mobile app becomes interwoven into your daily life to assist you through the tasks you must complete.

Now look at the same scenario in context of a mobile app. Using a mobile app, you can research TVs with the full function web browser, scan the product UPC code to get the best price, and then make the purchase online immediately (or perhaps negotiate with the retailer for a better price). Figures 2.1 and Figure 2.2 contrast the old versus the new experience of purchasing a TV.

The mobile app can greatly reduce the steps to complete a task at hand. It can do this because multiple tools and capabilities on the device come together to streamline a process. This convergence of tools and capabilities can leverage context, time, and information to help make the steps in the task progress more efficiently or reduce the steps. In the TV purchasing example, you do not need to keep shuttling between the home computer, the bookstore, and the electronics store to gather information for the purchase. All this can be done on the device in the context of the purchase decision.

Purchase a TV tasks (the old way)

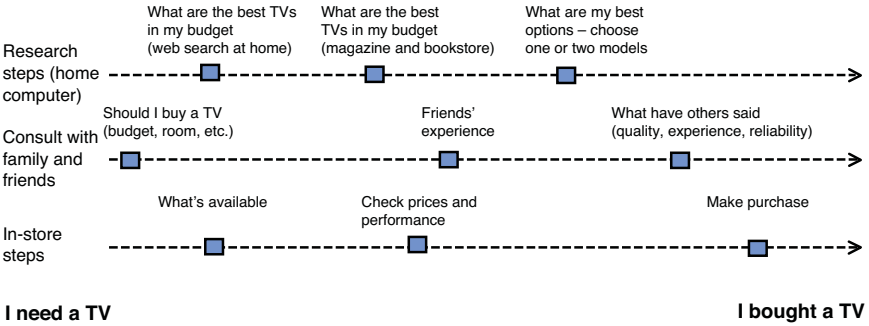

Figure 2.1 Purchasing a TV without mobility

Purchase a TV tasks (the app way)

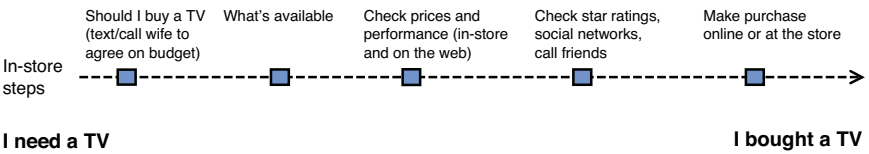

Figure 2.2 Purchasing a TV with mobility

It is clear that the mobile device provides a lot of value to you as a consumer in this scenario. However, what about the electronics store? The mobile device has provided you with a lot of consumer power in the purchase decision based on quick-and-easy availability of function, quality, and price information. In the past, you might have limited information, and given the choices, you might simply buy what was available. While profitable for the retailer, it might not deliver the best price for the customer. The new model provides the customer with instantaneous pricing and quality information and the ability to make a purchase with a single tap on the mobile device. The good news is that the retailer is now also armed with new tools to win customers, increase loyalty, and drive new profits based on the mobile device and app.

The retailer can provide a better customer experience by arming its employees with concierge apps to better assist customers and provide greater

service. These apps could offer instant access to product information, locate items in a nearby store, or place orders on the spot, which can help with the sale process. Quick checkout and same day delivery can help close the sale.

Location-based promotions can make a difference. If customers are already in your store, they are much more likely to make a purchase. Why not offer a discount through a push notification to customers when it is known they are in the store? Loyalty points can be offered for those who make the purchase in store. This further keeps people from making a purchase online while in the store. Also, new forms of mobile marketing and advertising provide opportunities to reach customers with offers in context of what they are doing in the moment whether in your store or in the competitor's store. The mobile retailer also may have access to previous purchase decisions that can help drive tailored offers for those who have made purchases in the past. All this can be done in context of the users' daily lives by building a relationship with them while assisting them to accomplish their task.

Augmented reality is another way to engage users during the shopping experience. Here is how it works: Shoppers capture images via the built-in video camera on their smartphone or tablet and use image-processing technologies to quickly and accurately identify a product. After the application recognizes the products, it can display information above the product images in the camera view. Shoppers see a product through their camera and then see additional information placed on top of the image that may rank the products based on attributes such as price or nutritional value. It can also provide shoppers with any loyalty rewards, offers, or discounts that may apply and suggest complementary items based on the shoppers' preference or context.

