Mobile and Wireless Design Essentials

Martyn Mallick
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Martyn Mallick
To my beautiful wife Catherine, for her support, understanding, and encouragement.
Contents

Acknowledgments xviii
Introduction xix

Part One Introduction to the Mobile and Wireless Landscape 1

Chapter 1 Welcome to Mobile and Wireless 3
Definition of Mobile and Wireless 4
m-Commerce 5
m-Business 7
Components of a Wireless Environment 9
  Wireless Operators and Service Providers 9
  Independent Hardware Vendors 9
  Software Infrastructure Providers 10
  Independent Software Vendors (ISVs) 10
  System Integrators (SIs) 10
  Device Manufacturers 10
The Mobile Market Evolution 11
Why Go Mobile? 12
  Business Benefits 12
    Increasing Revenue 12
    Reducing Costs 13
  End-User Benefits 14
Challenges 14
  Wireless Network Issues 14
  Mobile Device Diversity 15
  Software Infrastructure Choices 16
Chapter 2 Mobile Devices

Device Overview
Input Mechanisms
  Keypad Input
  Pen-Based Input
  Keyboard Input
  Voice Input
Wireless Communication
  Two-Unit Configuration
  Detachable Configuration
  Integrated Configuration
Mobile Device Classifications
  Web-Enabled Phones
  Two-Way Pagers
  Low-End Smart Phones
  Palm-Sized PDAs
  High-End Smart Phones
  Handheld PCs
  Tablet PCs
  Notebook/Laptop
Device Manufacturers
Summary
Helpful Links

Chapter 3 Wireless Networks

Overview of Wireless Networks
  Four Categories of Wireless Networks
  Frequency Fundamentals
Wireless Personal Area Networks (WPANs)
  WPAN Standards
    IrDA
    Bluetooth
    802.15
  WPAN Comparison
Wireless Local Area Networks (WLANs)
  WLAN Configurations
  WLAN Standards
    802.11
    802.11b/Wi-Fi
    802.11a
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.11g</td>
<td>60</td>
</tr>
<tr>
<td>Other 802.11 Standards</td>
<td>60</td>
</tr>
<tr>
<td>HomeRF</td>
<td>61</td>
</tr>
<tr>
<td>HIPERLAN/1 and HIPERLAN/2</td>
<td>61</td>
</tr>
<tr>
<td>WLAN Summary</td>
<td>62</td>
</tr>
<tr>
<td>Wireless Wide Area Networks (WWANs)</td>
<td>64</td>
</tr>
<tr>
<td>Communication Fundamentals</td>
<td>65</td>
</tr>
<tr>
<td>Analog versus Digital Signals</td>
<td>65</td>
</tr>
<tr>
<td>Circuit-Switching versus Packet-Switching</td>
<td>66</td>
</tr>
<tr>
<td>Cells, Handoffs, and Roaming</td>
<td>66</td>
</tr>
<tr>
<td>Multiplexing Techniques</td>
<td>67</td>
</tr>
<tr>
<td>First-Generation Networks (1G)</td>
<td>68</td>
</tr>
<tr>
<td>Second-Generation Networks (2G)</td>
<td>69</td>
</tr>
<tr>
<td>Second-and-a-Half-Generation Networks (2.5G)</td>
<td>70</td>
</tr>
<tr>
<td>GPRS Handsets</td>
<td>71</td>
</tr>
<tr>
<td>2.5G Applications</td>
<td>71</td>
</tr>
<tr>
<td>Third-Generation Networks (3G)</td>
<td>72</td>
</tr>
<tr>
<td>3G Devices</td>
<td>74</td>
</tr>
<tr>
<td>3G Applications</td>
<td>74</td>
</tr>
<tr>
<td>Network Protocols</td>
<td>74</td>
</tr>
<tr>
<td>Paging Networks</td>
<td>75</td>
</tr>
<tr>
<td>Data-Only Networks</td>
<td>75</td>
</tr>
<tr>
<td>TDMA (2G)</td>
<td>76</td>
</tr>
<tr>
<td>GSM (2G)</td>
<td>76</td>
</tr>
<tr>
<td>cdmaOne (2G)</td>
<td>77</td>
</tr>
<tr>
<td>PDC (2G)</td>
<td>78</td>
</tr>
<tr>
<td>GPRS (2.5G)</td>
<td>78</td>
</tr>
<tr>
<td>CDMA2000 1x (2.5G)</td>
<td>78</td>
</tr>
<tr>
<td>EDGE (3G)</td>
<td>79</td>
</tr>
<tr>
<td>CDMA2000 1x EV (3G)</td>
<td>79</td>
</tr>
<tr>
<td>WCDMA (3G)</td>
<td>80</td>
</tr>
<tr>
<td>WWAN Operators</td>
<td>80</td>
</tr>
<tr>
<td>Criteria for Selecting a WWAN Operator</td>
<td>81</td>
</tr>
<tr>
<td>Evolution to 3G</td>
<td>82</td>
</tr>
<tr>
<td>WWAN Summary</td>
<td>83</td>
</tr>
<tr>
<td>Satellite Systems</td>
<td>85</td>
</tr>
<tr>
<td>Summary</td>
<td>87</td>
</tr>
<tr>
<td>Helpful Links</td>
<td>87</td>
</tr>
</tbody>
</table>

