Strategies and Scenarios for Wireless Information Services

by

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Abstract

This thesis investigates the emerging market for wireless information services caused by the convergence of Internet, information and telecommunication technologies. Portals and content and application providers are now entering a market previously controlled and dominated by the wireless network providers.

This thesis starts with a description of this new value chain and a discussion of the power of each of the participants. This is followed by an overview of the market size and the projections for the future, together with a description of services currently available around the world and associated business models. A case study on wireless financial services follows next, to illustrate what might happen and be available in other industries in the near future.

I developed three scenarios for the wireless Internet services the next three years:

• A closed case:	The Wireless Network As A Toll Road
• Status quo:	Internet and Commerce Without Wires, Why The Hype?
• An open case:	New Unique and Value-added Offerings Create New Markets

I used interviews with leading industry expert to validate these scenarios. There was a general consensus among the experts and managers that my most optimistic and pessimistic scenarios represent the likely range of possible future outcomes. The majority believes we will move from the current closed (i.e. the pessimistic) case to the open model (i.e. the optimistic scenario) ending up somewhere close to the open case. The experts believed that the open model would eventually "win" due to technical improvements and competitive pressure.

Based on this, I arrived at ten strategies for successful market penetration of wireless information services. The top three are; act quickly to gain first-mover advantages, enter into profit sharing because this is a complex and networked marketplace, and thirdly address unspoken and subtle needs. The main challenges facing the players in this market are:

- They have to share the ownership and responsibility of the customer experience
- The need for developing open standards together to fuel the growth of the market
- That the timing of the products and services must be right the first time

Thesis Supervisor: Henry Birdseye Weil
Senior Lecturer

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1 Introduction

1.1 The Brave New World or Clever Hype?

There is currently a lot of interest in how emerging wireless network technologies, new handheld devices and standards like Bluetooth and WAP will deliver the Internet to wireless devices and open up a new era of wireless commerce. The market potential is however hard to estimate because the customer have no intimate knowledge of the products and services in the pipeline. Will the phone be the terminal of choice in the mobile information society or continue to be a tool mainly for voice communication and messages?

The goal of this thesis is to investigate how the new technology, standards and infrastructure creates new market opportunities and redistribute the power among the different players. I will subsequently develop scenarios anticipating possible industry and market trends. Based on this, I will suggest the most sustainable strategies for this marketplace.

Due to time and space constraints, I will limit the analysis to the likely development the next three years. I will use wireless financial services as a case study on types of services that will evolve. The bulk of the work was performed during the spring of 2000.

1.2 Definitions

Throughout this document I use the term '**wireless information services**' frequently. I use this term for offerings other than pure voice and data communication over wireless networks.

However, the terms '**wireless data services**' and '**wireless applications**' are more often used in the US even though the word information would be more correct from a semantic point of view, since we are talking about services based on interpretation and processing of data. Increasingly we see that '**mobile Internet**' or '**wireless Internet**' services being used to describe these types of services. I will use all these terms interchangeably throughout this document to vary the language.

Wireless or **mobile commerce** are also terms growing in popularity. In this document, I use the term wireless/mobile commerce for a subset of information services. I subdivide information services into content, applications and commerce. However, the distinctions between these are becoming more and more blurred and the different types are often combined in the services currently being offered.

1.3 Terminology

I will use the word "**wireless device**" as a general term for any gadget connected to a wireless network. My use of the term '**handset**' refers to a wireless digital or analog telephone or telephone-like device. Similarly, a '**handset manufacturer**' is a company such as Nokia, Ericsson, or Motorola who makes the handsets.

I use the term '**handheld**' to refer to PDAs (Personal Digital Assistants) such as Palm's palm pilot products, Psion's model range or Handspring's Visor and to a handheld or palmtop computer like the Windows CE devices from Casio and Hewlett-Packard (HP). The term '**carrier**', '**access provider**' or '**network provider**' refers to a regional or national wireless network access provider.

Generation	Name	Technology	Bandwidth	Features
First	**NMT**	Nordic Mobile Telephony	9.6 (Kbps)	• Analog voice service • No data capabilities
Second	**GSM**	**Global System for Mobile Communication**	**9.6-14.4**	**• Digital voice service • Advanced messaging • Global roaming • Circuit-switched data**
	HSCSD	**High-Speed Circuit Switched Data**	**9.6-57.6**	**• Extension of GSM • Higher data speeds**
	GPRS	**General Packet Radio Service**	**9.6-115**	**• Extension of GSM • Always-on connectivity • Packet-switched data**
	EDGE	**Enhanced Data Rate for GSM Evolution**	**64-384**	**• Extension of GSM • Always-on connectivity • Faster than GPRS**
Third	**UMTS**	Universal Mobile Telecommunications System	64-2,048	• Always-on connectivity • Global roaming • IP-enabled
Other	**Bluetooth**	*Modified from Forrester Research*	**721**	**• Short-range wireless connectivity between networks and devices**

Figure 1 GSM Network Generations and Features

This industry seems to love acronyms and this will easily confuse the newcomer. A dictionary of term can be found at http://www.wirelessweek.com/industry/terms.htm. An **ISP** is an Internet Service Provider, while an **ASP** is an Application Service Provider. **IP** stands for Internet Protocol, while **WAP** is short for Wireless Application Protocol, a standard established to enable Internet-like services and applications on wireless networks and devices.

The figure above gives an overview of the different network generations, technologies, bandwidths and enabled services. First generation (**1G**) network is used for analog wireless voice communication, second generation (**2G**) is the most common network type today applying digital technology to transmit voice and data. Different techniques like **EDGE** and **GPRS** can improve the current 2G networks and this is often called a **2.5G** network.

A wireless network consists of a net of **cells**, each with a **tower** equipped with antennas and a **base unit**. The base unit is a collection of switches and routers together with computers, software and power systems. Messages are transported from the phone via radio waves to the nearest cell tower. From the tower the message is transmitted either via radio signals to the next tower or via fixed lines or microwave links between the base units and **switching centers**.

There are two main modes of wireless communication, circuit-switched and packet-switched. **Circuit-switched** means that a closed circuit connection is maintained between the

sender and receiver, this is OK for voice communication, but a waste of network capacity for data communication. **Packet-switched** means that data is sent in packets and that the device can remain connected to the network continuously using very little of precious network capacity.

The frequency spectrum is limited so different ways of communicating (TV, Radio, wireless etc.) have been assigned different parts of the spectrum. In addition, with one wireless cell, there will normally be more than one mobile phone trying to connect to the network. So to prevent chaos the frequencies spectrum has to be divided to allow for many simultaneous conversations. There is three different ways of doing this and this is partly the reason for the different network standards around the world.

FDMA (Frequency Division Multiple Access) means that the spectrum is divided up according to frequency, analog to having many people gathered in one room talking in different frequencies. Another method used in **GSM** networks is **TDMA** (Time Division Multiple Access) analog to having people in a room speak in turns. The other method, popular in USA, is **CDMA** (Code Division Multiple Access) analog to having people speaking in different languages.

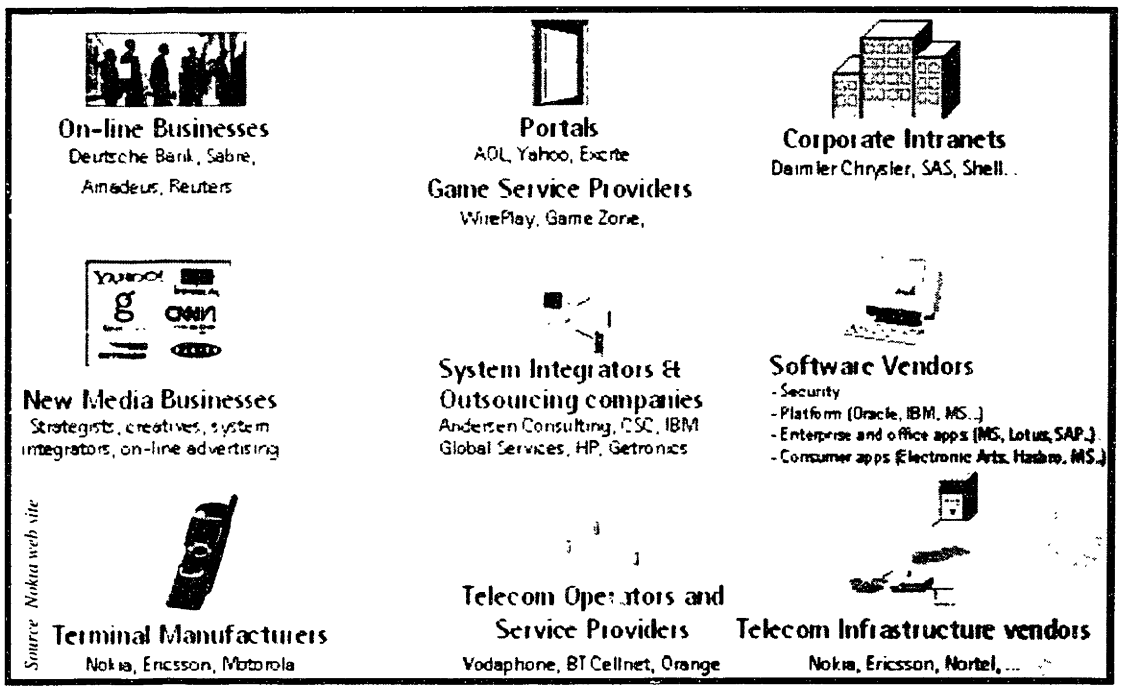


Figure 2 Overview of the Wireless Industry

Most people in the industry hope that the involved governments and the industry can agree on one standard, as it would reduce the cost of deploying the new networks and handsets. The standard for the third generation (**3G**) network has not been settled yet, but it looks like it will be a high speed, packet-switched network compliant both with TDMA and CDMA. The 3G network is also commonly referred to as the **UTMS**, Universal Mobile Telecommunications System.