For example, consider technology developed by IBM Research that can bring some of the benefits of online shopping into traditional brick-and-mortar stores, utilizing augmented reality. Shoppers looking for breakfast cereal could specify they want a brand high in protein (see Figure 2.3). As shoppers pan the mobile device's video camera across a shelf of cereal boxes, the augmented reality app can show which cereals meet the criteria. In addition, the app could provide a same-day coupon to entice shoppers to make a purchase. Although the app can enable shoppers to be more informed about products, it can also help retailers to better connect with their customers. Using the personal information provided by their customers' experience in the store, retailers could gain insight on the preferences of their shoppers, as well as which areas of the store see the most traffic. Using this information, retailers could better organize their store, adjust inventory, and adjust marketing programs.[7]

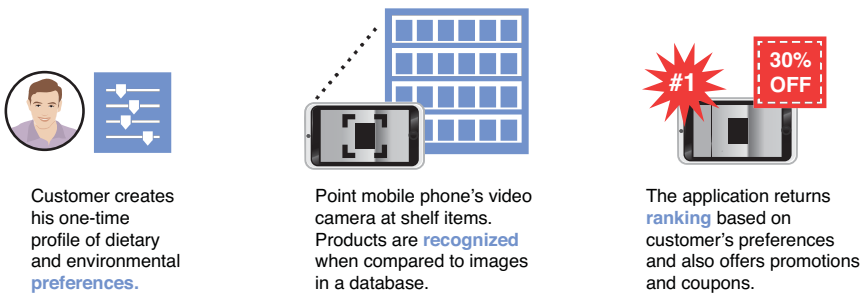

Figure 2.3 Augmented reality in a retail store

Defining Goals Based on Business Value

The previous section established that to be successful, a mobile app must include context, mobile intelligence, and engagement; however, before you can define a successful mobile strategy, you need to define the business goals of your project. These goals must be based on clear value proposition for your customer and your organization. Value-based goals are critical to understanding and measuring the value of a mobile strategy. These goals help to ensure that the mobile project stays focused and delivers on the intended value. Mobile value goals will be rooted in the mobile-solution attributes but will be specific to either a business-to-consumer (B2C) scenario, how the business delivers value to customers, or a business-to-enterprise (B2E) scenario in which the value to the employee is defined. The business-to-business (B2B) scenario or how the business interacts with partners and suppliers can be seen as a special case of the business-to-enterprise (B2E) scenario with some aspects of customer interaction included. The following sections provide a set of example goals based on business value that are summarized in Table 2.1 and then detailed in the remainder of this section. It is important to choose an overarching goal that helps you to define the scope of your project and set measurements for success.

Table 2.1 Value Based Goals for a Mobile Project

Business to Enterprise	Business to Consumer
Increase worker productivity.	Increase quality of service.
Increase revenue.	Improve customer satisfaction.
Extend existing applications.	Deepen customer engagement and loyalty.
Reduce fuel, gas, or fleet maintenance costs.	Drive increased sales through personalized offers.
Increase employee responsiveness and decision making.	Increase competitive differentiation.
Resolve internal IT issues.	Improve brand perception.
Reduce expenses.	Understand customer behavior.
Attract and retain talent.	Reduce cost of delivery.
Improve work life balance.	Use new value-added services.

B2E or B2B Value Goals

Examples of B2E or B2B value-based goals and associated measurements are as follows:

- **Increase worker productivity:** Can be defined in time reduced or number of milestones reached.
- **Increase revenue through sales engagements, improvement in information, and workflow**: Can lead to improved transactions and more customer deals closed. This can be measured in number of deals, pipeline progression, and closed deals.
- **Extend existing applications to mobile workers and customers**: Can be measured by the number of employees who have access to the mobile devices and applications. This may be an indicator of participation and access.
- **Reducing fuel or fleet maintenance costs:** Employees have immediate access to information, improving collaboration and reducing travel and meetings. This can be measured by total fuel and maintenance cost-savings.
- **Increase employee responsiveness and decisions:** Having access to information and improved workflow can make the decision-making process faster and of higher quality. This can be measured by comparing the length of projects and how their cycle time has been reduced.

- **Resolve internal IT issues faster:** Occurs when people have improved access to information in the form of systems alerts and problem tickets. In addition, this improves collaboration and access to information. This can be measured by comparing IT resolution cycle times.
- **Reduce expenses (utilizing personally owned instead of corporate-issued devices):** In the case of bring your own device (BYOD), a business can reduce the cost of issuing mobile devices to employees by allowing them to use their own. The business needs to consider the total cost involved, including enhanced security and data protection that will be required in a BYOD deployment.
- **Attracting and retaining talent:** An effective BYOD program can be critical in helping to retain and attract talent. Employees want to use the mobile technology they are accustomed to.
- **Improved work life balance:** Because individuals have their mobile device with them, they can participate in leisure and travel activities without having to be tied to a laptop or PC. While watching a children's soccer game, an individual can quickly check email and then get back to the game.