**Chapter 4 Mobile Application Architectures**

Choosing the Right Architecture

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Users</td>
<td>89</td>
</tr>
<tr>
<td>Device Type</td>
<td>90</td>
</tr>
<tr>
<td>Enterprise Connectivity</td>
<td>90</td>
</tr>
<tr>
<td>Enterprise Data</td>
<td>91</td>
</tr>
<tr>
<td>Enterprise Integration</td>
<td>91</td>
</tr>
<tr>
<td>User Notification</td>
<td>91</td>
</tr>
</tbody>
</table>
Chapter 5  Mobile and Wireless Messaging  113
Messaging Basics  114
   Asynchronous versus Synchronous Messaging  114
   Push versus Pull  114
Types of Messaging  115
   Email  115
      SMTP Server  116
      POP3 Server  116
   Paging  117
   Short Message Service (SMS)  117
   Enhanced Message Service (EMS)  119
   Multimedia Message Service (MMS)  120
   Instant Messaging  122
   HDML Notifications  123
   WAP Push  124
      Architecture  124
      Operations  126
Application-to-Application Messaging  126
Chapter 6 Mobile and Wireless Security 133

Security Primer 133
Creating a Secure Environment 134
  Authentication 134
  Data Integrity 134
  Confidentiality 134
  Authorization 135
  Nonrepudiation 135
Security Threats 135
  Spoofing 135
  Sniffing 136
  Tampering 136
  Theft 136
Security Technologies 137
  Cryptography 137
  Digital Certificates 139
  Digital Signatures 140
  Public Key Infrastructure 141
  Leading Protocols 141
Other Security Measures 142
  Firewalls 143
  Virtual Private Networks (VPNs) 143
  Two-Factor Authentication 143
  Biometrics 144
  Security Policy 144
WAP Security 145
  Transport-Level Security 145
    WTLS 146
    The WAP Gap 146
    WAP 2.x 147
  Application-Level Security 147
Smart Client Security 148
  User Authentication 148
  Data Store Security 149
  Transport-Level Security 149
Summary 150
Helpful Links 150
## Chapter 9 Persistent Data on the Client

### Types of Data Storage
- Flat-File Databases
- Relational Databases
- Object Databases
- XML Databases

### Reasons for Using a Database
- Key Features
  - Data Storage Properties
  - Tool Support
  - Flexible Synchronization
  - Administration Requirements
  - Low Resource Requirements
  - Operating System/Device Support
  - Standards Support
  - Security
- Persistent Storage versus Real-Time Access

### Database Development Options
- Proprietary Storage
  - Palm OS
  - Windows CE
  - Symbian OS
  - J2ME
- Proprietary Storage Summary
- Custom-Coded Databases
- Commercial Relational Databases
  - Sybase/iAnywhere Solutions
  - IBM
  - Oracle
  - Microsoft
  - PointBase
  - Other Database Vendors
- Conclusions

### Summary

### Helpful Links

## Chapter 10 Enterprise Integration through Synchronization

### Synchronization Fundamentals
- PIM Synchronization
- File/Application Synchronization
- Data Synchronization

### Synchronization Architectures
- Architecture Overview
- Publish/Subscribe Model
- Common Synchronization Configurations

