1 Introduction

If we look at the progress made by *Homo sapiens* over the past 1000 years, the past 100 years have had more impact on us than the rest of the centuries combined. The breathtaking pace of advances in various fields of technology has transformed the human landscape. As we move into the twentyfirst century, the impact of *wireless technologies and globalization* will have a profound effect on the way we interact culturally, socially and intellectually across geopolitical boundaries.

The new millennium will continue the feverish pace of globalization, and bring its denizens closer to each other than ever before. One of the critical factors at the heart of this revolution is mobility; both wireless voice and data technologies will continue to enhance our daily lives and help transform the business and consumer market place over the course of next several decades. The global community continues to embrace wireless applications and services and globalization, irrespective of region, gender, culture, or age. This trend is not limited to human beings; even machines are exchanging information wirelessly.

The recent explosive development of wireless technology has contributed not only to the acceleration of globalization of the world economy, but has also changed our lifestyles. Conversely, the rapid globalization of the world has also made a great impact on the wireless industry. For wireless engineers like Chetan Sharma and Yasuhisa Nakamura, the present authors, physical borders mean nothing. Everyday, a new wireless device is being introduced and a new service starts somewhere in the world. This is especially true with the introduction of global third-generation (3G) standards serving as a great catalyst in establishing borderless global markets and greater service commonality of wireless services across regions.

When Yasuhisa Nakamura was a 10-year-old elementary school student, he was taken to a movie theater in Yokohama, Japan, by his father to watch the movie *2001: A Space Odyssey* by Stanley Kubrick. At that time, he understood almost nothing about the essential message of the movie. As he grew up, he watched the movie repeatedly and discovered many of its messages along the way. In this movie, we can find a full line-up of advanced wireless technologies such as smart antenna, voice recognition, video phone and data communications, etc. Most of the products and technology

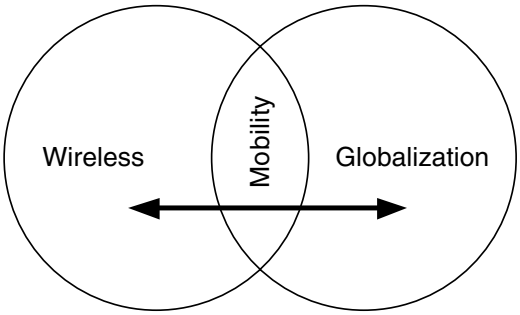

Figure 1.1. Relationship of the wireless industry with globalization.

shown in the movie are already available (3G, voice recognition, broadband access and biometrics). In most cases, we have actually done better. This shows how the progress in wireless technology keeps on exceeding the imagination of human beings.

Nobody can ignore the globalization of the world. Economical activities and lifestyles are becoming borderless in spite of cultural differences and physical boundaries. It often happens that a Japanese singer becomes a superstar in Hong Kong after a single performance. This is true for economical activity as well. We can not forget the tragic events of 11th September 2001 in New York, Washington, DC, and Pennsylvania, which had a serious impact on the global economy. A situation in one part of the world can have a tremendous effect thousands of miles away. Industries such as banking, tourism and manufacturing are closely knit across continents. The world is becoming a smaller place every day.

As briefly mentioned before, one of the fundamental threads that tie wireless and globalization together is mobility. Wireless access enables the mobility of the end-users and services. Globalization can not be achieved without mobility of information and human activities. Mobility is a unique function of the wireless system that no wired system can enjoy. Wireless systems accelerate the mobility, and mobility in turns accelerates globalization. Mobility bridges wireless and globalization, which makes it a win–win relationship (Figure 1.1).