B2C Value Goals

Examples of B2C value goals include the following:

- **Quality of service is specific to your particular project**: In the case of a healthcare solution, you might measure the cycle time for lab results and determine how a mobile deployment helps nurses more efficiently administer a test and collect results.
- **Improve customer satisfaction:** Determined by how satisfied your customer is with the service you provide. This can be measured through surveys and feedback forums. In addition, your app can have a star rating that can feed into the measure of overall quality of service.
- **Deeper customer engagement and loyalty:** Can be measured by the growth in the number of customers who download your app, upgrade to the latest release, join your community, or participate in your loyalty program.

- **Drive increased sales through personalized offers**: How does your app's personalized offers compare to a control group? Measurements may include numbered transactions or responses.
- **Competitive differentiator:** May be measured based on comparing downloads and star ratings of your app when compared to the competition.
- **Improve brand perception:** May be measured by press and analyst mentions. Surveys may determine how your app has impacted your brand perception based on customer interviews.
- **Understanding customer buying behavior:** An important measurement to ensure that your mobile marketing system is actually working. A mobile app gathers tremendous information that can give you deep understanding of your customer. This understanding can give you tremendous potential to up sell and cross sell. Is your solution actually taking advantage of the key attributes of mobile?
- **Reduce cost of delivery:** Considers a number of questions. What is the overall cost of the mobile solution and is it sustainable? Is the project within budget? How does it compare with traditional IT projects? Defining a cost metric can ensure that you think holistically about the mobile project and ensure that you make the appropriate technology choices. This might lead to a decision that a mobile platform is required to pull all the aspects together in a cost-effective way.
- **New valuable services:** Essential to keeping your customers happy and preventing them from going to your competitor. Because a mobile application can become an essential part of an individual's life, there is a great deal of information that can be gained as your customer uses your application. This information can be analyzed to deliver new services and capabilities that differentiate you from the competition.

Thinking Through Mobile App Value

As you consider your mobile project, you must root the effort in customer (a customer may be external or a company employee) and business value. Establishing a set of value goals that defines how the end user receives value is critical. This set of goals shapes and defines the project. The previous

section outlined a set of example value goals, but all projects have their own set. Value goals may be linked to a particular industry and have their own unique characteristics.

In addition, you want to establish the appropriate measurements to ensure that the desired goal has been achieved. As a result, each value goal should also be linked to a set of measurable performance indicators. This can help answer the following questions:

- Did I achieve the value I want?
- Is the result measurable?
- Does it help me define corrective action such that I can make improvements?

Finally, you want to link the value goal with the type of functions you would want to deliver in the mobile solution. How can you achieve the value goal? What are some of the ways the app can deliver on the value goal?

Building a value table, as outlined in Table 2.2, can help. The table begins to lay out the basis for your mobile strategy by defining an approach that delivers the customer value you have identified. It then ties an approach to specific measurable value indicators. This approach can help avoid getting caught up in chasing the latest device functions or industry fads and instead using the appropriate technology needed to deliver the value goal identified.

In the example in Table 2.2 the healthcare mobile strategy team set their value-based goal to be improving customer satisfaction. They then determined their approach would be to build an electronics patient chart app. From there they outlined a set a value indicators to outline the attributes of success (workflow optimization, quality of care, patient safety, and costs). A set of performance indicators and corresponding measurements were then determined to ensure that they stayed on track to achieve the value they desired. For example, a performance indicator would be to reduce time of patient check-in which would be measured by a percentage reduction in check-in time compared to a base line. Finally a set of key tasks and app functions were determined that would correspond to a specific value-based goal of the project. These functions were based in engagement, context, and mobile intelligence. For example, they could use a tablet-based app to begin checking in the patients at the door or as they drove up instead of having them wait in line.