### The Data Synchronization Process
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronization Techniques</td>
<td>230</td>
</tr>
<tr>
<td>Synchronization Modes</td>
<td>230</td>
</tr>
<tr>
<td>Data Propagation Methods</td>
<td>231</td>
</tr>
<tr>
<td>Key Features of Synchronization</td>
<td>233</td>
</tr>
<tr>
<td>Data Subsetting and Partitioning</td>
<td>233</td>
</tr>
<tr>
<td>Data Compression</td>
<td>233</td>
</tr>
<tr>
<td>Data Transformation</td>
<td>234</td>
</tr>
<tr>
<td>Transactional Integrity</td>
<td>234</td>
</tr>
<tr>
<td>Conflict Detection</td>
<td>234</td>
</tr>
<tr>
<td>Conflict Resolution</td>
<td>235</td>
</tr>
<tr>
<td>Network Protocol Support</td>
<td>235</td>
</tr>
<tr>
<td>Multiple Transport Mechanisms</td>
<td>236</td>
</tr>
<tr>
<td>Enterprise Integration</td>
<td>236</td>
</tr>
<tr>
<td>Security</td>
<td>237</td>
</tr>
<tr>
<td>Synchronization Development Options</td>
<td>238</td>
</tr>
<tr>
<td>Mobile OS Synchronization Conduits</td>
<td>238</td>
</tr>
<tr>
<td>Windows CE ActiveSync</td>
<td>238</td>
</tr>
<tr>
<td>Palm OS HotSync</td>
<td>239</td>
</tr>
<tr>
<td>Symbian OS Connect</td>
<td>239</td>
</tr>
<tr>
<td>Synchronization Conduit Considerations</td>
<td>240</td>
</tr>
<tr>
<td>Custom-Coded Synchronization Solution</td>
<td>240</td>
</tr>
<tr>
<td>Commercial Synchronization Solutions</td>
<td>241</td>
</tr>
<tr>
<td>Database Synchronization Vendors</td>
<td>242</td>
</tr>
<tr>
<td>Other Synchronization Vendors</td>
<td>245</td>
</tr>
<tr>
<td>Commercial Solution Conclusions</td>
<td>246</td>
</tr>
<tr>
<td>SyncML Overview</td>
<td>247</td>
</tr>
<tr>
<td>What Is SyncML?</td>
<td>247</td>
</tr>
<tr>
<td>Why Use SyncML?</td>
<td>248</td>
</tr>
<tr>
<td>SyncML Target Audiences</td>
<td>248</td>
</tr>
<tr>
<td>SyncML Advantages</td>
<td>249</td>
</tr>
<tr>
<td>How SyncML Works</td>
<td>250</td>
</tr>
<tr>
<td>Future of SyncML</td>
<td>252</td>
</tr>
<tr>
<td>Summary</td>
<td>253</td>
</tr>
<tr>
<td>Helpful Links</td>
<td>253</td>
</tr>
</tbody>
</table>

### Part Three Building Wireless Internet Applications

#### Chapter 11 Thin Client Overview

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture Overview</td>
<td>257</td>
</tr>
<tr>
<td>Client</td>
<td>257</td>
</tr>
<tr>
<td>User Interface</td>
<td>259</td>
</tr>
<tr>
<td>Browsers and Content Types</td>
<td>259</td>
</tr>
<tr>
<td>Wireless Networks</td>
<td>261</td>
</tr>
<tr>
<td>Middleware</td>
<td>261</td>
</tr>
<tr>
<td>Wireless Application Servers</td>
<td>261</td>
</tr>
<tr>
<td>Wireless Gateways</td>
<td>267</td>
</tr>
<tr>
<td>Messaging Servers</td>
<td>268</td>
</tr>
</tbody>
</table>
Chapter 14  Wireless Internet Technology and Vendors  343
Microbrowsers  344
Technology  344
Markup Languages  344
Image Support  345
Push Technologies  345
Offline Support  345
Web Clippings  345
Security  346
Device Support  346
Microbrowser Vendors  346
Openwave Mobile Browser  346
Microsoft Pocket Internet Explorer  347
AvantGo Client  347
GoAmerica Go.Web  348
Neomar Microbrowser  348
Palm Web Browser  348
Opera Software  349
Device-Specific Browsers  349
Wireless Application Servers  349
Technology  350
Request-Handling Proxies  350
Content Transformation  350
Device/Browser Identification  351
Dynamic Content Generation  351
Session and State Management  351
Enterprise Integration  352
Messaging Integration  352
Security Services  352
Scalability  353
Operating System Support  353
Development Tools  353
Wireless Application Server Vendors  354
Development Tools  355
Technology  355
Rapid Application Development  355
Multichannel Support  356
Built-in Emulators  356
Extensibility  356
Contents