1.4 The Break-up the Value Chain creates Opportunities

A few years ago, wireless communication was a simple and profitable market. The network providers controlled the whole value chain. They built the infrastructure, sold you the cellular phone and gave you the opportunity to talk to anyone, anytime and anywhere.

Then, about five years ago, applications like voice-mail, the possibility to send and receive faxes and short messages added value to the communication service and introduced new players like providers of financial news into the value chain.

The advent of the wireless Internet due to new technology, devices and standards opens up the playing field even more. The new technology enables new entrants to offer their Internet services to any mobile phone user. However, the question is whether the content and application providers will be able to offer this to every mobile phone owner or if they have to partner with the network operators to get access to their user base.

As competition increases and voice call revenues decline, the wireless carriers need to obtain new revenues and retain their present customers. They therefore face the choice of creating these services themselves, acquire them or lending out their infrastructure (bit pipe) and customer base to the content and service providers.

The value chain becomes more complex and gives rise to a new set of strategies and business models and dilemmas like who owns the customer? However, it also creates new opportunities.

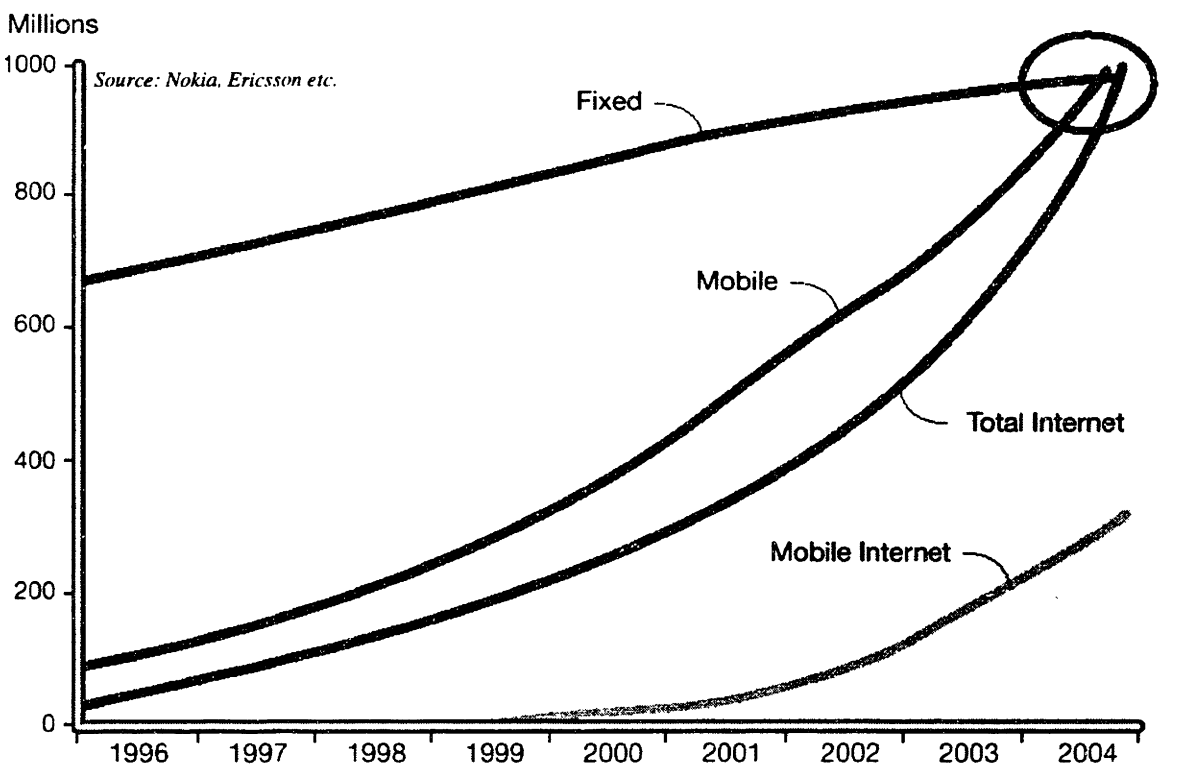


Figure 3 Estimates for Growth of Subscribers of Internet and Telephony

1.5 Fundamental Trends

The market for wireless information services is quite complex and uncertain, both because of the large number of players, but also because of the dynamic evolution. We are clearly at the start of a diffusion curve because of the lack of a dominant design (here used in a broad sense, not only for devices or technology alone) and standards for the different services and products. A hectic merger and acquisition activity and an increasing stream of new alliances add to the complexity. The trends driving the market can be divided into business, technology, government and sociological trends.

1.5.1 The Growth of the Internet

The Internet has emerged as a global communications medium enabling millions of people to share information and conduct business electronically. The dramatic growth in the number of business and consumer Internet users has led to a proliferation of useful information and services on the Internet, including email, news, electronic commerce, educational and entertainment applications, and a multitude of other value-added services. As a result, the Internet has become a primary and ubiquitous daily resource for millions of people.

1.5.2 The Growth of Wireless Telecommunications

Worldwide use of wireless telecommunications has grown rapidly as cellular and other emerging wireless communications services have become more widely available and affordable for the mass business and consumer markets. Advances in technology, changes in telecommunications regulations and the allocation and licensing of additional radio spectrum have contributed to this growth worldwide. There are now more mobile phones than PCs and the number is growing fast, the number of cellular phones are expected to reach 1 billion by 2003 according to Nokia.

1.5.3 A new Era for Wireless Network Providers

As a result of deregulation, privatization and rapid network expansion by new entrants, the competitive environment among network providers in major markets worldwide has become intense. Efforts to attract and retain subscribers have resulted in significant price-based competition. Increased competition has, in turn, raised the costs associated with acquiring new subscribers, lowered average revenues per subscriber, and increased the propensity of subscribers to switch from one network operator to another.

The network operators are therefore looking for new revenue sources in the form of value-added services they can deliver to their wireless subscribers. They are also looking for ways to differentiate their product offerings in an effort to retain customers. Finally, they are focused upon finding and deploying solutions that enable them to deliver and support their services in a more cost-effective manner.

1.5.4 The Convergence of the Internet and Mobile Telephony

As people have become increasingly dependent on email services and electronic scheduling, remote access to corporate Intranets and other Internet-based services, mass-market wireless telephones that provide mobile access to these resources have become increasingly useful tools.

In 1998, the WAP Forum published technical specifications for application and content development and product interoperability based on Internet technology and standards. By complying with WAP specifications, wireless telephone manufacturers, network operators, content providers and application developers can provide Internet-based products and services that are interoperable and device type independent.

1.5.5 Rapid Technological Evolution

Advances in microprocessor, battery, network communication, miniaturization and display technologies have enabled mass-production of ever smaller and more powerful devices. The current phones and PDAs are easier to use due to radical improvements in speech and handwriting recognition software, and user interface design.

1.5.6 Social and Organizational Factors

The number of workers spending more and more time outside their official workplace has been growing for many years. Reorganizations are putting more and more decision power into the hands of the frontline workers, further increasing the need for timely information anytime and anywhere. Increased competition gives rise to increased time pressure.

Families and friends are also becoming more dislocated as double-income becomes the norm and the work force mobility and the divorce rate increases. Blurring of work and leisure time increases the need for time management and coordination. The drivers are:

1.	There are more mobile phones than PCs and the growth rate is faster than for PCs
2.	Wireless data traffic is growing much more than voice traffic
3.	Deregulation and increased competition increase the need for differentiating services
4.	Convenience: The phone is with the customer all the time
5.	The user ID and location is known, this enables unique and targeted services
6.	The billing infrastructure is partly already in place for wireless communication
7.	Necessary infrastructure, standards and technology are emerging
8.	Families, friends, co-workers and organizations are no longer co-located
9.	Increasing time pressure means that time saving tools are highly appreciated
10.	Longer commutes increase "idle" time available for wireless communication
11.	Flat fee trend because of price wars increases the need for additional revenue sources
12.	New entrants due to converging technologies increase the competition
13.	Phone makers push for replacement purchases to achieve recurring revenue streams
14.	The blurring of work and leisure time creates the need for personal information systems
15.	Teenagers seem to have an unparalleled ability to sending text messages despite the lack of user-friendly user interfaces, and an unlimited need to be connected at all times

Table 1 Enablers for Wireless Information Services

The largest obstacles to the rapid adoption of wireless information services are:

1. Risk of over-hyping the services since the network speed will be slower than wired phone lines for another 2-3 years until the third generation network is widely deployed
2. Cumbersome creation of text messages because speech recognition is not in place
3. Wait-and-see consumer attitude because no standard network, no dominant device design, no open operation system allowing for download of upgrades and applications
4. Lack of killer device and killer application for early and large majority segments
5. Too many players involved to establish network effects and tip markets

Table 2 Bottleneck for Wireless Information Services

1.5.7 Regulations

The telecommunication industry is still heavily influenced by regulations and governments still play a significant role, mainly by establishing standards and by handing out frequency spectrum licenses. The governments play a delicate balancing act by handing out few enough licenses to motivate the carriers to invest in high cost, high quality, broad coverage networks, and at the same time handing out many enough to secure the "right" level of competition.