Table 2.2 Example Relationship Between Value Goals, Performance Indicators, and Approach

Value Goal: Improve Customer Satisfaction *Project Capability: Healthcare—Electronic Patient Chart App*			
Value Indicators	**Performance Indicator**	**Measurements**	**Approach**
Workflow optimization	Reduce time of check-in.	Percentage of change in check-in time	Staff checks in patients with tablet as they enter the hospital. (engagement)
	Reduce time of diagnosis.	Percentage of change in time to diagnosis	Mobile app contains patient x-rays, latest tests, and recommended diagnosis based on best available information. (intelligence)
Quality of care	Improved communications between doctors.	Survey of employee satisfaction	Sending messages and patient information securely between staff. (engagement)
		Reduced misdiagnosis due to more detailed information	Dictate notes into patients' record or take pictures of injury. (context)
Patient safety	Reduced drug allergies.	Percentage of change in drug allergy-related incidence	Mobile app has access to drug allergies and information about how new drugs conflict with existing patients prescriptions. (intelligence)
Cost	Reduce lab work.	Percentage of decrease in number of duplicate lab tests	Check and track status of lab work to prevent duplicate tests. (intelligence)

Summary

Mobile devices have revolutionized the computing industry and have had a profound impact on personal and professional lives. In many respects, you are just at the beginning of the mobile revolution in which you will continue to see unprecedented new capabilities added to mobile devices to make them even more valuable. Just as with the early days of the Internet, where it

seemed everyone wanted to put up a web site just to say they have one, it seems that now everyone is putting up a mobile app just to say they have one. However, people are finding that the cost and complexity of building and managing a mobile app can be high. In the same way people quickly discovered that putting up a web site does not define a web strategy, putting an app in an app store does not define a mobile strategy.

Fundamentally, a mobile strategy needs to be based in the value to the end user and the enterprise. Smart mobile devices have come on the scene with amazing capabilities. However, these capabilities need to be brought together in a solution that delivers the wanted goal based on the value defined by the project. The mobile app needs to be scoped to optimize value. Mobile apps derive the most value as they focus on a specific task the individual needs to perform. Leveraging context and fitting within a discrete moment of time are key characteristics of a mobile app that can derive value. As the app functionality moves from simple information access and capture to engagement and intelligence, the app becomes an integral part of daily life and creates opportunity for the enterprise to have a deeper relationship with the customer or improve productivity of their employee.

You also must ensure that your mobile solution delivers the value that your customer requires in context of your investment. Your return on investment (ROI) must be monitored to ensure that your project delivers on its intended purpose without exceeding your budget. Given the rapidly changing nature of the mobile market, unforeseen costs can crop up sending your project into the red. Having the right tools, technology, and strategy can guide you to increasing value and reducing unforeseen delivery costs.

In the end, the mobile strategy must define a set of measureable value goals. These will help shape the project and align functionality to the proposed outcome. Linking the desired value to a set of task-based functions rooted in the principles of context, engagement and intelligence creates a framework that can define the tools, infrastructure, and technology needed to deliver on a mobile project.

Endnotes

[1] A Brief History of Smartphones: http://www.pcworld.com/article/199243/a_brief_history_of_smartphones.html

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[4] Ibid
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[6] http://consumergoods.edgl.com/trends/80--of-Retailers-to-be-Affected-by-Showrooming83330
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3

Mobile Business Challenges

Although tremendous opportunities exist for becoming a mobile business, you must overcome a number of challenges. It is difficult to navigate a fragmented and rapidly changing technology landscape. The expectations for delivering and maintaining high-quality apps that engage users may be outside the scope of your team's skills and expertise.

Building mobile applications requires a unique skill set which is different from those for developing PC applications. Meeting the demand for a highly accelerated development cycle can be daunting. Mobile apps must be enterprise-ready—even though some of the platforms offered by mobile OS and handset providers are not designed to fit within the enterprise development process. Integration into existing enterprise systems is critical, and ensuring that a mobile app can fit within the enterprise architecture and processes instead of being something completely separate is also of paramount importance. The mobile app development process is further complicated by a fragmented market with many different device types and operating platforms. With so many devices to support, this not only makes it difficult to build mobile apps, but also it creates a challenge for testing and maintenance.

Security has been and always will be a concern, because a mobile device is easily lost or stolen, putting data on the device at risk. As mobile devices become more popular, they become a prime target for hackers. Malware and attempts to compromise corporate security is on the rise. Finally, the need to separate work and personal data on personally owned devices presents particular challenges when multiple platforms are involved.

It can be overwhelming to start to develop a mobile strategy that takes into account business-to-consumer, business-to-enterprise, multiple device platforms, different application types (for example, native, web and HTML5, hybrid, and virtual), as well as bring your own device (BYOD).