Support for Standards 356
Server Integration 357
Development Tool Vendors 357
Wireless Internet Service Providers 358
Summary 359
Helpful Links 360

Chapter 15 Voice Applications with VoiceXML 361
Why Voice? 362
VoiceXML 363
  History of VoiceXML 363
  Design Goals 364
  VoiceXML Architecture 364
Building VoiceXML Applications 367
  Language Concepts 367
    Session 367
    Dialogs 367
    Applications 368
    Grammars 368
    Events 368
    Links 368
    Scripting 369
    Application Example 369
Voice Vendors 373
Summary 374
Helpful Links 375

Part Four Beyond Enterprise Data 377

Chapter 16 Mobile Information Management 379
PIM Sync 380
  What Is PIM? 380
    Email 381
    Calendar 382
    Contact Lists 382
    Task Lists 383
    Memo Pad 383
PIM Architectures 383
  Wireless Internet 383
  Smart Client 384
Mobile OS PIM Software 385
Core PIM Product Features 386
Standardization Efforts 388
  SyncML 388
  vCalendar/iCalendar 389
  vCard 390
Enterprise PIM Vendors 390
.NET versus J2EE 425
Web Services in a Mobile Environment 427
Binary Runtime Environment for Wireless (BREW) 428
  BREW Benefits 429
  Relationship between BREW and J2ME 430
Speech Application Language Tags (SALT) 430
  SALT Elements 431
  Competition between SALT and VoiceXML 431
M-Services 432
  M-Services: What Are They? 433
    User Interface and Navigation 434
    Downloadable Objects 434
    Messaging 435
    Who Benefits from M-Services? 435
Summary 436
Helpful Links 437

Index 439
When I started writing *Mobile and Wireless Design Essentials* a year and a half ago, I never imagined what a monumental effort it would require. Without the support and assistance from my family, friends, and colleagues it would not have been possible to write on such a broad, evolving topic.

In particular, I must thank my wife Cathy for being patient and understanding when I wrote late into the night, and during most weekends.

I would also like to thank the rest of my family, including my parents Adrian and JoAnn, and my siblings David, Anita, Bryan, and Marissa for helping me stay focused throughout the writing process. Thanks also goes to Carol Long and her team at John Wiley & Sons including Scott, Micheline, Felicia, Janet, Erica, Adaobi, and Holly for offering their insight into the publishing process and for keeping me on schedule. Also deserving my gratitude are many of my colleagues at iAnywhere Solutions including David, Bharat, Alex, Liam, Matt, Chris, and Eric, who allowed me to bounce ideas off of them, and provided technical editing during the latter phases of writing. Additionally, a special mention goes to Michelle Cheng, a very gifted individual, who worked endless hours putting together all of the figures you see throughout the book. And finally I would like to thank my employer for providing an environment that is conducive to expanding my knowledge about both the business and technical aspects of the mobile and wireless industry. I hope the knowledge I have gained, and the lessons I have learned, prove to be valuable as you develop your mobile and wireless solutions.

*Martyn Mallick*  
*January 2003*
Mobile and wireless application development has come a long way in the past few years. It has progressed beyond the hype of wireless Web applications for consumers to the reality of high-value mobile applications for corporate users. Opportunities abound for creating new mobile and wireless applications that provide vital benefits to any business. A sampling of these benefits includes increased worker productivity, reduced processing costs, heightened accuracy, and competitive advantage. In contrast is the concern that developing mobile and wireless applications will involve many new technologies and concepts that many corporate developers are still learning to use.

One of the challenges in the mobile application space is the variety of application architectures available. Though many by now are now familiar with Wireless Application Protocol (WAP) applications, they are not familiar with smart client and messaging application architectures. (Note: WAP is a specific protocol, but is commonly used to describe any type of thin client wireless application. For a detailed discussion of thin client applications, see Chapter 11, “Thin Client Overview,” and Chapter 12, “Thin Client Development.”) Thin client refers to server-based applications that make it possible to browse the Internet on a wireless device. All of the business logic and data access logic is located on the server. The only software required on the client is a micro-browser, which is often preinstalled on wireless devices. Thin client applications are attractive because they can build upon existing Internet applications and do not require deployment to the client device. They can be viewed by anyone with a wireless Web-enabled device and can be updated at any time simply by changing the software on the enterprise server.

