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# Mobile Computing

# 移动计算

A System

Integrator

Handbook

Chander Dhawan

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# Mobile Computing

## A Systems Integrator's Handbook

Chander Dhawan

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## ABOUT THE AUTHOR

Chander Dhawan is president of DOLNET Mobile Info Services in Toronto, Canada, and previously spent 13 years with IBM Canada. An independent consultant and a systems integration expert with over 25 years of experience in information technology, he has designed and installed some of Canada's largest computer networks, including a sophisticated mobile workstation pilot for the Canadian government.

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# Preface

The idea of writing a book on mobile computing came to me soon after I finished an assignment as project manager of a sophisticated mobile computing pilot project for a large public-sector organization. I realized during this assignment (during 1993 to 1995) that there was a dearth of information available in a form that I could use as a technology architect and project manager. Although I have an extensive background in implementing IT networking projects, I had then only a superficial understanding of wireless networks and the integration issues of mobile computing systems. It was tough finding independent and comprehensive end-to-end application and systems-integration expertise and knowledge.

When I started doing technology research, I found that only a few large organizations such as Federal Express and UPS had implemented mobile computing solutions on proprietary private/public networks, but their experience base was not available to other practitioners. Several public safety organizations were just trying to implement old applications on new devices and networks. I wanted an open and long-term solution that would address new ways of doing business with new processes. Vendors were willing to provide information but had very narrow, product-oriented, and biased viewpoints. So I set out to acquire this knowledge and experience the hard way through industrywide technology research, requests for information, requests for proposals, and an actual technology pilot.

In 1993, there were several good books on radio engineering available, and, in 1995, a selection of titles on wireless networks was published. Mobile computing systems integration is a more comprehensive and complex topic altogether; however, it seemed to me that the time was ripe for a book on mobile computing that was comprehensive and addressed the issue from an end-to-end perspective—a book that would deal with business process reengineering, business case development, wireless networks, application analysis, application development, product knowledge, network management, and end-to-end design.

Having been through the process myself, I felt that I should gather together the experiences of early implementers of this leading-edge technology and give others the benefit of our combined knowledge.

Writing a book on mobile computing from a systems-integration perspective was at that point, however, only a dream in my mind. I flirted with the idea for several months but I did nothing about it. Then, in April 1995, I attended a seminar by Bob Proctor, one of the finest motivational seminar leaders in North America. Bob convinced me in his seminar that the hardest thing to do is to make up one's mind. As soon as that is done, everything else follows. Making the decision brings out the necessary creative energies required to fulfill the dream. Bob Proctor asked us to each write down on a piece of paper our dream wish. It was there and then that I decided I was going to write this book.

Subsequently, my resolve was further strengthened by an extremely positive reaction when I broached the idea to Jay Ranade, Series Editor for the IBM, DEC, and Communications Series at McGraw-Hill. Jay encouraged me and reinforced my conviction that a book on the subject was needed.

Prior to this, I had spoken at Comdex and other such seminars and had even written a few technical articles for publication in trade magazines. But writing a book—that was something entirely new for me. I found myself approaching the undertaking with both fear and excitement.

For over eight months I collected background information, researching the subject, surfing the Internet and CompuServe, discussing issues with industry experts, putting ideas down on paper and illustrating them with graphics. I limited my consulting work to just one part-time contract and spent a majority of my time on the book. Although it was a long struggle and I am glad it is over, looking back, I realize I have learned a lot and have enjoyed myself in the process—so much so that I might well do it again.

## Organization of the Book

The book follows the life cycle of a typical mobile computing project. It is organized into six parts.

The first part deals with the business vision, potential applications, and economics of mobile computing. Here, I discuss business applications, business process reengineering, and the development of a mobile computing business case.

The second part deals with the development of an architecture.

In the third part, I review various component technologies including end-user devices, wireless LANs, wireless WANs, ISDN, and public

switched telephone networks. I also review communications switches, application-development tools, and strategies that are unique to mobile computing.