Developing a mobile strategy starts with answering a few key questions:

- *What business problem am I trying to solve with mobile?*
- *Who is my intended audience?*
- *What mobile platforms do I need to support, and what mobile device features should I leverage?*
- *How can users access my application, and how do I distribute updates?*
- *How do I deliver my mobile solution quickly and with the highest quality possible?*
- *How do I optimize the user experience for my app?*
- *Where do I get the skills to support my mobile strategy?*
- *How do I test across so many devices and environments?*
- *How do I integrate and connect to back end systems easily and quickly?*
- *How do I manage and secure my mobile applications and devices?*
- *How should I gather feedback from my customer to improve the quality of my app?*

Mobile Application Development Challenges

Mobile development is different than traditional application or web development. Unique characteristics about mobile technology can create new challenges for enterprise developers. Perhaps the biggest challenge is developing mobile applications for multiple platforms, including Apple iOS, Google Android, BlackBerry, and Windows Phone (for now). Although each platform has a similar set of capabilities, the operating system and associated

programming model is different. In addition, there are multiple ways to develop and deploy mobile applications to consumers and employees. Customers and employees also have expectations that an app is high quality. Developers have more pressure than ever to deliver a "five-star app," yet need the tools, resources, and skills to pull it off. Developers need to extend existing business systems and data to mobile that might not have been originally designed for mobility. Another critical development challenge is the expectation for speed and the constant pressure to deliver more frequent releases. Finally, the mobile development effort must fit within an existing enterprise development effort. It needs to have the tools and capabilities that deliver secure, manageable, and scalable enterprise-ready applications.

Developing for Multiple Mobile Platforms

It is clear that for the foreseeable future there will be a wide variety of mobile devices in the market. Device diversity will increase as more and more vendors enter the market and the cost of hardware and software goes down. You are already seeing this with the open source version of Android enabling a wide variety of inexpensive versions of the Android-based mobile devices. Android has been "forked" (when a developer takes a copy of the source code from one software effort and starts a new and independent software package) and has created even more diversity in the market. Smartphones and tablets are just the beginning. There will be more and more smart devices that will permeate our lives. Sometimes referred to as the 'Internet of things' or Machine to Machine (M2M), these simple devices will be connected, intelligent, and focused on a specific purpose. For example, there are already smart devices with the Nest smart thermostat or the Withings smart scale. There will be more and more of these types of smart devices that will need to be part of an overall mobile strategy, creating implications in application development, management, and security.

One of the critical requirements for enterprises is that the app works across multiple device types. Particularly in the case of a customer or partner facing app, you cannot control which device they will use. This might be less of a concern for an employee-facing app if you issued devices to your employees. However, when a BYOD policy is in place, you might again need to support multiple device types. So it is clear that you must support the latest devices in the market because this is what your customers, partners, or even employees will be demanding.

Developing for multiple platforms is unavoidable in the mobile era. So what are the key requirements for building cross-platform apps? The following list provides a set of expectations that you need to consider:

- **Ability to create the user interface that you need:** Each device has its own set of capabilities that are unique to the device. When you build a mobile application, you want to have the flexibility to leverage any of the unique capabilities of the devices, including any of the sensors, or output functions, such as the camera, GPS, accelerometer, and contact list.

  The user interface must match the mobile device and leverage its unique icons, color scheme, and so on. After all, people often have a "relationship" with the interface of a particular device. They want something that looks, feels, and acts like what they are used to. For example, if you target an iPhone and a BlackBerry 7 device, you want the iPhone app to be touch-friendly and the BlackBerry 7 app to be easy to use with a pointer and keyboard. You might also want the app to self-adjust its user interface based on whether it is on a different form factor (tablet or phone) of a particular operating environment (such as the iOS or Android), taking into account particular screen real estate, resolution, and dimension.
- **Avoiding the lowest-common-denominator approach:** As you consider the complexity of supporting multiple platforms, one approach may be to produce a lowest-common-denominator app where you support the simplest features that are easiest to deliver on every platform. As a result, you sacrifice the unique characteristics of each platform to achieve cross-platform support. This would be a mistake. You want to deliver a rich and engaging experience that exploits the specific features of each device.
- **Learning curve:** Each device has its own native language, operating environment, and platform. Because native apps are not portable across each platform, you need to build distinct apps for each platform. One of the biggest challenges is finding and staffing development resources with the skills on each platform (Google Android, Apple iOS, BlackBerry, etc) or building the skills within your own organization. In the past, the predominant enterprise platforms were Java and .NET. In the mobile era, you need to add the new required skills and techniques. Mobile skills are in short supply and are not easy to obtain. In addition, the development of mobile apps requires some unique experience around the mobile interaction model that exploits the unique characteristics of the devices.
- **Avoiding vendor lock-in or technology that won't keep up:** Unlike the web, which is open standard-based and enables easy switching across

platforms, the mobile market is ripe with vendor lock-in. With proprietary technology you can get tied to a particular platform if you do not have the resources to duplicate your application across multiple platforms. Some have attempted to get around this issue with code-generation approaches. However, code generation has its own set of pitfalls and has the potential for lock-in through the use of proprietary code generation languages.