Thin client applications have one fundamental shortcoming, however: They require a wireless network connection to be effective. Without a connection, information cannot be retrieved from the server, essentially making the application useless. Even when a connection is available, unreliable wireless network coverage, slow data transfer rates, and cost also impact the success of thin client applications.
Consequently, a movement is growing toward *smart client* applications. These applications allow corporations to deploy an application to the mobile device so the user can continue to interact with the application even when a wireless data connection is unavailable. (For more detailed information on smart client applications and technology, see Chapter 7, “Smart Client Overview,” and Chapter 8, “Smart Client Development.”) These applications commonly include a form of persistent data storage that communicates with enterprise systems using data synchronization. This combination enables applications to have sophisticated user interfaces and high-performance data access, making them suitable for offline computing.

The third mobile application architecture of interest is *messaging*. (For more detailed information on messaging technology, see Chapter 5, “Mobile and Wireless Messaging.”) Messaging technology can be used either on its own or to enhance existing applications. Adding notification capabilities to an application can increase its effectiveness dramatically. Mobile users can have important data “pushed” to them, as opposed to constantly requesting it from an enterprise server. Information notifications can be applied to both thin client and smart client applications. Messaging applications can also be developed on their own using messaging as the data delivery mechanism. In these applications, message queues are present on both the client and the server, allowing for information to be stored when a user is not connected to the network. Once the user connects, the stored messages are automatically forwarded to him or her. This type of messaging is commonly referred to as store-and-forward.

The technologies available to companies that want to extend their enterprise systems to their mobile workforce are covered in depth in the chapters that follow. All three mobile applications architectures are covered in some depth, as is related information on mobile devices, wireless networks, mobile and wireless security, mobile information management, and location-based services. This book provides all of the information you require to build highly successful mobile and wireless applications. Though the content is mainly focused on the creation of enterprise applications, you will find information relevant to developing consumer applications as well.

**Overview of the Book and Technology**

Developing successful mobile applications requires the integration of many technologies. Handset manufacturers and wireless network operators lay the basic groundwork for many applications, but they are only one component of the solution. Mobile middleware software, in conjunction with client-side technology, rounds out the solution. Developers are responsible for putting the pieces together to form effective mobile and wireless applications.

In order to be successful with this task, a broad knowledge of the mobile and wireless industry as a whole is required. Obtaining this knowledge can be a difficult quest. Although many books have been written on mobile and wireless computing, they typically focus on a very specific topic, meaning that developers would have to read several of these books to learn what is required for a single project. Obviously, this is too time-consuming. Moreover, due to the specific nature of the content being covered, many of these books simply rehash industry specifications or product manuals and do not cover the important issues for designing and developing enterprise mobile
solutions. To fill in these gaps, readers then have to spend still more time doing their own research on the Internet before they can be productive.

The lack of comprehensive books on mobile and wireless computing was the motivating factor behind this book. *Mobile and Wireless Design Essentials* was written to make things easier for developers. It is a single resource whose objective is to bring you up to speed on the full spectrum of technologies and issues related to mobile and wireless computing. Every chapter provides insightful information on its respective topic, beginning with an overview of the subject matter and followed by in-depth analysis of how it is useful to application developers. Each chapter also contains helpful Web links where you can go for more information on any of the topics covered. These Web links alone will save you countless hours of searching for information.

To meet this goal — to be an all-in-one resource—a great number of topics are covered in *Mobile and Wireless Design Essentials*. The book starts with an overview of the mobile and wireless landscape, to ensure that all readers are “on the same page,” before tackling the topics of developing smart client and thin client applications. Each of these application architectures has several chapters dedicated to related design and development issues. The final parts of the book focus on related technologies that are being used today—such as mobile email, mobile device management, and location-based services—and technologies that you will come across in the near future, including mobile Web services, M-Services and BREW.

**How This Book Is Organized**

*Mobile and Wireless Design Essentials* is divided into 4 parts and 18 chapters. Part I provides core information, making it essential to read first, to get the most from the rest of the book. After that, feel free to read the rest of the material in any order, as each part is self-contained. The same is true for most of the chapters: each is complete in itself so you can easily reference any one to get what you need on the subject covered. The chapters were written to give you a concise overview of the technology under discussion; you will not be overwhelmed by needless details.