The US government has issued an important regulation called E911, that requires the network providers to be able to track down any call from any cellular phone to 911, the emergency number in the US, to an accuracy of 100 meters within year 2001. It is anticipated that this requirement will fuel the growth of a wide range of location dependent services.

1.6 Enabling Technologies and Standards

An important consideration for wireless information service providers is how quickly the carriers adopt the digital networks. A delay in the development and deployment of the next generation wireless standards will slow down the entry of service providers into the wireless information services market. The 3G standards will be "packet-based", and they will support Internet Protocol (IP). With the packet and IP support in 3G standards, a wireless information service provider will be close to its familiar Internet development environment.

The packet technology is inherently designed for data transmission and supports the Internet Protocol (IP). The carriers hope that the new digital wireless networks will reduce operations costs, improve the quality, and help offer new services that will increase network usage. Some wireless carriers have adopted one of several competing evolutionary packet-based technologies that support IP. Most are packet technology upgrades based on the underlying circuit-switched technologies.

The three predominant technologies are Cellular Digital Packet Data (CDPD), Enhanced Data for GSM Evolution (EDGE), and General Packet Radio Service (GPRS). Most carriers are waiting for the third generation and the first UTMS licenses have just been awarded in Europe.

Unlike the approach for PC operating systems, there is an unprecedented cooperation among leading players to develop open wireless operating systems. Several joint ventures

such as Symbian are accelerating wireless operating system developments. In the wireless communications industry, the handset producer holds power over the OS provider since the wireless OS market is fairly competitive.

As the network performance improves, starting with 3G systems, a variety of new applications will be used to access and process information. As the 3G standards diffuse, broader wireless application standards will develop. For example, the Wireless Application Protocol (WAP) allows content providers to develop content that does not depend on the underlying wireless network technology or the mobile operating system.

An important consideration for developers is whether the applications run locally or on a server. With the current state of technology, the handhelds have a temporary performance and capability advantage over the smart phones. The future of the wireless client/server model depends on the final format of 3G. It is fair to expect that, as was the case with PCs, that the emphasis on client vs. server computing would shift, as the wireless bandwidth and local CPU performance leapfrog each other.

1.7 Research Method

The work described in this document rest on four parts, first a general literature and data search, secondly a competitive analysis of the industry, thirdly the development of three scenarios and a validation of these through interviews with leading industry experts. Lastly, I synthesize these into a set of strategies and recommendations.

1.8 Document Structure

In chapter 2, I will look at the industry structure, describe the value chain, the different players and their strengths. Chapter 3 discusses the size of the market and the different market segments along behavioral, geographical, social and cultural dimensions. The chapter also describes the types of services available today and current revenue models.

Chapter 4 describes current applications for wireless financial services. In chapter 5, I develop three high level scenarios for the wireless information services market and evaluates the scenarios based on interviews with leading industry players across the value chain. Based on this, I arrive at recommendations and conclusions in Chapter 6.

1.9 Disclaimer

Unless otherwise noted, the information provided within this document is based solely on my own personal views and interpretation of information given to me. No part of this document represents official statements or views of any of the persons or companies that have been contacted during the work on this thesis.

2 The Value Chain

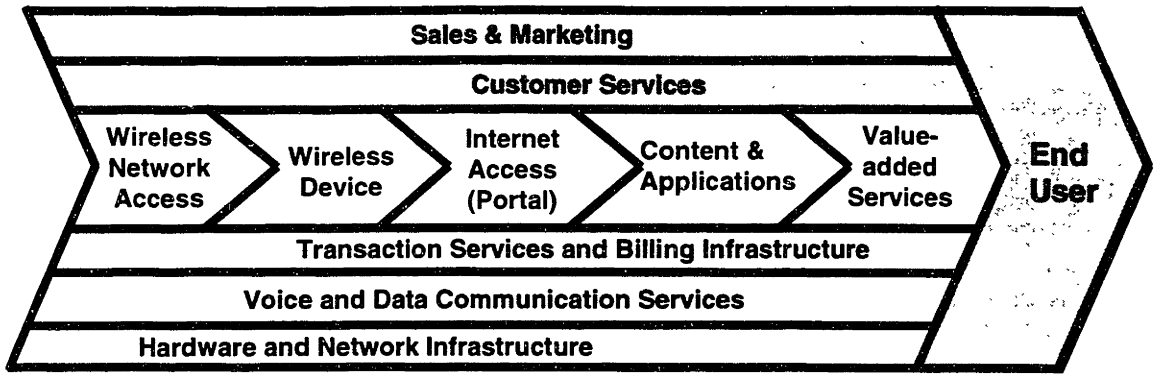


Figure 4 The Value Chain for the Wireless Internet

2.1 Introduction

It is beyond the scope of this thesis to analyze the whole industry, but a rough description is given here as a basis for subsequent discussions, the value chain is illustrated above.

The first step for a user is to use a device to connect to a wireless network through a network provider. Next, the user has to decide whether to go to a portal, i.e. aggregator of information and applications or directly to a content or application provider. If the service includes a purchase of any sort, the seller and buyer need to use the service of a transaction provider that may be the network provider itself.

During the whole interaction, the receiver (the customer) and the sender(s), i.e. the carrier and/or data service providers, rely on a backbone of software tools like the operation system of the device, micro-browsers and web site servers. While only to parties were involved for voice communications, we see that a whole range of players are involved and shaping the customer experience for wireless information services.

2.2 Network Infrastructure Vendors

The network equipment vendors have experienced years of growth lately due to the deregulation of the world wide telecom markets, creating demand for multiple networks in many regions of the world. In addition, technology development has made it cost-effective for many developing countries to deploy a wireless network instead of a fixed line infrastructure.

The current wireless infrastructure has been developed based on two different services: voice and paging in vertical market. The two products have evolved in response to the industry and regulatory changes, and the adoption of new technologies. Data services have moved in to horizontal mass markets, as a result of the growth of the horizontal voice communication market and large scale diffusion of ever more advanced handsets, driven mostly by the anticipated growth of wireless Internet applications.

The equipment vendors have been battling to establish the new 3G wireless communications standards, while introducing enhanced 2G standards (2.5G) to support the carriers who have substantial investment in 2G networks. The vendors believe that the cost saving and backward compatibility of 3G with 2G systems will eventually convince the carriers to begin installing 3G equipment.

The support for packet-based IP in 3G standards and the increase in wireless Internet applications will catapult the demand for new network equipment. However, despite the expected rapid growth in wireless data communication demand, the equipment vendors may see a slow adoption of the new packet-based networks in the short-run, because the carriers will need some time to recover their capital investment in the 2G networks[1].

The wireless equipment vendors' current strategy is to become a 'one-stop vendor shop' for voice and data wireless networks. They try to provide equipment for carriers who still have circuit-switched network needs, while they position themselves to offer packet-based data equipment to other carriers who are installing new networks.

It is worth noting that three of the big firms in this business are Nokia, Motorola and Ericsson, which also are the three biggest cellular phone makers. The "big three" can therefore offer a one-stop-shop solution to the network providers. Other prominent players are Lucent Technologies, Nortel Networks and Cisco, and increasingly the server and computer manufacturers.

The equipment vendors have realized that to provide equipment for a range of carrier needs, they must increase their scale and gain new expertise. As part of this strategy, they have started a wave of acquisitions and partnerships. The one-stop shop approach and the consolidation of the vendor power may encourage the carriers to balance the increased power by purchasing products both from the PC network and PC device side of the industry, rather than the package offered by the incumbent network equipment companies.

The entry of new competitors due to the convergence of data and voice communication increases the rivalry in this part of the industry. The result is consolidation to gain access to a larger customer base, a wider product and technology platform and to achieve economies of scale and scope. Key differentiators are technology, intellectual property, customer relations (i.e. carriers and governments) and complementary products.

As fewer countries need new wireless networks, the infrastructure providers need to replace this business with network upgrades to the 2.5G and 3G standards and new local wireless networks in homes and offices.

2.3 Network Access and Internet Service Providers

The network access providers are mainly either the remnants of the former national telecom monopolies or new telecommunication firms formed after the recent worldwide deregulation of the telecommunication markets.