- **Mobile testing:** With so many different mobile operating environments and device types, testing a mobile app can be more challenging than testing an app for the web where there is generally a consistent user interface—the browser. Granted there are many variations of the browser; however, the ability to maintain and test against multiple browsers is within the scope of many enterprises. With mobile, many completely different device environments exist. First, there are multiple operating systems—Apple, Android, Windows Phone, and Blackberry—just for starters. There are also permutations of each operating system in the market, including previous versions. Also, each handset manufacturer might make modifications to the mobile OS environment to meet their particular market needs.

  In addition, there can be multiple types of devices, screen resolution and form factors for each platform. Finally, each carrier network causes the app to behave slightly differently. Add all this together, and you are presented with a complicated test matrix. In order to perform a proper test, you need to have access to the physical devices and the various carrier networks around the world. You need to test against all the possible peripherals and add-on capabilities such as cameras, accelerometers, GPS optional keyboards, or pointing devices. Mobile testing creates a tremendous challenge for the enterprise.
- **Available skills:** When developing a mobile strategy, you must consider available skills. Mobile development often requires unique skills in the particular mobile OS platforms. Deeper skills in user experience design may also be required. When choosing a development platform, ensure it is based on open standard technology in which readily available skills are available in the market. As an alternative, if your organization does not have the required skills, outsourcing may be an option.
- **Avoiding code generation:** Some may consider a development platform that generates code for each mobile device platform. This approach usually entails developing an application once, and then using the

development platform to generate code for each mobile device environment. The downside of this approach is that you usually have to write the application in a unique proprietary language and then have it cross compile into each specific mobile OS platform. The challenge is you lose some control of the final output of the cross compiled application. If you make changes to the cross-compiled code, you are now out of sync with the original source code. The end result is that maintenance and management can become a challenge.

Delivering High-Quality Apps That Engage Users and Meet Business Objectives

Meeting high user expectations is a core requirement for mobile. Your end user will expect functional apps geared to a specific task or tasks. They will expect the quality to be as high as what they are experiencing with their personal apps. This creates a challenge for development teams that have not always focused on the aesthetics of their traditional applications. There needs to be a level of understanding of visual design that is not often an available skill within the enterprise.

App performance is also a critical requirement. Users have a much higher expectation for performance. Web users are accustomed to a web site that takes a few moments to load. If there is an issue with the site, they simply press the reload button and continue on their way. Not so with a mobile app. The mobile app is expected to function crisply with fast load and quick transitions between screens.

Connectivity to Back-End Systems and Data

The mobile app must fit in with the existing web and desktop applications infrastructure. The mobile architecture should not be a separate thought but rather integrated into an existing infrastructure. The mobile app infrastructure must be designed with consideration for how it interacts with the existing systems while managing the differences presented by the unique mobile app requirements:

- Mobile development must be able to access existing back-end systems quickly and easily. To execute quickly, you need to avoid complex integration solutions that require a lot of programming and testing.

- The ability to support hundreds of thousands of users all communicating with the back end.
- How will the data be delivered to the mobile app? Will it be binary, Extended Markup Language (XML), or JavaScript® Object Notation (JSON)? How will the format impact the device performance and battery life?
- Ensuring that the app can access data in offline mode when the device is not connected to the network is also important.
- If building multiple apps, it may become necessary to have an intermediate infrastructure or middleware that can mediate with back-end systems and provide app monitoring and management for security and operations.

Another key challenge associated with connecting to back end systems is corporate network connectivity. Smartphones and tablets will connect to corporate networks across a variety of Wi-Fi or cellular networks. Scenarios include the following:

- Connecting employee mobile devices to the corporate Wi-Fi network
- Connecting guest mobile devices to the corporate Wi-Fi network
- Connecting employee mobile devices on a noncorporate network (for example, cellular or home Wi-Fi) to the corporate Wi-Fi network in order to securely access corporate data

Given the variety of network configurations across trusted and nontrusted networks and devices, security and management become important issues. Dedicated connection or encryption of the network via a VPN (Virtual Private Network) becomes important. The VPN may be at the device or the app level.