In the fourth part, I look at the current state of technology implementations in terms of vendor product strategies. Brief descriptions of important products are given in the appendixes.

In the fifth part, I emphasize design and integration issues. This is the glue that binds everything together.

Finally, in the sixth part, I analyze the challenges facing mobile computing and look at technology trends that practitioners need to take into account while planning for future projects.

### New Concepts and Ideas

The book introduces several new and not-so-new concepts and several well-established technologies. Many design concepts and products in this industry are still going through evolutionary changes and have not fully gelled. I have given significant substance to the idea of mobile-aware application design and the mobile computing server/switch and have done so to encourage readers to use my ideas to crystallize their own, and thus to formulate them into functional products and applications systems. I also encourage readers to investigate the client-agent-server concept in mobile computing.

### Intentional Repetition

The reader will encounter a certain amount of repetition in different chapters. This is intentional for two reasons. First, it keeps the subject matter together and avoids repeated references to different parts of the book. Second, information has been repeated, where appropriate, in order to emphasize its importance.

### Feedback on the Book

Obviously, as mobile computing technology evolves, the information in this book will have to be updated. As well, in spite of the efforts of the editorial staff, errors may creep into the final copy, or perhaps certain statements will be challenged by experts and specialists. Whatever the reason, I would like to receive your comments, feedback, and corrections. My e-mail address is cdhawan@mobileinfo.com; my telephone number is (905) 881-9070, and my fax number is (905) 881-3589.

I hope this book meets its objective of being comprehensive and that it meets your information needs.

Special thanks go to my lovely daughter, Priya, who did most of the graphics work for the book. She became an expert in Microsoft Powerpoint, and it is her work that stands out more than my writing.

Thanks also to Nicholas Stephens, my Toronto editor, who cleaned up the grammar and improved the structure of my sentences. He refused to allow my impatience with the subtleties of English grammar to show through in the manuscript.

Thank you, Priya and Nicholas.

To the editorial and production staff at McGraw-Hill, who converted my manuscript into a finished product, I want to say, "Thank you for your patience, understanding, and efforts in producing this book." Christina Palaia of North Market Street Graphics was meticulous and thorough in editing my manuscript to meet McGraw-Hill standards.

Finally, special thanks go to my ever optimistic and confident wife, Bina, and my very bright elder daughter, Sonia, who is currently doing her Ph.D. thesis and appreciates how tough it is to write a handbook on an emerging technology.

Although my family thought I was crazy to sit in front of my PC late into the night, only to rise with the sun for more creative writing, they nevertheless held on to the belief that the end result was worth the effort.

*Chander Dhawan*

# Information Update Service

Mobile computing technology is changing rapidly. New technology concepts, networks, and products are being introduced on a regular basis. Many existing technologies are becoming obsolete. While we have tried to give you the latest information when the book went to print, some may become obsolete by the time you purchase the book. This cannot be avoided since publishing a book is a long process involving many organizations, and the technology changes during this time lag. We feel that there is a need to update information in this book on an interim basis before a new revision of the book is published.

In the past this was not feasible and the only mechanism was a formal revision—another long process. Now the Internet offers a mechanism to update this information quite easily. This hybrid combination that updates information in the book with a service on the Internet will make our book unique because it marries an old, traditional form of information delivery with the latest and most modern form of information update.

We are offering to put up an interim book update on the Internet during 1997. The details for this update mechanism are being worked out as we go to print. We shall make this information available at www.mobileinfo.com to those who send in a request to the author through fax or Internet e-mail. Please note that this update will be interim and limited to essential changes and corrections, if any. It will not replace the need for a comprehensive revision to the book in the future.