The 1996 Telecommunications Act has promoted intense competition in the US among the wireless carriers. In many urban areas, as many as six wireless carriers compete for subscribers. The US government has taken a hands-off attitude towards regulations, letting the network operators decided what technology to use and which area to cover. The result is a mess. Three incompatible network technologies are currently in use plus a mix of

analog and digital networks. National coverage is only possible through an intricate mesh of partnerships resulting in complex rate plans and expensive roaming charges.

Additional frequencies will be auctioned out in USA this summer and it is rumored that new players like AOL, Cisco and Microsoft may bid for licenses. The government also continues to auction wireless service licenses that had been returned to it by carriers who could not invest in using them. In April 1999, a government auction of over 300 licenses raised about $412.8 million compared to $10.3 billion for 493 licenses in 1996.[2]

The consumers have benefited from the increased competition the last years. The data shows that the average monthly bill in the US has fallen to $41.24 in 1999, from $98.02 in 1988. The US government is attempting to further promote carrier competition by pushing regulations through the Congress that, among other requirements, introduce the concept of "number portability".

As the next generation wireless communication standards are being debated, the government is requiring that the carriers allow subscribers to maintain their telephone numbers, as they switch among carriers. Currently, this is not possible. This switching cost, along with subscribers' initial investment in a handset that may only work with a specific carrier's network, has helped the carriers minimize their subscriber churn rate and stifled competition.

We have seen the same development in European telecom market after the dismantling of the national telecommunication monopolies in 1998. The presence of national telecom companies and a climate positive towards regulations made it possible for the EU to standardize on the digital GSM technology. Cross country mergers and a large number of people traveling in Europe led to the establishment and harmonization of pan-European roaming charges.

Unlike in the US, European carriers focused on increasing the penetration of mobile communication by subsidizing the handset in stead of skimming revenues from business people that are less price conscious. This has led to mobile phone penetration as much as twice as that of the US. The west-European governments have just started to distribute 3G (often called UTMS) licenses through auctions, "beauty contests" and tenders. The recent hugely successful British auction will probably establish a trend towards auctions as it is a tempting income source for the European nations. The high bids also show the carriers optimism for the future wireless information market.

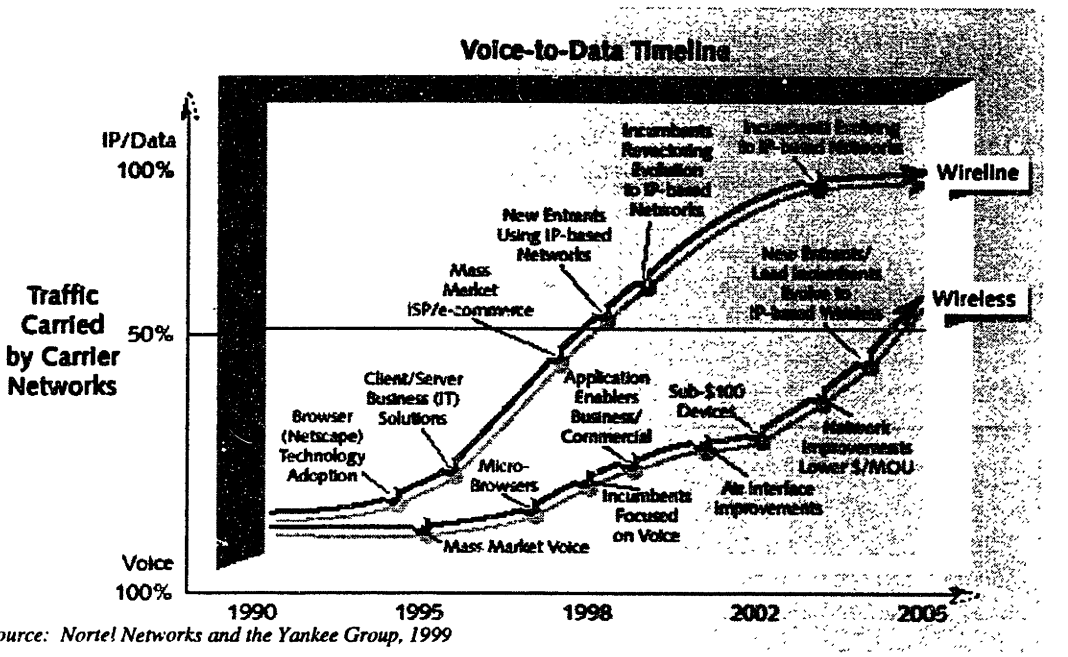
Number portability regulations, similar to the US, are probably coming in the EU soon. With telephone number portability, the consumers will be able to shop for the lowest cost and the best quality of service in their area. Obviously, the carriers prefer not to compete on price, and in many European they do not have to since they have few competitors. Most carriers in the US plan to improve their quality of services and their coverage area in the next few years and this has fed the merger and acquisition wave we have seen the industry lately.

Forrester Research predicts that by 2002, in most urban areas, service quality and coverage will no longer be major service differentiates.[3] Unless the carriers introduce new features and products to differentiate their services, price will soon become customers' primary criteria for carrier selection.

The carriers are partly protected since governments normally grant wireless licenses only to a handful of providers in each region in order to give them incentive to invest in expensive infrastructure. However, the actual diffusion of new digital wireless networks in

the US has been relatively slow, primarily due to a lack of dominant digital wireless standards.

As competition drives down the per-minute billing rates, the carriers will rely on the growth in subscribers' monthly usage, introduction of new services, and cost savings, to maintain their profit margins. The carriers believe that offering wireless data services will help with all three strategies. Several of the network providers have also diversified into providing ISP, ASP and other data communication products, either buy organic growth or acquisitions.



Source: Nortel Networks and the Yankee Group, 1999

Figure 5 Projections for Wireless and Wireline Voice and Data Traffic

Observing that the data traffic is about to dominate the traditional landline communications by 2001, the wireless carriers realize that the same is inevitable in the wireless domain, see the figure above [4]. In the US, carriers now see the need to invest in upgrading their networks from the existing analog systems to the new digital technology to prepare for an expected rapid growth in the wireless data applications.

The supply of wireless bandwidth and services will outrun the demand in the foreseeable future due to competition among the carriers. The competition will make wireless services more affordable and attract broader customer segments. An expansion of the wireless market will increase the probability of a wider acceptance of wireless computing. On the other hand, competition may lead to consolidation among the wireless carriers and a shift of power to the carriers away from the customers.

The network operators are currently the strongest players, as they own the customers and the infrastructure. They have also a billing structure in place. Many of them have also the possibility to bundle, and cross subsidy wired and wireless telephony and Internet access. The network providers are in a strong position as they can offer access to their networks, existing customer base, and sales channels to the other players.

The network operators need to decide how to increase their share of value-added services. Otherwise they risk becoming the plumbers of the Internet, a slow growth, low margin commodity business. Several strategic choices must to be made, as the carriers today do not possess all the skill necessary to offer value-added services. Should they for instance build their own portal and partner with content providers or partner with a portal that wants a wireless presence?

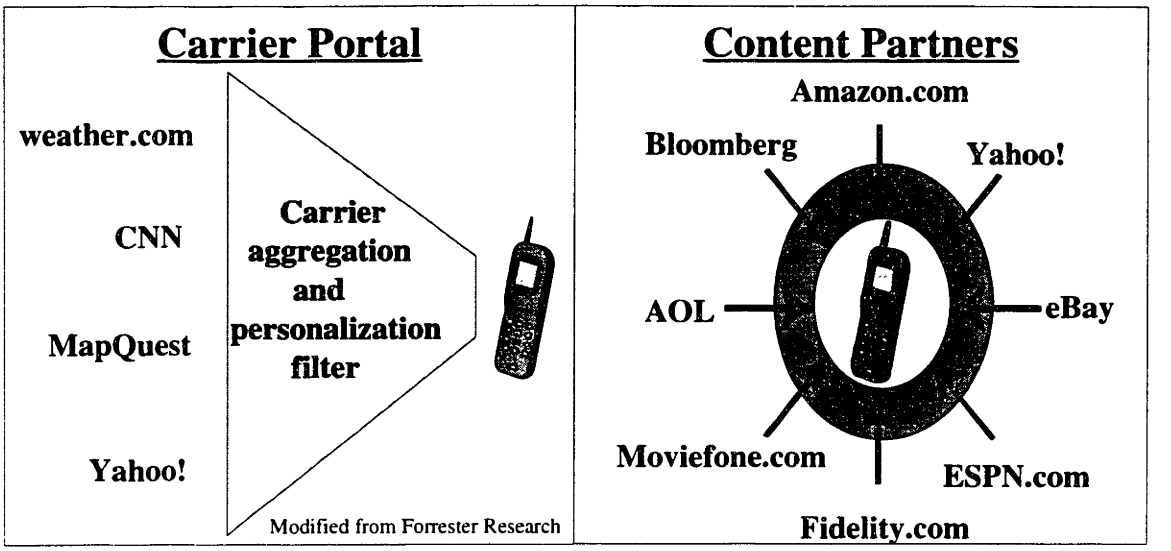


Figure 6 Wireless Portal Strategies

As Internet access becomes a necessity for many consumer and corporations, it also transforms into a commodity like other utilities, however, a utility with advertisement opportunities. This is a crowded place with traditional ISPs (often telecommunication firms) fighting head to head with cable companies and fixed and wireless telecommunication companies.