As we take a deeper look at the wireless industry, the growth in usage and popularity of mobile phones has just been phenomenal. By the time this book is published it is estimated that there will be over 1.3 billion mobile subscribers (2 billion by 2006) around the world. That is just astonishing. Another fact that is often overlooked is that wireless technologies have progressed differently in Asia, Europe and North America. Technologies such as i-mode in Japan, SMS in Europe, PDAs (personal digital assistants) and Blackberry in North America point us to the fact that wireless applications and services are unique to the culture and business models of a region. When thinking about transferring successes and learning lessons, one must consider the effects of globalization on wireless communications and vice versa. This is one of the focus areas for this book. We will look at various wireless technologies impacting

on the businesses and consumers alike, various business models of different players in the value chain, and the effect of globalization on wireless and vice versa. This book takes a deeper look into why certain technologies, business models and adoption strategies succeed whereas others fail, and how all these elements will impact on the future of wireless communications. With the help of examples, case studies and interviews with industry luminaries, we will learn some lessons and derive some conclusions and recommendations. Books often concentrate only on technology, but technology is only part of the picture. By looking at different business models and cultural nuances around various geographies, we hope to provide a complete picture that will benefit the planners and implementers around the world.

1.1 Progress in wireless technology

Since the early 1980s, when brick-size mobile phones were introduced on analog networks, we have come a long way. Today an average cell-phone weighs less than 100 oz., has a rich graphical user interface, the processing power of a desktop computer, and is loaded with features that a few years ago seemed possible only in fiction movies. With the advent of 3G services like FOMA (Freedom of Mobile multimedia Access) in Japan and around the world, we are looking at broadband networks able to support video streaming, voice recognition, international roaming, high-resolution GUI, and much more. We have not only made significant strides in wireless WAN (wide area network) technologies, but also in wireless LAN (local area network) with IEEE 802.11 or Wi-Fi and wireless PAN (personal area network) with Bluetooth, UltraWideBand, HomeRF and RFID (radio frequency identification) tag technologies.

An almost unprecedented adoption of wireless devices has led to the growth and popularity of wireless applications and services over the past decade. Just as the Internet enabled legacy systems to be linked to and accessed from the Web and led the e-business revolution; access to information anytime, anywhere using wireless devices such as mobile phones, PDAs, autoPCs, Kiosks, etc., is enabling the next phase in pervasive computing – the mCommerce, or mobile commerce, revolution. The wireless applications and services enable consumers and enterprises to access information via their hand-held devices such as palm or pocket PCs or WAP phones, thus empowering the individual.

Advances in technologies in wireless and computing are energizing the vision of making Internet device independence a reality. No longer must we be shackled to our desktops to access information. It is now possible to access that same information from an endless number of devices – PDAs, palmtops, smart phones, landline phones, TVs, elevator kiosks, airline entertainment seats, pagers, autoPCs, gameboys, refrigerators, exercise machine screens and video phones.

Also, the convergence of the computing and communications industries has rapidly blurred the lines between the devices produced by each industry. Phones and PDAs now possess the power and sophistication of desktops. This, coupled with an astonishing surge in mobile subscribers worldwide, is fueling the tremendous momentum of a world without wires. Players in all industries seek ways to lever the wireless Internet phenomenon to reinvent themselves and extend their reach to customers, partners and opportunities. Those who do not will risk being obliterated by competitors.

Advances in wireless technologies are redefining the existing Internet model and its services. Technologies such as WAP (wireless application protocol) are bringing Internet e-commerce closer to the mobile world. A bank that extended its operations arm to provide services over the Internet now provides access to user data and services over the air. The bank uses WAP-based applications, essentially putting its services at consumers' fingertips. As e-commerce vendors connect their warehouses to these wireless devices, they provide continual, anywhere service.

Leaders in all major industry segments are participating in trials and launching experimental services to learn, and adapt to, customer behavior and worldwide market opportunities. Sample applications include trading stocks; checking weather, news, and traffic conditions; buying books, running auctions, providing location-based customized information and playing games – all while being mobile.

1.2 The business model and global wireless competition

Like other global industries such as finance, manufacturing and information technology (IT), the wireless telecommunication industry is also facing intensive global competition. Cellular terminal vendors such as Nokia, Motorola and Panasonic have global strategies to increase their market share. International wireless operators such as Vodafone and NTT DoCoMo are trying to get as many customers as possible, through acquisitions and strategic alliances, because they know that the key issue to win the game is the scale of merit and service commonality in the global market.