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# Introduction

## What Is Mobile Computing?

Mobile computing is the discipline of creating business solutions using computers and telecommunications to allow users to work away from the fixed facilities where they normally operate. Mobile computing conveys many different visions to people. Besides mobility and remote computing, it often implies dial-up, ISDN, or wireless networks, pen-based applications, notebooks, handheld computers, PDAs, communications servers, and, of course, the users on the go. But more than anything else, it conveys the untethering of the network users.

Mobile computing solutions cover a variety of applications—occasionally connected to continuously connected, small-scale to large-scale, simple to complex, and single-application to multiapplication. The focus here is on the requirements of larger organizations with hundreds or thousands of potential users who require access to several applications on more than one platform under a multitier technology architecture. This is where the need for systems integration knowledge, skills, and know-how is the greatest. This is also where mobility, accessibility to the corporate information, and value of integrated mobile computing solutions are high, as is shown in Fig. I.1.

## The Hype and Reality of Mobile Computing

With notebook computers selling in ever increasing numbers and cellular telephone usage growing at a compound rate of 20 percent per year, mobile computing has been hailed as a hot new technology that will significantly change the way in which we conduct both work and non-work-related activities. It stands to reason that providing a salesperson with a notebook equipped with a modem and a cellular telephone makes that salesperson more mobile; or that giving a dial-up connection to a telecommuter with a desktop PC or Macintosh computer at home (or at the cottage) makes that worker more accessible. Equipping service representatives with two-way pagers, or installing

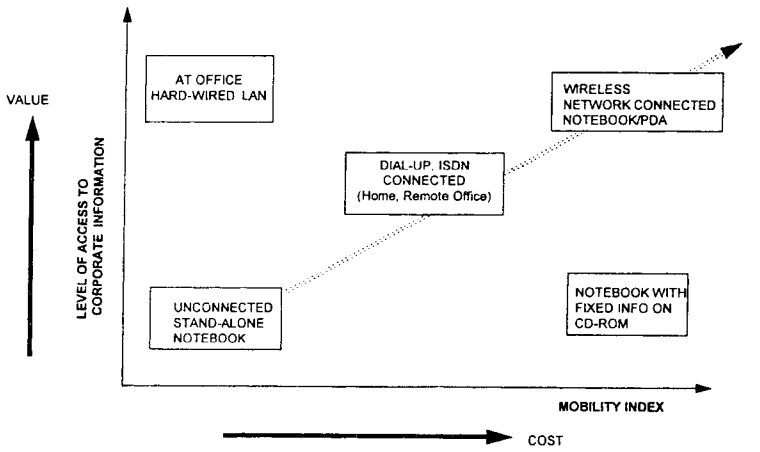


**Figure I.1** Relationship of mobility with level of information access.

ruggedized notebooks in service vehicles, are yet other mobile computing implementations. Recognizing this, many computer trade magazines, *PC Week* and *Communications Week* to name just two, have introduced exclusive feature sections on mobile computing and remote network access. Specialized wireless network equipment suppliers like Motorola, and service providers such as RAM and ARDIS, are investing billions of dollars in their network infrastructure.

Early adopters of mobile computing, UPS and Federal Express among them, have already demonstrated the potential of the technology. The competitive advantages they have gained as a result of incorporating mobile computing solutions in their strategic business plans are now leading other businesses to launch pilot schemes based on wireless network connections. Coca Cola's automated sales route undertaking is one such example.

It is not surprising, then, that research findings from firms like IDC, BIS Strategic Decisions, and Infonetics indicate a significant growth potential for mobile computing, and that vendor marketing executives, encouraged by these findings, are urging the user community to take advantage of the growing availability of reliable, high-capacity/wide-coverage public wireless networks to start implementing solutions.

Yet, despite all this, penetration of mobile computing as a mainstream technology into organizations has fallen behind most industry forecasts. There are many reasons, which we will explore in detail in

Part 6 of this book. Suffice it to say here that any complex emerging technology must pay its dues in order to become mainstream—a process that includes conducting field trials and working with early technology adopters to iron out bugs and generally assuming a leadership role. Mobile computing is no exception to this rule.