Players like AOL try to compensate for declining ISP revenues by selling value-added service and by moving their services to other hardware platforms. One option for AOL could be to offer voice communication. VOIP or voice communication over the Internet Protocol has been available for some years, but has not taken off due to low quality due to low bandwidth over the Internet infrastructure. This will change if the data rate increase. AOL with its Instant Messenger and ICQ messenger community of over 70 million may actually morph into a network provider. The same might be true for cable companies like Time Warner who control the "fat pipe" that goes directly into key customers, the families, this might be used for rich Internet content, but also voice.

A plethora of business models are growing up from expensive, high-speed, high quality offerings to free services based on advertising. One of the latest models is free PCs for ISP contracts. This resembles the free phone for a calling plan that has been successful at driving the market for and penetration of wireless communication.

2.4 Device Producers

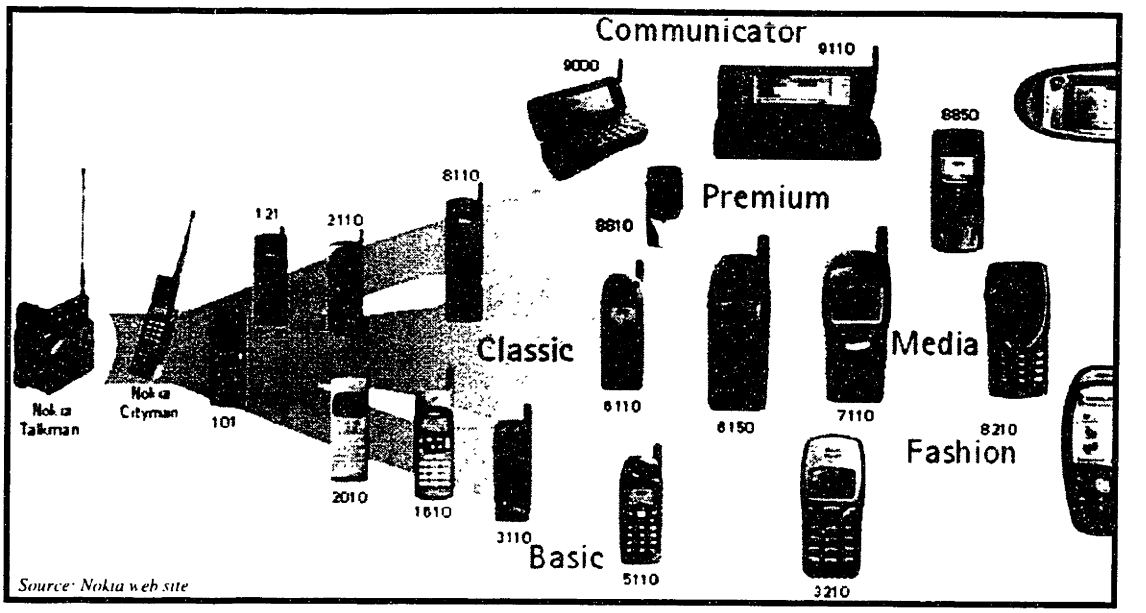


Figure 7 The Evolution and Segmentation of Mobile Phones

All kinds of device makers are trying to grab market shares in the new wireless Internet market as they assume that new devices will be bought because the wireless Internet will fulfill the needs of customers in a new and improved way. PC and PDA manufacturers, makers of all kinds of consumer electronics, game console producers, pager and phone producers have all joined the battle.

The main competitors are the makers of phones, PDAs and portable PCs. Each of them sees an opportunity to grab new markets and a part of the other players' current segments. No dominant device design has been established, there is currently two design schools, one that believe in specialized gadgets and the other betting on modular, multi-purpose devices. The jury, i.e. the customers, is still out on the issue as very few devices have been sold.

The phone handset producers would like to see a phased rollout of the new network technologies, as it will create waves of replacement purchases. A fast adoption and deployment of 3G would allow the phone manufacturers to enter the wireless information services market faster than the PC, PDA and pager producers because of their unique knowledge, specific assets and relations to the network providers.

In the beginning of the development of a wireless communication market, the network providers and device producers usually work together to grow the market. The handsets are subsidized so that people can afford to call each other. Most of the phones sport the brand of the carrier in this phase. As the penetration grows the phone becomes a commodity and the phone manufacturers begin to develop several phone types to segment the market. At the same time they build their own brands so that the consumer select phones according to its functionality, status and image.

Nokia has been particular clever at this, Nokia is now that strongest non-US brand in the world and they have a wide range of different phone types catering to all segments, as shown in the figure above.

Nokia is the largest handset producer in the world followed by Motorola, Ericsson and Panasonic. Siemens is currently enjoying strong growth in the sales of handsets in Europe after having launched WAP phones priced below that of Nokia and Ericsson.

In many regions, there is an interesting tension between the carriers who want to diffuse a lot of affordable devices, while the device makers want to build their brands to get out of the grip of the carriers. The recent comment from Orange, an UK carrier, stating that they are looking into the possibility of offering private label phones do not ease this tension[5]. In the middle to high-end market, the prominent handset manufacturers compete based on features, design and deliverability rather than price, as users demand certain hot phone types, the network providers are eager to secure their supply of these phones[6].

Global market differences are other challenges facing the device makers. In Europe, the device makers need to sell to the end user directly, as a large part of the network access is prepaid. This prevents the need for a long-term contract with a carrier; the user is free to buy the phone he or she wants. In Finland, the most developed market, subsidies are no longer used. In Japan, NTT DoCoMo has a very strong position, both in terms of market share and proprietary technology, so that the handset manufacturers have to compete for production contracts according to DoCoMo's specifications.

In the US, prepaid calling is not common and handset subsidies are still necessary to grow the market. The carriers demand therefore that the phone buyer signs a calling plan so that they can recoup their subsidies through airtime charges and that the phones carry their name. The power is shifted more towards the carriers compared to Europe, since the carriers buy phones in very large volumes.

The three big manufacturers, Nokia, Ericsson, Motorola, have a strong position as they can leverage their market shares to gain economies of scale. They have erected large barriers to entry for newcomers through huge investments in production facilities, research and development and supplier relations.

However, the transition to wireless information services is a golden opportunity for new entrants. This is exemplified by Neopoint, a two years old US phone maker, that has come from nowhere by combining PC and PDA features with a phone form factor in a new and compelling way. The big producers have outsourced more and more of their production over the last ten years. This implies that entrants do not need to build their own production facilities due to a growing industry of suppliers.

While the phone makers try to put more computing facilities into their smart phones, the PDA and portable PC producers try to include wireless communication into their devices. It will be interesting to watch how this will evolve, Palm has a particular strong position in the US. If they manage to make good wireless products and drive down the airtime rates, smart phones may never be a hit in USA.

A small company called Microsoft is also trying to get a piece of the growing wireless market by persuading device makers to use their scaled-downed Windows version as the operation system thereby gaining interoperability with popular PC applications. Microsoft launched its Windows CE, now called PocketPC, for the third time in mid April with usual fanfare and an impressive array of application partners and Casio, Compaq and HP as hardware partners. The pocket PCs will sell for around $500 later this summer.

Microsoft's efforts have been disappointing up to this point in this market, but one should never underestimate them, they usually get it right the third time. Branding these devices and applications under the pocket PC theme may be a smart differentiation as it signals a powerful computer crammed down into a little box compared to the limit functionality of phones.