Presently, there seem to be two fundamental business strategies in this endless war. One is to increase profit per end-user (consumer and corporate) by adding new values to the existing services. A typical example of such a strategy is to integrate wireless and Internet to introduce new revenue streams by adding new applications and services. The unprecedented success of i-mode by DoCoMo is a typical example of such wireless Internet integration. Before i-mode, there was no real business model for wireless Internet; however, after i-mode DoCoMo enjoyed an increase in ARPU (average revenue per user) in spite of the extreme disappointment of WAP in Europe and North America.

Another strategy is to enjoy the scale of merit, since the greater the market becomes, the less is the cost for operations and the price of product. Vodafone and Nokia are typical promoters of this strategy. By the end of 2001, the Vodafone group had extended its reach to 28 countries and by mid-2002 the total number of subscribers to this group exceeded 91 million, which is twice as many as DoCoMo. Based on this huge number of subscribers and its footprint in the world, Vodafone is increasing its sales every year.

Unlike the PC software or aircraft manufacturing markets, where Microsoft and Boeing pretty much own the market, there are no dominant winners in global cellular competition at present. Neither Vodafone nor DoCoMo have established a stable position and there are many challengers every day. This represents a very attractive opportunity for ambitious entrepreneurs and also for existing wireless players in the global arena. Telecommunications players and Internet business players are trying to catch this huge potential market.

In this book, we will carefully study the various business models (both successes and failures) and give the reader some insights. We will also take an in-depth look into the success of i-mode in Japan and see what lessons can be drawn from the experience.

1.3 Cross-cultural challenges

We will always face cross-cultural challenges in the process of globalization of any kind of business. The development of wireless business is no exception. These challenges often come from the difference in business customs, languages, cultural behavior and also life-style.

In the USA, almost 60–70% of the total voice traffic of the cellular service is placed or received in a vehicle, which is very different from the cell-phone usage trends in Asia. In Japan and in several European countries, the train is the most convenient form of transport, so while commuting the consumers use that time to place or receive calls or to play games or check news on their cell-phones. The language poses significant localization and transcoding challenges for service providers. One Chinese or Japanese-Kanji character has multiple meanings. A sentence of 15 Kanji characters may have the same meaning as a sentence of 50 Roman alphabet characters. This affects the design of display of cell-phone terminals as well as the applications and services (see Figure 1.2).

The high penetration rates of Internet-enabled desktop PCs into residential homes in the USA exceed the rest of the world by several orders of magnitude. For most consumers in other countries, their first (and may be only) interaction with the Internet is via their wireless devices.

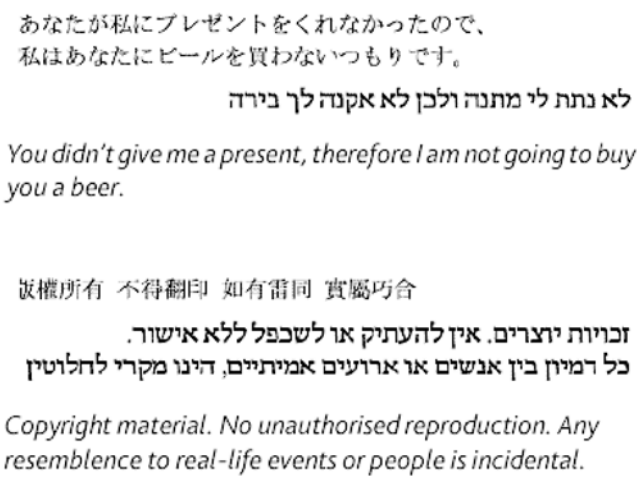

Figure 1.2. Internationalization – intelligent translation is more than word-for-word (top); layout and real-estate can be markedly different (bottom) (source: *BT Technology Journal*, 2002).

These are just a few examples. To promote a wireless project across the continents, careful investigation is needed into what the respective market wants. This approach is similar to that of PC software products. Newly developed PC software is carefully localized, including the human interface aspects, for each respective country in order to satisfy the demand of the market.

In spite of cultural differences across the world, the explosion in the increase of the number of cell-phones is a common phenomenon. In 2001, China became the country with the largest number of cellular subscribers. A similar explosion is happening in other Asian and South American countries. Many young people walk along Ipanema beach in Rio de Janeiro, Brazil, talking with cell-phones. This scene is as common as it is in New York, Beijing or Paris.