Meeting Accelerated Time-to-Market Requirements

For developers, one of the stark realities of delivering a mobile app in an era of consumer-driven devices is the acceleration of new platform releases. End users will almost immediately upgrade their operating system after it is released. This means that a development team likely must upgrade your app to a new platform as soon as it comes out. On average, the mobile platform

vendors release new operating system updates two to three times a year. This means you may need to release a new version of your app for a particular platform whenever it is updated. Multiply that by the number of platforms you plan to support (which is at least two and possibly three or four) and it is easy to see that you could be releasing 8 to 12 versions of an app each year. Multiply this again by the average number of apps your business may have, which could be four or five apps. You are now looking at between 50–60 mobile app releases a year. Not only that, but the rate and pace of device leadership will change rapidly. Most devices are replaced every 18 to 24 months. As a result, this creates significant volatility in device market share. The leading mobile device platform may drop from leadership to the back of the pack in 3 to 4 years.

A dynamic market that acts with unprecedented speed points to the need for an efficient and agile organization. However, this leads to a challenge in aligning the appropriate teams early in the development process. Getting the right stakeholder involved so that requirements are defined correctly upfront is critical. The development teams need to be efficient and keep the lines of communications open so that the flow of information is nimble and well-defined.

Integration with Existing Development Processes

Companies doing in-house mobile application development have existing software development processes in place. These are not necessarily adapted to mobile app development. Also, not all mobile development tools are designed to be adapted into an existing software development process. For example, iPhone and iPad apps can be compiled only on Macs. The management of support for Macs can be a challenge for some companies. To actually compile and test the app, each Mobile OS platform requires the use of its particular software development kit (SDK), compiler, and simulators. In addition, these SDKs are updated frequently, and integrating these SDKs into an existing development process can be a challenge.

Mobile development is also a multidisciplinary process that involves cooperation and sharing of code across multiple developers who most likely have differing levels of expertise. In addition, when building native code for multiple mobile Operating Systems (OSs) each platform is completely different, requiring a different set of developers. These different developers need to coordinate. In addition, you need to ensure that as teams come together, they

have a platform in place that simplifies the interaction between the different developers and simplifies the mutual work done by the different developers across different skill sets.

Quality assurance and beta testing require different processes for mobile development when compared to traditional software development. You need to determine how to test across multiple devices, and in many cases, having the physical device present is a necessity. If your app communicates to back-end services, you may need to have the ability to test against a variety of server environments. One developer may want to work against a production server, whereas another may want to target a test server. In addition, there needs to be a way to distribute the app to your development and test teams. Remember that the app is not available through the public app store yet. So during development, you need a private app store and/or Mobile Device Management (MDM software helps to secure, monitor, and manage mobile devices) solutions to distribute the app.

Another consideration is the scenario in which different parts of the broader organization develop their own mobile apps. Some of these apps may have been developed outside of IT's knowledge and control. Eventually, these apps may need to come under central management of IT for day-to-day operational and security control. Managing and consolidating a variety of app development approaches can become a challenge for organizations. It might make sense to outsource your mobile operations to a qualified partner if there is a lack of resources and skills to execute.

Security and Management

Security is an important consideration for many types of mobile applications. Whether you develop a mobile application for consumers to perform online banking or an internal application to track sales leads, security is a key requirement. As mobile devices become more popular, mobile threats are on the rise. Because these devices are always with them, individuals frequently access unsecured Wi-Fi networks or they lose the device more easily than they would with a PC. With personal devices entering into the enterprise (BYOD) the situation gets even more complicated. In addition, mobile devices are more likely to be shared with others, further putting corporate data at risk.

Following is a key set of security challenges an enterprise faces when developing a mobile strategy:

- **Securing and managing the devices:** With a wide variety of mobile devices in the market today, how does a company manage them all while fitting within an existing infrastructure that manages PCs, desktops, and servers? With a device that is frequently lost, a mechanism needs to be in place to kill and wipe the device remotely to protect corporate data. A roles-based policy can define the content, apps, and level of access appropriate for a particular individual based on membership within a group. A company needs to ensure the integrity of the mobile device by detecting if the device's base operating environment has been compromised by jailbreaking or rooting the device. Jailbreaking (for Apple iOS operating systems) and rooting (for Google Android operating systems) refers to the process of altering the mobile operating system to eliminate restriction or attain privileged control over the device. End users may want to do this to get around the restrictions imposed by the OS manufacturer. For example, users may want to install non-approved apps, change the device clock speed for better performance, or have flexibility in which carrier they want to use. While Jailbreaking or rooting a device may give the end user more flexibility, it also alters the operating environment to open it up to potential threats. As a result, the enterprise will want to detect and block such devices from accessing corporate networks.
- **Mobile threats:** Attacks on mobile devices are on the rise. With mobile devices containing both corporate and personal information, they become compelling targets for hackers. In some cases, the attack vectors will be different than with PCs. A company needs to constantly adapt to new threats and hacking techniques.
- **Network protection:** Mobile network communications need to be secured and protected from eavesdropping or unauthorized access. Encryption from the device or even at the application level back to the enterprise is important.
- **Identity and access management:** The mobile app must integrate with the existing authentication infrastructure. If an app provides access to sensitive corporate data, you must ensure that malicious software that might be running on the device cannot steal user credentials during or after the login process. Multifactor authentication is often a requirement for protecting against unauthorized access.