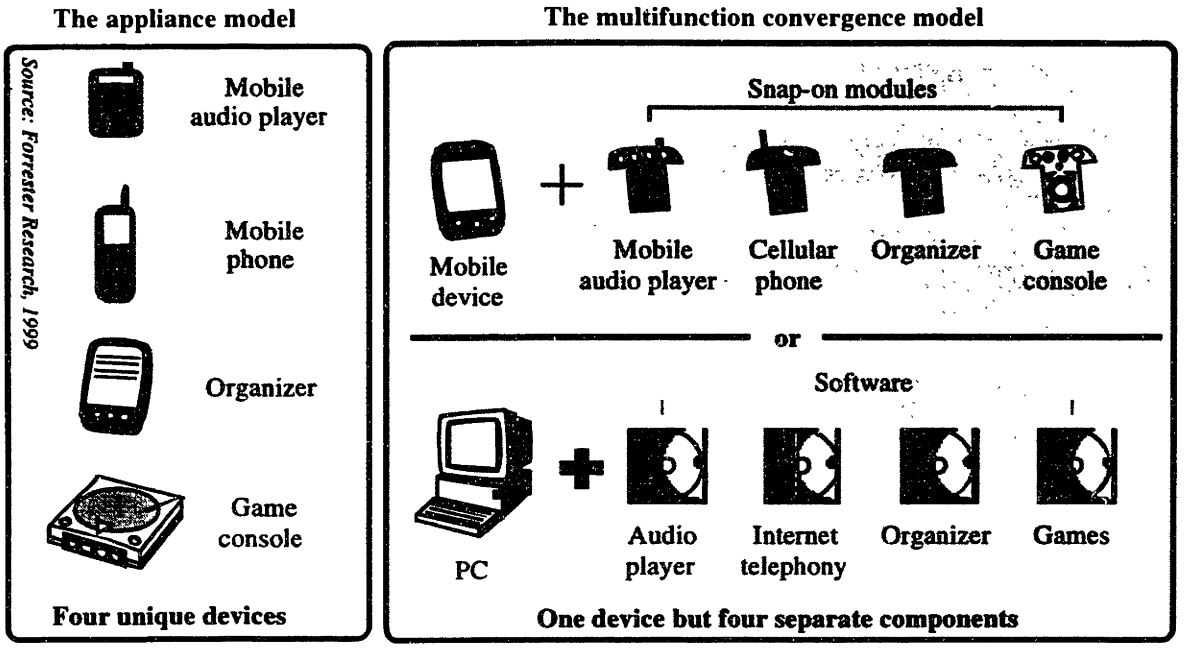


Figure 8 Device Design Strategies

Microsoft's design strategy is to put as much functionality as possible into one device to make it more valuable for the user, while Ericsson's philosophy is on the other side of the spectrum. The last fall, the Ericsson released a FM radio and an MP3 player snap-on-module for their mobile phones.

In the corporate market, wireless information services and devices will need to be approved and supported by corporate IT departments before a large-scale diffusion can take place, unless the need for integration and support is negligible. This may give the PocketPC platform an edge since applications for this platform will be compatible with other Microsoft products.

Another small company called AOL has acquired a stake in Gateway, one of the largest PC producers in the US, and they are now strategic partners. The two companies just recently announced the launch of a new category of Internet appliances later this year that will be priced below the important $500 mark. The appliances consist of a monitor and wireless keyboard. The only applications able to run on the devices are a Netscape (another AOL company) browser and a dial-up connection to the AOL web site.

AOL has also announced that they will co-brand a two-way paging service with Motorola. This service will be compatible with AOL's email and instant messaging system. This is just two of many cornerstones in AOL's Anywhere strategy, which looks like a strategy for integration throughout the whole value chain, additional examples of this strategy will be given later.

2.5 Wireless Portals

The most popular Internet portals like Yahoo, AOL and Microsoft MSN are already targeting the wireless market by offering special version of their portals using web clipping or WAP. They are also continuously adding new personal information management (PIM) features like calendar and address books to their web sites to get repeat visits and make it inconvenient to use more than one portal and switch to another portal. Many pundits believe their newest offering, instant messaging, can become the killer application of the wireless Internet, especially for the teenager and student segments.

Top Ten AvantGo Channels

1. Stock Smart
2. Fox Sport
3. MapQuest - directions
4. New York Times
5. FT.com
6. Bloomberg Personal
7. The Weather Channel
8. Fox News
9. The Wall Street Journal
10. USATODAY.com

AOL, with its 22 million subscribers, is the heavyweight in this market. Despite many expert predictions, AOL have managed to grow their business by heavy marketing, offering free trials, wide distribution and by providing a compelling and broad range of exclusive and non-exclusive content in a user-friendly environment. The coming merger with the media giant Time Warner will create a very strong Internet and media conglomerate.

AvantGo aggregates and repackages content from an impressive suite of content partners for Palm users who can download the content (channels) for free. AvantGo uses the free service to build their brand among business people so they will buy their corporate solutions for access to Internet, intranet and extranet applications.

Many of the wireless carriers are currently building their own portal. They believe it is important to control the bottleneck the subscriber has to go through to access information service on a wireless device. In addition, the network providers have right now may be no choice because the current network technology and user interface constraints makes it cumbersome for the user, and sometimes impossible, to navigate the web freely. The current portals are more rudimentary content aggregators than true portals. The user interface is very basic, just a menu three operated by the keypad.

Most of the European network providers build their own portal. One reason could be that they have cash to burn from their heydays as monopolies. They are also often the largest ISPs in their respective countries and have therefore often already an Internet portal. Another reason is the fact that the traditional European media and content powerhouses have been slow to move to the Internet.

Most US carriers take another route to the wireless Internet. The majority establishes partnerships with content providers and Internet portals. This reflects the higher Internet penetration in USA, stronger competition between the telecommunication companies and a marketplace populated by strong ISP and Internet brands.

The carriers have nonetheless a short window of opportunity they can use to sell access to their portal to content and service providers or enter into profit sharing contracts. They can also leverage their control of the menus to strike partnership deals with important information services that will drive customers to their network and increase the frequency

and length of each "phone call". Smaller carriers will need to pay the content providers to be able to offer the services.

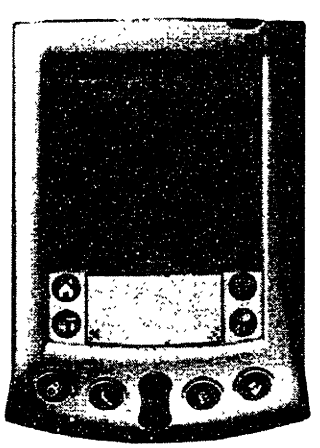
Some network providers demand that the handset manufacturers embed a software lock in the phones so that the user can not roam freely on the Web. However, most analysts believe it will only take one carrier to offer open Internet access before the rest will need to follow suit.

Palm has true its Palm.net also chosen a proprietary road. They aggregate content from content partners and reformat the content using their own web-clipping method. The data is subsequently sent upon request to owners of the wireless Palm over a BellSouth wireless network. The users can choose between paying $45 per month for unlimited amount of downloads, or a smaller monthly fee and $0.20 per additional downloaded kilobyte.

Search and shopping engines act partly as portals too, many of them are also embedded into the portal sites.

The wireless portal market will probably be a power game in which the carriers and current Internet portals will be wrestling their customer bases against each other. Some of them will probably join forces, while others will continue to compete fiercely against each other.

2.6 Content Providers



Current Internet content providers and media companies have a natural lead in this category. However, this is also becoming a crowded place because new players see an opportunity to grab niches in the emerging wireless content market. Some traditional media companies that came late to the Internet game will probably look upon the mobile Internet as a second chance to join a new and growing market, and vertical service providers see a golden opportunity to migrate horizontally into other markets.

A key question is how readily offline and online content can be repackaged to the wireless Internet. This is partly a technological issue, but some observers claim the winners will be the content providers that are able to adapt to the new form factors and at the same time take advantage of the unique features of the wireless medium. If the Internet meant the death of distance and time differences, the wireless Internet with its ability for communication anytime and anywhere, will mean the death of co-location.

Another question is whether wireless content will be a complement or alternative to current online and offline content. The jury is still out on this issue since the penetration of wireless Internet devices is to small to tell. What we see today is a lot of experiments and a hectic battle to grab land and build brands in this new field.

AOL is active in this area too, they have, in addition to the wealth of content provided by Time Warner, acquired MapQuest, the number one online mapping services, and DigitalCity, the number one online local city guide. The different types of wireless information services currently available will be described in detail in the next chapter.

2.7 Application Providers

The difference between content and application providers is not straightforward. In this document, I use the term application for a software program residing on a server or in the device that through interaction with the user and information processing executes some tasks. Applications like an address book and an email program are examples of software that does more than display or transfer data and information.

A wide range of applications like fleet management, remote control and monitoring are examples of solutions for so-called vertical corporate markets.

The most basic and popular applications like personal information management usually come bundled with the device or can be downloaded for free, while the price of vertical applications tend to be inverse proportional to the size of the market and the number of potential users.

The market is characterized by a chicken-and-egg problem; very few software companies will develop an application if few customers use the hardware platform. On the other side, the users will not buy a device if very few applications are available.

The Palm has currently a huge advantage over the smart phones and pocket PCs because over 50,000 entities develop applications for the Palm OS platform (recently licensed by Sony and Nokia) while only around 350 develop for the Microsoft platform. The phone producers used to develop proprietary applications for the handsets; however, the WAP standard makes it possible to transform Internet content applications to the smart phone platform.

2.8 Wireless Commerce Vendors

The advent of the wireless Internet promise the current e-commerce retailers a tripling of the number of storefronts since mobile phones are much more abundant than PCs. It may also allow for higher sales growth since the number of mobile phones is growing faster than any other mass-market product in the history. Wireless Internet also offers brick and mortar merchants a new sales channel. However, the storefront is literally very small and currently without space for advertisements.

The online retailers are therefore reluctant to make the move; however, we see a lot of pilots being launched to test the waters. The majority of the retailers will not move to m-commerce before the transaction infrastructure is in place and not until they can increase sales and/or reach new customer segments.

Wireless devices are currently merely an extension to current sales and distribution channels since they today are best utilized for time-critical text and voice messages. The short-term candidates are therefore retailers of perishable goods, events and services. Bank services, stock trading, auctions, betting and business-to-business exchanges are the hottest candidates.