1.4 What makes this book unique?

This book aims to take a wider view of evolution of wireless[1] services around the world. We look at its impact on society from three critical angles: *technology innovation, business models, and cultural nuances that characterize global markets.* We believe that only by taking these three aspects into consideration can any business strategy, application or service become successful and truly global. We study the impact of globalization on the wireless industry and how it keeps shaping the industry's future

[1] In this book, we are going to be mostly talking about wireless data related technologies and business models. Unless otherwise stated, wireless refers to wireless data (and wireless Internet).

by analyzing the effect of global markets on key business sectors such as operators, equipment manufacturers, and the computing industry. To follow up on our global view theme, we take a deeper look at the trends across various important geographical areas such as the USA, South America, Japan, South Korea, China and Europe. We discuss the various computing and communications technologies that are of great interest to the industry, and also those that are going to pave the way for new exciting applications and services. A large portion of the book is dedicated to understanding and discussing the business side of running a wireless business, whether you are dedicated 100% to it or just 10%. We do this by analyzing the wireless value chain in detail and discussing the business models adopted by players in different segments of the chain, and by looking at what has worked and what has not. No wireless Internet discussion is complete without the inclusion of the growth and impact of i-mode on the industry. In various sections throughout the book we draw upon the lessons learned and dispel some i-mode myths on the way.

Another important aspect of the book is the case studies and executive interviews. The examples and views presented and argued represent a wide spectrum of thoughts and ideas as to how to empower the end-user with more information and functionality. The executives represent some of the most accomplished players in various segments of the value chain and should provide the reader with a unique collection of perspectives. They share their knowledge and perspective on the future of the wireless industry, applications, wireless devices, 3G, the international landscape, regulatory issues and much more.

Finally, we look at the future of wireless technologies, applications and services, and draw upon the lessons learned in taking an educated guess about what is to come in the future. Our aim has been to provide a perspective of the industry from all angles to help the reader understand the complexities, vagaries and opportunities that wireless applications and services present.

We believe that by taking the broad view of the wireless industry, we offer valuable insights to a wide spectrum of readers around the world.

1.5 How is the book organized?

Wireless Data Services is organized into 14 chapters, including this Introduction, as well as suggestions for further reading. As with any technology, to build wireless applications and services successfully, one needs to understand the market trends, history, supporting technologies and the industry in general. We have tried to cover all of these areas to give the reader a good understanding of the wireless space in the context of technology, business models and global markets. The chapters of the book are organized as follows.

Chapter 2 The impact of globalization

This chapter looks at the impact of globalization on the wireless industry and vice versa.

Chapter 3 Adoption trends and analysis by region

In this chapter, we will look at the adoption trends across various regions around the world. We will take a look at the USA, South America, Japan, South Korea, China, Hong Kong and Europe. In addition we will analyze the affect of wireless data on different business sectors such as the telecommunications industry, equipment manufacturers, and the computing industry.

Chapter 4 Subscriber needs and expectations

We will discuss the needs and expectations of consumers when it comes to using wireless data on a daily basis – whether it is for personal or business applications.

Chapter 5 The wireless value chain

In this chapter we discuss the wireless value chain in some detail.

Chapter 6: Global wireless technologies: systems and architecture

The wireless technology ecosystem will be discussed in more detail. As will become obvious from the discussion, with the convergence of the communications and computing industries, the wireless industry is becoming more dynamic and the value chain is becoming more extended and vibrant. We have divided the discussion into systems and architectures where we talk about various network architectures (2G–3G) and device technology. We will also look at various WAN, LAN, PAN, IP and related technologies.

Chapter 7 Global wireless technologies: network, access, and software

In this chapter we look at how network, access, and software technologies are changing the face of the industry.

Chapter 8 Business models and strategies

In this chapter we will discuss in more detail the various business models being adopted. We will also take a deeper look at i-mode, the most successful wireless Internet service to date.

Chapter 9 Business issues and challenges

This chapter will focus on business issues. Although some industries have some common idiosyncrasies, the wireless industry is unique and sometimes issues and problems are specific to a region or country. For instance, spectrum (which we will discuss later) is squarely an issue for the USA, while their counterparts in Japan do not encounter such problems, and 3G spectrum auctions are driving many carriers out of business in Europe. While Europe and Japan are approaching saturation in the consumer market, the US market is largely untapped.