**Part Summary**

Part I, “Introduction to the Mobile and Wireless Landscape,” lays the foundation on which the other parts of the book are based. To that end, it covers mobile devices, wireless networks, mobile application architectures, mobile and wireless security, and messaging technology. These are core topics that should be well understood by anyone involved in a mobile application project. Subsequently, each of these topics is covered in its own chapter to provide a concise introduction to mobile and wireless computing.

Part II, “Building Smart Client Applications,” provides an in-depth look at the concepts and technologies pertinent to developing smart client applications. It starts with an overview of the smart client architecture and proceeds to the development process, persistent data technology, and enterprise data synchronization. This part gives you everything you need to know in respect to the design and development of smart client applications.
Part III, “Building Wireless Internet Applications,” provides an in-depth look at the concepts and technologies inherent to developing thin client applications. Similar to Part II, this part starts with an overview of the thin client architecture and proceeds to discuss the concepts and technologies involved in thin client development. A complete overview of the thin client markup languages—HDML, WML, cHTML, and XHTML—is provided, along with the techniques that can be used to generate this technology for the wide range of wireless devices being used today. Wireless Internet technology and voice application development using VoiceXML are the final topics discussed in Part III.

Part IV, “Beyond Enterprise Data,” takes a look at technologies that are not core to the leading mobile application architectures but that are significant in the adoption and deployment of mobile applications. The first topic is mobile information management, which includes both personal information management (PIM) and mobile device management capabilities. These technologies are becoming increasingly important as mobile devices proliferate and become the responsibility of enterprise IT staffs. The second topic in Part IV is location-based services (LBS). Much of the hype around LBS refers to its use in the consumer market, but many corporate applications can also benefit from location information. Part IV finishes with information on four technologies that gaining momentum in mobile computing: Mobile Web Services, BREW, SALT, and M-Services.

Chapter Summary

Chapter 1, “Welcome to Mobile and Wireless,” is a nontechnical introduction to mobile wireless computing. It starts with an overview of key terms (e.g., mobile, wireless, m-commerce, and m-business) and moves on to a discussion of the benefits and challenges that surround mobile computing. An overview is also provided of the main mobility enablers, including wireless networks, mobile devices, and software infrastructure. This chapter will help organizations understand the risks and rewards in developing mobile solutions.

Chapter 2, “Mobile Devices,” overviews the mobile device market, with an emphasis on devices that are most appropriate for corporate solutions. For each device category, we will look at the leading features, such as screen size, data input mechanisms, wireless support, and storage space.

This chapter also covers key criteria for selecting mobile devices, with a focus on data input mechanisms and wireless connectivity options. The chapter concludes with information on mobile device manufacturers and the classes of devices they provide.

Chapter 3, “Wireless Networks,” addresses all aspects of wireless network coverage, including wireless personal area networks (WPANs), wireless local area networks (WLANs), wireless wide area networks (WWANs), and satellite networks. For each category, the prevalent technologies are examined, followed by a discussion about what the future holds. From this chapter you will gain an understanding of the wireless network protocols that are being used today and for what types of applications. This knowledge will be valuable as you continue through the book to learn more about the design and development of mobile and wireless applications.
Chapter 4, “Mobile Application Architectures,” introduces you to the leading application architectures available for mobile computing: thin client (wireless Internet), smart client, and messaging. The chapter starts with a list of key criteria that should be considered when determining which application architecture is most suitable for a given application. It then proceeds with an overview of each application model, which includes a discussion of the advantages and disadvantages they present.

Chapter 5, “Mobile and Wireless Messaging,” takes a look at the key messaging technologies currently available. It begins with an overview of the common messaging systems, such as email and paging, then moves on to SMS, EMS, and MMS, and finishes with push and application-to-application messaging. After explaining the various messaging systems, it covers the messaging value chain, from device manufacturers to messaging middleware providers.

Chapter 6, “Mobile and Wireless Security,” starts with a security primer on the key aspects of creating a secure environment; it then provides information on each of the technologies involved in building secure applications. Next the chapter offers insight into issues surrounding WAP security, such as the WAP gap, before addressing issues related to securing smart client applications. The goal of this chapter is to provide developers with enough information to make educated decisions when implementing security in their mobile solutions.

Chapter 7, “Smart Client Overview,” highlights the main components of a successful smart client solution. It then takes an in-depth look at the major mobile operating systems that are available for smart client solutions. The combination of the mobile operating system and the device hardware often dictate whether a smart client solution is possible to implement.