The most common add-on services from e-commerce firms are alerts and updates of financial information and general news on a subscription basis. An increasing number of retailers are using pager and email alerts and coupons to drive customers to their sites and stores, as click-through and conversion rates are dropping on the fixed-line Internet.

Amazon.com, the world 's biggest Internet retailer, is one of the pioneers of mobile commerce. Their Amazon Anywhere service enables books to be purchased via your smart phone or PDA. Amazon has also invested in Kozmo.com, an online shop for impulse items like videos, music, ice cream, and take-away food, promising delivery within one hour in major US cities. This alliance will offer Amazon customers instant gratification by receiving top selling books at their doorstep within an hour.

Moviefone, also owned by AOL, enables customers to buy movie tickets online on almost any device in the US and a wide range of similar services are available in Europe and Japan. The I-mode services by NTT DoCoMo in Japan has been particular successful and will be described later.

A frenzy of deal making is brewing between carriers, ISPs, portals, content providers and retailers as they all hope the wireless Web will create a closer customer relation and a more compelling and convenient shopping experience. First-to-market, buzz and brand building, clever marketing and strategic partnerships will be key success factors in this battle too.

2.9 Software Infrastructure Developers

Software is, together with the physical network, the glue that put the wireless Internet together. There is therefore a growing market for vendors offering software like micro-browsers, WAP servers, transformation of web pages from HTML to WAP, network monitoring and optimization, operation systems and mobile commerce. However, the lack of a standard software development platform partly explains the few software applications compared to the PC and game market.

Up to now, each phone maker has developed its own operation system (OS) and user interface. This is likely to change in the near future as it put customers and application developers in an uncomfortable lock-in situation that prevents widespread diffusion of applications for smart devices.

The handset manufacturers and the industry are aware of this and have therefore formed alliances to create a common development platform and prevent that one company gets a de-facto monopoly due to a first-mover advantage or market power (read Microsoft). The Symbian alliance, the WAP forum and the Bluetooth consortium are examples of this.

The three big phone makers, Nokia, Ericsson and Motorola, and Psion, a British PDA producer formed the Symbian alliance two years ago. The goal was to make EPOC, Psion's operation system (OS), into an open standard OS for wireless devices, allegedly because Microsoft was not willing to license Windows CE to Nokia at an affordable price in 1998. The future of Symbian is uncertain because they have been slow to ship products and Microsoft recently recruited their CEO. It also looks like the three partners are hedging their bets by making alliances with Symbian's competitors, exemplified with Ericsson's alliance with Microsoft and Nokia's with Palm.

The third contender in the OS war is Palm, which already has licensed their OS to their closest PDA competitor, Handspring. Palm seems to be on the offensive after having signed two important licensing agreements with Sony and Nokia last fall. This is a battle among giants, Microsoft has a of course a strong position, and Palm too, due to its 75% markets share for PDAs, but the big three phone makers are not small boys either.

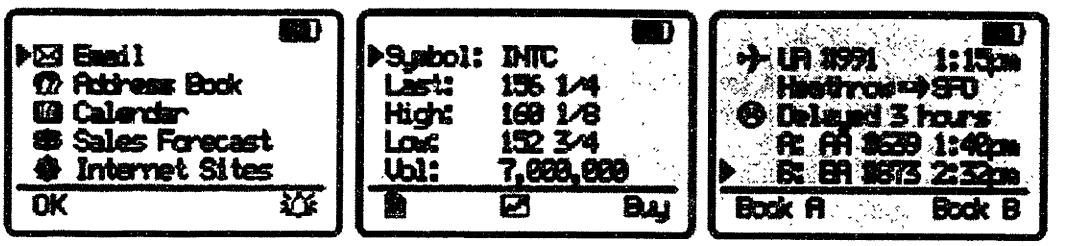


Figure 9 Examples of Wireless Internet Browser Pages

The proliferation of WAP services and web sites generates a market for WAP browsers and servers. A WAP server is a software system that translates HTML content to WAP content and that feeds data and information back and forth between the clients (the handsets) and the server. There is currently also a frenetic fight over the browser market for wireless appliances. The participants are phone.com, the pioneer and one of the founders of the WAP forum, in addition to the phone producers, Netscape (now owned by AOL), Microsoft and several smaller, new companies.

Phone.com enjoys a near monopoly in the browser market since it was the first independent company to develop a micro-browser for telephones. They have also signed exclusive contracts with the majority of the largest carriers around the globe to provide their WAP software infrastructure. Phone.com has been called the Netscape of the wireless Internet, both because they use the same tactic of giving away the browser for free, while earning money on the server side, but also because of a similarly extremely successful IPO and strong stock price performance.

Phone.com has also a strong position since it can influence the development of the WAP standard due to its leading role in the market and in the standard body. The big three phone makers have safeguarded themselves by developing their own browsers and servers, and by including three network gateways in the handsets. The latter enables simultaneous use of several browsers, avoiding the lock-in situation IBM came in by licensing MS-DOS from Microsoft.

Everyone is cautiously watching each other and establishing open standards to prevent anyone from building monopolies like we have seen in the PC industry.

2.10 Transaction Infrastructure Providers

The lack of a secure payment backbone is currently one of the main bottlenecks for the take-off of mobile commerce. Consumers are still afraid of exposing their credit card numbers over wireless networks that are rumored to be insecure. The majority of current

services are therefore paid for over the wireless phone bill. This prevents purchase of expensive items since the carriers are not willing to take on the financial risk.

However, secure credit card payments are in the pipeline, both VISA and MasterCard have pilots running in Scandinavia, this will be discussed later. However, these two large institutions are facing stronger competition from their owners, the banks. Some banks, especially successful Internet banks like MeritaNordbanken in Scandinavia and Egg in UK, are developing their own WAP banking solutions. They do this to get even closer to their customers, to increase the loyalty, and thereby the revenues, and to save costs at the same time.

Order fulfillment and last mile delivery are important parts of commerce transactions. These two services have been bottlenecks for e-commerce via the fixed-line Internet and maybe even more so for the mobile Internet. This is so because the convenience of wireless devices may increase the amount of impulse purchases, thereby increasing the demand for instant gratification and delivery.

2.11 Chip Makers

Ever smaller and faster microprocessors are an important prerequisite and enabler for the expected explosion wireless information services. As the client, the device, gets smart, more memory and faster chips will be needed. Giants like Intel are therefore moving into this high growth market.

Qualcomm is extremely well-positioned to reap large revenues from the wireless Internet revolution because the company own over 300 patents covering a large part of the CDMA technique, but also because the company has a thriving chip design business as well.

3 The Market

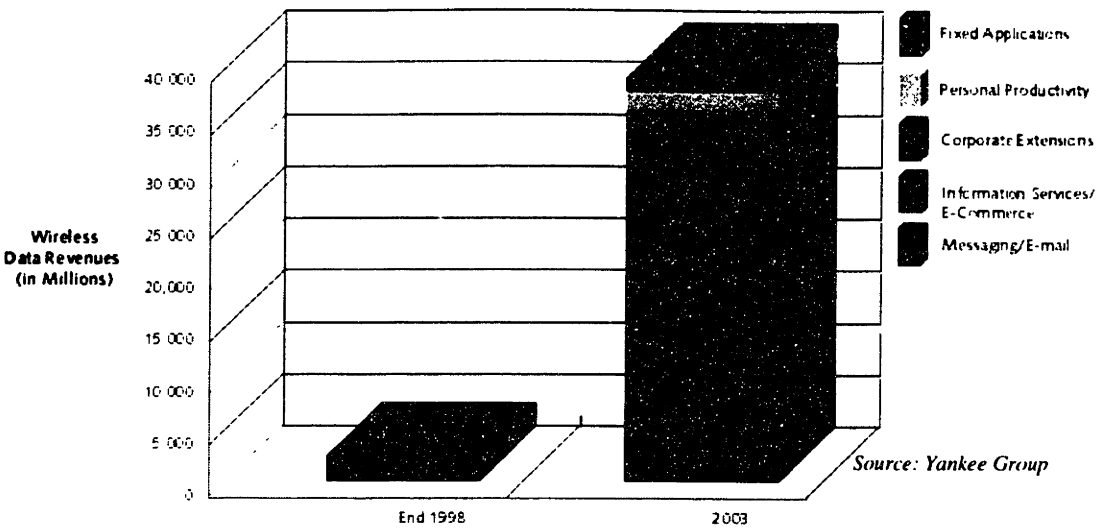


Figure 10 Market Projections for Wireless Information Services

3.1 Introduction

In this chapter I will give an overview of the magnitude of the market for wireless information services and growth predictions. I will also categorize the different types of services and gives examples of current products and business models. This is however, a very rapidly evolving marketplace, this overview will therefore not be complete and up-to-date.