*While we are of the opinion that business forecasts quoted in the trade press indicate general trends only, rather than specific rates of growth, it nevertheless does appear to us that the time for planning the implementation of mobile computing solutions by the user community has come.*

There are several reasons for our assertion. These reasons can be classified into six categories:

- Business factors
- Economic justification of mobile computing solutions through business process reengineering
- Hardware and software technology affordability
- Wireless and wire-line network infrastructure availability
- Emergence of ready-to-implement applications
- Remote-access industry readiness

### Business factors

The following important business factors are having an impact on mobile computing:

- *Societal shifts toward a more mobile work force.* Human beings have always wanted to be mobile. However, we also have always wanted to communicate effectively with each other when necessary. Increasingly, we are spending more time away from our homes and are traveling greater distances from our offices to conduct business. Thirty-three million North Americans (and almost twice as many as that in the rest of the developed world) are estimated to travel regularly as part of their job. Included are salespeople, service representatives, business professionals, and remote workers in the field, at satellite offices, and on project sites.
- *Customer demand for superior service.* In an increasingly competitive world, customers are demanding more concise information and superior service from salespeople and service representatives. Equipping employees with mobile computing workstations that connect them to corporate resources is an effective way to achieve this.
- *Global competition from developing countries.* Because of lower costs from developing countries, industry in developed countries

must cut costs at the same time as it provides superior service. Every cost factor, especially sales and administration overhead, is being scrutinized to achieve this goal.

#### Economic justification through business process reengineering

Innovation-driven companies such as UPS and Federal Express have demonstrated that mobile computing can be an important factor in the elimination or reengineering of many business processes. Other organizations are also benefiting from sales automation via mobile computing. Economic justification through formal business case preparation has started.

#### Hardware and software technology affordability

These business factors herald profound changes and are creating a large demand for tools and technologies that can make workers more productive and more creative while away from their desks. With advances in end-user devices (notebooks, PDAs, and palmpads), implementation of electronic communication networks (wired and wireless), and availability of shrink-wrapped business applications, industry players are starting to bring forth technologies that can satisfy business needs at affordable price points.

#### Wireless network infrastructure availability

Billions of dollars have been invested during the past five years and significant investments are still being made to establish a comprehensive coast-to-coast wireless network infrastructure in North America, Europe, and Japan in support of mobile applications. Remote network access through switched network services such as ISDN and frame relay are moving at an ever accelerating pace. On a global scale, satellite technology offers the best potential for a wireless network infrastructure. Several such projects are being implemented.

#### Gradual appearance of ready-to-implement applications

Many new business applications are being engineered from scratch. Existing applications are being upgraded to support mobile access. Most commercial e-mail applications now have a mobile client component. Paging enhancements based on two-way paging are moving ahead, eliminating the need for office callbacks.

### Remote-access industry creating demands for true mobility

The remote access industry is satisfying the basic needs of mobile workers to be able to communicate from home and from other off-site locations through PSTN, ISDN, and frame relay. Once users have tasted this technology, they tend to want to advance to the true mobility of a wireless network. As this demand builds, designers of mobile applications will be forced to develop "mobile-aware" versions of existing and future applications—applications that will use wireless bandwidth efficiently.

## Is the Industry Ready to Meet the Challenge?

There still are several obstacles to the implementation of mobile computing solutions, however. In Chap. 19, we shall review the reasons why mobile computing is being held back. Here, we shall explore only one reason.

While individual vendors are gearing up to support their own products, there are not enough third-party systems integration experts trained in multivendor solutions especially for enterprisewide deployment. Education by the seminar industry has begun, but formal and structured education processes have not yet started. Necessary educational resources in the form of books on the subject are not available for systems integrators or implementers. *The key objective of this book is to begin to address this important need.* We hope that this book will assist the adopters of mobile computing by giving them a comprehensive understanding of the business applications, technology components, and planning considerations for mobile computing solutions.

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