Chapter 8, “Smart Client Development,” prepares you for some of the technical challenges you will encounter while developing smart client applications. It also gives you some pointers on how to get started with development. The chapter steps through each part of the development process, taking a look at technology that is available to help you build your mobile solutions. It also discusses the pros and cons of developing native versus Java applications. Information regarding device emulators, SDKs, and development tools is also provided, to help you get started with your mobile solutions.

Chapter 9, “Persistent Data on the Client,” explores one of the fundamental components of smart client applications: persistent data storage. This is the technology that allows you to maintain data on the device, removing the requirement for wireless network coverage. When it comes to how the data is stored, you have a variety of options from which to choose. You can use the device’s file system to store data, build your own data storage mechanism, or purchase a commercial solution. This chapter evaluates all of these options, in addition to taking a closer look at the reasons why databases are an important component of smart client applications.

Chapter 10, “Enterprise Integration through Synchronization,” provides information on the primary way in which smart client applications access enterprise data, using synchronization. This chapter covers the fundamental concepts involved in enterprise synchronization, including synchronization architectures and techniques. It also covers some of the synchronization technologies available commercially, and provides an overview of SyncML and where it fits into data synchronization.
Chapter 11, “Thin Client Overview,” defines the thin client application architecture by highlighting the main components that comprise a successful solution. The overview is followed by a comparison of J2EE and .NET for server-side development. The chapter concludes with information on the leading wireless Internet protocol, Wireless Application Protocol (WAP), and the steps involved in processing a wireless Internet request.

Chapter 12, “Thin Client Development,” explains how to start developing wireless Internet applications. It steps you through the various stages of the development process, starting with needs analysis phase and finishing with deployment options. As you move through this process, helpful hints are provided for avoiding common pitfalls of developing thin client applications. At the end of the chapter is a section on the common thin client application models, which outlines the target audiences, technical challenges, and types of solutions available for each application type.

Chapter 13, “Wireless Languages and Content-Generation Technologies,” investigates the range of markup languages being used for wireless Internet applications, including HDML, WML, HTML, cHTML, and XHTML. For each markup language, sample code is given to demonstrate its syntax. The second part of the chapter delves into the various techniques that can be used to generate dynamic wireless content. This includes server-specific technology, such as CGI and ASP, as well as cross-platform technologies such as Java servlets, JSPs, and XML with XSL style sheets.

Chapter 14, “Wireless Internet Technology and Vendors,” looks at the technologies commonly used when implementing wireless Internet applications. These technologies have been divided into four categories: microbrowsers, wireless application servers, development tools, and wireless service providers. For each category the key technology features are investigated, and a summary of related vendor solutions is provided. The goal is provide you with enough information to make educated decisions as to which technology and vendors you will want to evaluate further.

Chapter 15, “Voice Applications with VoiceXML” explains how voice applications are built using the Voice eXtensible Markup Language, VoiceXML. Unlike other applications discussed in this book, VoiceXML provides a voice interface into enterprise systems, rather than a visual one. The VoiceXML architecture is very similar to that of Internet applications, but the Web browser is replaced by a voice browser, and the handheld device is replaced by a telephone. Voice interfaces give true universal access to your applications. After the history of VoiceXML is examined, the VoiceXML architecture is discussed, followed by information on building VoiceXML applications.

Chapter 16, “Mobile Information Management,” covers two separate but related technologies: personal information management (PIM) and mobile device management. PIM applications include email, calendars, task lists, address books, and memo pads. Access to these applications is often the reason why consumers purchase mobile devices. Mobile device management software can provide substantial benefits for both the deployment and management of software and devices. This chapter divides these topics into separate sections to focus on the capabilities that each solution provides.

Chapter 17, “Location-Based Services,” examines location positioning technology, specifically addressing how location information can be used in both consumer and corporate applications and previewing the standardization efforts that are underway for location information. It also covers what, why, and when location-based solutions are relevant to mobile and wireless computing.
Chapter 18, “Other Useful Technologies,” focuses on technologies that are just beginning to be adopted by mobile application developers. The four technologies covered include Mobile Web Services, BREW, SALT, and M-Services. All have been developed to improve upon previous technologies in the same market space and to become the standard in their respective fields. Of these technologies, Web services are clearly the leader in market acceptance and standardization. The others, BREW, SALT, and M-Services, are still working to achieve meaningful vendor and developer acceptance. The goal of this chapter is to introduce these technologies and explain how they relate to mobile computing.