Single sign-on can also be important so that several enterprise apps can share the same login session, so the user would not have to reenter credentials over and over again.

To speed development and simplify a security infrastructure, you could offload authorization and authentication to an access management infrastructure that is tuned for a mobile environment. A specialized mobile security access management system may include context awareness and strong session management.

- **Data loss prevention:** With personal devices entering the workplace, securing corporate data is a critical challenge to overcome. Encrypting the data on the device is important, particularly when the device is used offline and the corporate data resides on the device. You need to ensure the data on the device is protected from unauthorized users or malicious software. In addition, you must prevent data from "leaking" from a secure corporate space into an unsecure area on the mobile device or to public cloud services where security is suspect. You may want to prevent individuals from cutting and pasting from a corporate document, thus compromising secure data access. In many respects, you need to separate the corporate section of the mobile device from the personal part of the mobile device. This allows for protecting corporate data by managing access and defining a policy-based interaction model, while at the same time, giving free access to the personal side of the device.
- **Application security:** As an application is created, you must understand if the application has been developed in such a way that makes it more vulnerable to attacks. After an application is deployed, it is far more expensive to deal with a security issue than before it is put into production. Providing the appropriate code scans to ensure there are no known security vulnerabilities is a key challenge.
- **People and security:** Even with the best security, management technologies, and strategy, you still need to consider the human part of the equation. People's behavior can counter even the best security deployment. This is why it is important to form a partnership with your employees or customers. Establishing a set of clear and documented policies is critical. Reinforcing policy with comprehensive and thoughtful education can emphasize the importance of policy so that people understand not only what needs to be done, but also why a policy is in place.

Management and Post-Deployment Control of Apps

Another key challenge is what to do after the app has been deployed. As with any software, you can expect that users will experience problems. As such, you need to include a set of server-side logging mechanisms to monitor the application activity and understand what the user's activity may be just prior to having a problem. You may want to include client-side logging so that the app can send diagnostic information back to technical support. This needs to be done even in cases when the user is offline or fails to establish access. Having a feedback loop to constantly improve the customer experience is critical to ensure the highest quality of app.

Sending updates to apps or forcing users to perform an update to the app is another critical challenge for the enterprise. After an app is deployed to a public app store, it is a challenge to keep it updated—unlike a web app, where you can easily update the web site, allowing users to upgrade the next time they access the site. With the public app store, it may take days or weeks to work through a third-party app store approval process. In addition, the users must take an action to upgrade. So building in post-deployment management system where the app can call back to the enterprise to validate its state or currency is important. This allows the enterprise to perform remote disablement or provide new updates.

Summary

Mobile is hot and at the top of the minds of many business leaders. Mobile is clearly the next major IT trend that will be driving growth and opportunity. Business leaders see how mobile technology impacts their personal life and they see the opportunity to apply it to the enterprise. Competitors are using mobile technology to their advantage and putting pressure on business leaders. As a result, the business side of an organization is much more involved in driving decisions around a mobile strategy. This pressure to adopt mobile technology that originated in the consumer market is driving a new wave of *consumerization of IT*. This is raising expectations on IT. Cycle times are shorter, while at the same time there is a higher expectation on user experience. With multiple platforms to support in a fragmented market space, IT is struggling to keep up. In addition, much of the mobile technology lacks the enterprise capabilities for security and management.

To address these challenges and seize on the opportunities around mobile, you must have an overall strategy that addresses the needs across the organization. A strategy needs to address the entire life cycle of a mobile solution. You need to look at the increasing cost of managing multiple platforms, and how to deal with different types of mobile applications (web delivered, hybrid, or native). You want to take advantage of some of the capabilities of new and emerging smartphone technologies and deliver a solution in a consistent way across different channels and markets. As a result, you need to define an end-to-end strategic framework around enterprise mobility. This framework would outline a life cycle for a mobile solution describing how to build and run mobile applications, manage and secure mobile apps and devices, and extend your back-end system and transform your business. The framework for defining a mobile strategy will be discussed in detail in the following chapter.

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