Chapter 10 Technology issues and and challenges

This chapter will address some of the challenges in the technology arena.

Chapter 11 Case studies

So far we have talked about the wireless industry – its peculiarities, the challenges and issues with business and technologies, case studies and where

the industry is heading. In this chapter we will look at some case studies that show how companies have adopted wireless to solve problems, enhance their business and become more efficient.

Chapter 12 Perspectives

For this chapter, we sat down with several industry leaders belonging to different parts of the value chain, operating in various parts of the world, and with people who have been around the industry for a long time and witnessed the trials and tribulations of the wireless sector over the years:

1. Steve Wood, CEO, Wireless Services Corporation
2. Mark Tapling, CEO, Everypath
3. Mark Anderson, President and Editor, SNS
4. Jon Prial, VP Pervasive Computing, IBM
5. Frank Yester, VP Motorola Labs, Motorola.

This chapter presents our one-on-one discussions with them on the case studies, various aspects of the industry, their own organizations, and where they see wireless industry in the future.

Chapter 13 Future of wireless technologies, applications and services

This chapter aims to focus on the discussion of future of wireless technologies, applications and services in the twentyfirst century. In Chapter 10, we discussed some of the technology issues and challenges for the industry. In this chapter we will continue the discussion on evolution and challenges of wireless technology in the context of the next 5–10 years.

Chapter 14 Conclusions and recommendations

Finally, we leave the reader with our thoughts on how the industry might evolve under various scenarios and what the future might be like a decade from now.

References and further readings

For those of you interested in further exploring some of the topics discussed in this book, we have included a detailed list of references and web links at the end of the book.

1.6 Who should read this book?

Anyone who is interested in learning about the wireless market and its future will find this book helpful. This book is aimed at the following readership.

(a) Corporate technical managers around the world who are responsible for understanding and implementing wireless data solutions. These people are from different segments of the wireless value chain, from handset manufacturers to carriers to content providers.

(b) Marketing, sales and other non-technical staff members. Successful technologies, applications or services generally do not translate well across geographies unless

attention is paid to business models and cultural nuances. Marketing and sales executives need to understand this the most.

There are many books focusing on wireless technology and how it works and how one should be using it, but rarely do the discussions on *why* go into any detail. If one can't answer the why (should it be used?) of technology, something is wrong with the picture. Technology for technology's sake does not work very well, we have all witnessed that. It is the "value proposition", it is the "what's in it for me" question, that makes or breaks the solution offering. Although we delve into technical issues and discussion, this is mostly a business book about wireless technology, applications and services. We strive to answer the question: *why should you care about wireless data technologies?*

The salient features of this book are as follows.

- A review of various wireless WAN, LAN, PAN related and upcoming technologies.
- A discussion of globalization and its impact on the wireless industry.
- The strategy behind i-mode's success in Japan and lessons drawn.
- A look at various business models for players across the value chain.
- The transfer of technology issues and business models across borders.
- An analysis of successes and failures in the wireless industry.
- The convergence of the computing and communications industries.
- A discussion of the wireless Internet value chain.
- A preview of next-generation (3G and beyond) wireless technologies.
- The strategies for 2.5/3G and beyond.
- A detailed discussion of issues and challenges of the wireless data industry.
- Detailed case studies: consumer and enterprise.
- Interviews with industry executives and experts from IBM, Motorola, and others.
- Insights from professionals who have built systems and implemented technologies around the world.

1.7 Summary

Former Canadian English-literature scholar Marshall Mcluhan once said "the world will become a Global Village" and predicted the arrival of new social systems. He also said "Electronic media will make it happen". The development of electronic media, especially wireless technology, has helped support the new social systems. The broadband wireless networks around us will soon become an "air-like" infrastructure, which we will just use subconsciously. We will not be conscious of the charge, location, time or sometimes even the device, but we will enjoy high-speed integrated broadband services under ubiquitous networks. As time goes by, more and more people will become acclimatized to the omnipresent wireless infrastructure and environment, and the physical boundaries will be less clear. Some may become