Who Should Read This Book

If you or your organization is planning to build mobile and/or wireless applications, this book is for you. The content is appropriate for anyone who wants or needs to learn about mobile and wireless technology and how it applies to building successful applications. Though the book is technical in nature, it does not necessarily require you to have a strong technical background. If you are comfortable with general computing architectures and have some understanding of how applications are developed, then you will be able to gain valuable information from reading this book. More specifically, if you have in-depth development experience, and are already knowledgeable about mobile computing, the design and development chapters will prove to be beneficial, as will the chapters on related technologies such as location-based services and mobile information management. Many of my colleagues who are very proficient in mobile computing were able to garner new knowledge and ideas by reading this book.

Depending on your background, you can read this book in a number of different ways. Those of you who are new to mobile and wireless computing or who do not have a technical background will benefit most by reading the first four chapters in order. These will give you a solid understanding of the business aspects of mobile and wireless computing and of mobile devices, wireless networks, and mobile application architectures. You may then want to continue reading through each chapter sequentially, or you may want to jump to another section that is of interest to you. An entire part of the book is dedicated to each of the leading mobile application architectures; and the final part delves into technologies that are useful, but not necessarily required to build mobile applications.

For those of you who have experience with mobile devices and wireless networks, and who want to learn more about mobile application architecture design and development techniques, you may want to jump straight to Chapter 4, “Mobile Application Architectures,” and go from there. After reading Chapter 4, you will have a solid understanding of your development options, enabling you to move on to the chapters that are relevant to the applications you are planning to develop. As you are reading, you can always reference the chapters on key technologies, such as wireless networks, mobile devices, and security, to refresh your knowledge of those topics.

However you read this book, it will prove to be a useful reference tool. Whether you read it from cover to cover or only read the chapters most pertinent to your project, you will always be able to go back and review content as required. Each chapter also
contains a list of helpful Web links where you can go to get more in-depth information, updates on technology specifications, or another perspective on how the technology relates to your project. This book is intended as an all-in-one resource containing concise, yet insightful, information on all aspects of the mobile and wireless industry.

**Where to Go from Here?**

The mobile and wireless industry is in a very exciting phase in its evolution. It has moved beyond the marketing hype into the design and development of concrete enterprise solutions. This book provides an in-depth look at the technologies that are available to extend enterprise systems to mobile users.

Those of you who want an overview of mobile and wireless application terminology and business issues should start reading at Chapter 1. Those who want to dive right into the technology can start with an overview of mobile devices in Chapter 2 or wireless networks in Chapter 3. Regardless of what else you decide to read in this book, it is recommended you read Chapter 4, as it provides an overview of the leading mobile application architectures, with the advantages and disadvantages of each.

By reading this book, you will gain a solid understanding of mobile and wireless technologies that will help you to develop many successful mobile applications. Ultimately, it is these applications, not the hardware or software infrastructure itself, that will lead to the overall success of the mobile and wireless industry.
Mobile and wireless computing has the power to change the way business is conducted. It allows employees, partners, and customers to access corporate data from almost anywhere. Universal data access, combined with increased worker productivity and effectiveness, is driving the demand for enterprise mobile applications. As the demand continues to increase, the mobile infrastructure that makes creating sophisticated mobile applications possible is maturing. We have moved past the irrational exuberance that surrounded consumer wireless applications into the reality of creating advanced, integrated enterprise solutions that bring true value to enterprises that are adopting mobile and wireless technology as part of their core infrastructure.

Creating successful mobile and wireless applications requires a profound knowledge of various technologies, including network protocols, portable devices, application design and development, and security. In addition, enterprise managers need to understand the risks and rewards of introducing mobility into their organizations. The combination of business rationale and technical expertise can lead to the successful development and deployment of mobile and wireless solutions today!
The first part of this book is aimed at introducing the reader to the mobile and wireless landscape. It lays the foundation on which the rest of the book is based, covering mobile devices, wireless networks, mobile application architectures, mobile and wireless security, and messaging technology. Each of these topics is covered in its own chapter, as follows, to provide a concise introduction to mobile and wireless computing:

- Chapter 1, “Welcome to Mobile and Wireless”
- Chapter 2, “Mobile Devices”
- Chapter 3, “Wireless Networks”
- Chapter 4, “Mobile Application Architectures”
- Chapter 5, “Mobile and Wireless Messaging”
- Chapter 6, “Mobile and Wireless Security”