3.2 Market Projections

The Internet and wireless communication are the two fastest growing industries in the world today. The Yankee Group Europe predicts that "*by year 2003, 25% of total wireless revenue will be accounted for by wireless data, up from just 5% at the end of 1998. This amounts to almost $39 billion. Today, the primary application is e-mail and messaging, accounting for 93% of wireless data revenue. In five years time, though, the picture will be very different: information services/e-commerce and corporate extensions (e.g., file transfer, database access) will be the largest categories in terms of revenue, generating $18 billion (47% of wireless data revenue) and $12 billion (30% of wireless data revenue), respectively. These are the applications for which operators will be able to charge a higher price. E-mail/messaging, personal productivity (calendar, scheduling, personal information manager), and fixed applications will be important in terms of volume but operators will not, we believe, be in a position to charge a high price for these applications. E-mail/messaging and personal productivity features are likely to be bundled into basic wireless data packages*"[7].

The carriers, phone makers and other analysts share similar rosy forecasts. Since 1992, the rapid increase in demand for voice and data services has driven the growth of the wireless carriers' business. The customer demand for wireless services is forecasted to be strong for the next few years. Forrester Research forecasts that the phone penetration in the US will grow to 65% by 2005 with 143 million subscribers generating $150 billion in revenues.[8] This

assumes a healthy average compounded growth of 11% annually for the subscriber base the next 4 years. Ericsson estimates that by the year 2004, there will be one billion fixed line subscribers, one billion mobile phone subscribers and one billion people with Internet access[9].

Most of the new wireless applications have been related to the Internet and mobile electronic commerce. Dataquest projects that by 2001, the annual market opportunities for e-commerce will be an impressive $67 billion. Although most of this revenue is due to business-to-business commerce, the business-to-consumer commerce will generate about $7 billion annually[10].

Various forecasters predict that the overall Internet e-commerce market for consumers will increase from last year's $15 billion in revenue to more than $1 trillion by 2003 and $1.5 trillion in 2004. One analyst, Andrew Cole of Renaissance Worldwide Inc., boldly suggests that wireless e-commerce will amount to as much as 45 percent of the total e-commerce market in 2004. The Gartner Group expects more than 40 percent of business-to-consumer e-commerce transactions outside North America will be made over a wireless phone in 2004[19].

The number of Internet pages is growing exponentially, McKinsey; the management consulting company, estimates that 2.3 billion US built web pages will be available this year. They estimate that 24.5 million laptops and 11.4 million PDAs will be sold this year, see the figure below. McKinsey also believes that the number of mobile professionals will be about 60 million this year, double that of 1995. Mobile professionals are defined as people that are away from their primary workplace more than 20% of their time[11].

Japan and Europe are paving the way for mobile commerce as these countries have the highest penetration of cellular phones and one common network type, the GSM technology. Most GSM systems offer headline news, weather, sports, stock quotes and Short Messaging Services (SMS). Currently, banks, carriers, and a few mobile commerce providers offer solutions for specific markets, however, still mostly as prototypes.

The biggest problem in Europe right now is not lack of customers, but lack of devices, the three big handset manufacturers can not deliver enough WAP phones and a gray market has developed. However, the independent wireless applications and content providers await standardization before committing resources to major projects.

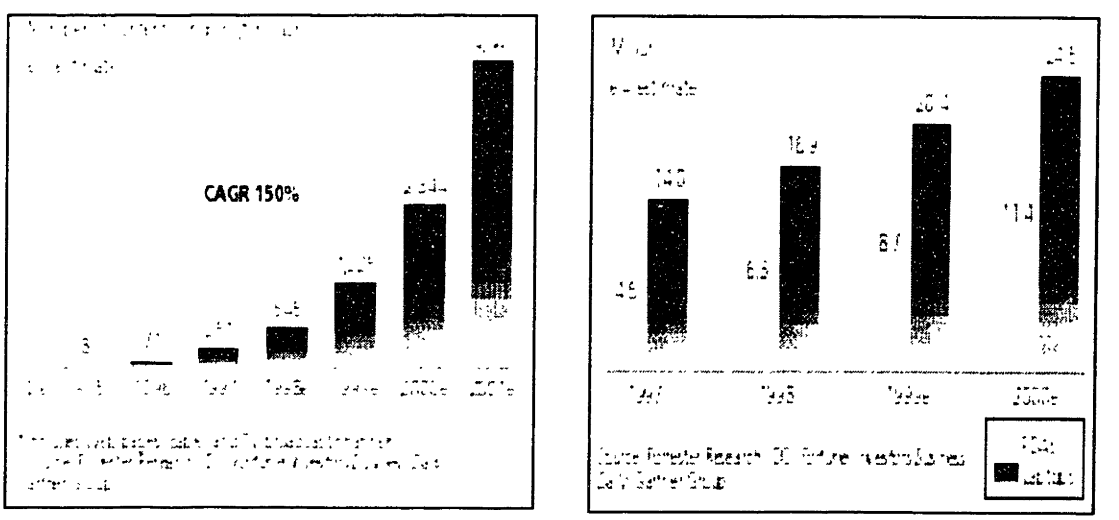


Figure 11 Growth of Internet Content, Handhelds and Laptops

3.3 Service Categories

Information	Entertainment
• News and Weather • Yellow Pages • Travel Guides • Alerts & Reminders	• Video • Radio & Music • Games • Gambling
Communication	**Transactions**
• Voice • Email/SMS/Chat • Video/Images • Data/Fax	• Finance • Online shopping • Reservations • Tickets

Figure 12 Wireless Information Service Categories

Wireless data services can be divided into four main categories; communication, information, transactions and entertainment. The borders between these groups are blurred and one service will often require another type of service as part of the total customer experience. Gambling will for example include a payment transaction and online stockbrokers often offer an alert service as part of their services.

3.3.1 Time Critical and/or Location Dependent

It is also possible to categorize services along other dimensions, the most important are perhaps **time sensitivity** and **location dependence** since they take advantage of the unique anytime, anywhere characteristics of wireless services. Stock trading, auctions and financial news are examples of time critical services. Local news, weather forecasts and restaurant and entertainment guides are examples of services that are location dependent.

Location dependent services can be further divided into safety, billing, tracking and information services. Safety services include roadside assistance and emergency service (911); tracking services comprise tracking of vehicles, people and assets. Location dependent information services are traffic updates and event and other lifestyle information. Some carriers are talking about billing wireless customers for fixed local calls when the user is at home and according to a cellular plan when the customer is away from home.

Combining time and location dependency open up for profitable yield and inventory optimization services. Discount coupons sent via email or SMS for overstocked, perishable groceries or cheap last-minute travels and movie tickets are just some examples.

3.3.2 Push or Pull or both?

Push and **pull** are increasingly popular terms. Alert and reminder services are push services since data or information is pushed to the device and the user, while database inquiries like yellow pages are pull services. It is also possible to distinguish between one-way and two-way (or interactive) services. Information and entertainment services are mostly one-way, while transactions and communication are intrinsically two-way.

Another way of segmenting the services is according to the usage frequency. I will in the following give a short overview of currently available information services around the globe, before I turn to surveys showing what the users actually wants.

3.4 Current Services

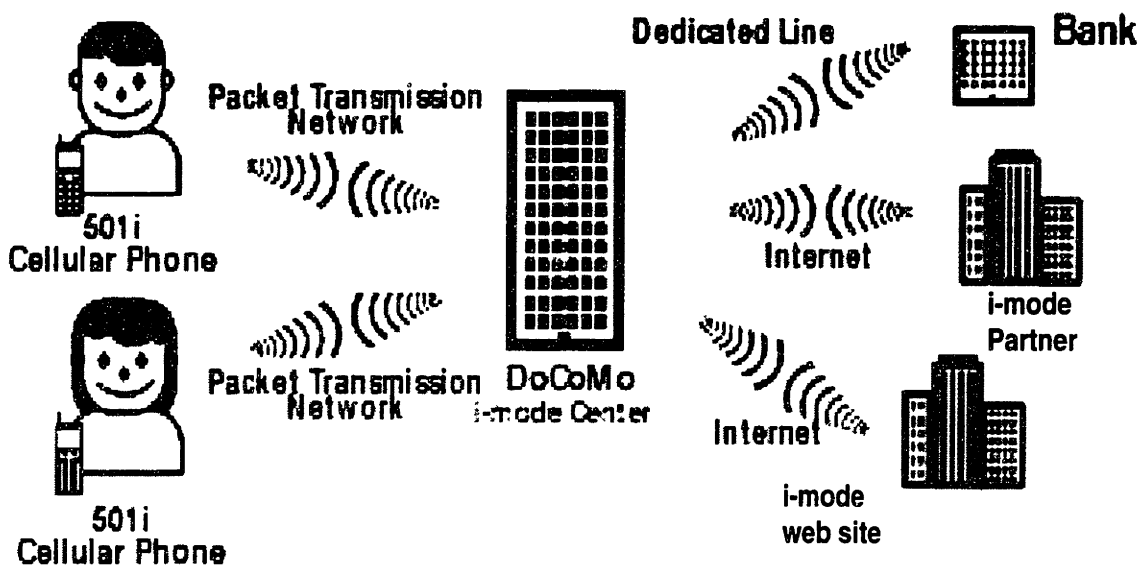


Figure 13 The i-mode Service from NTT DoCoMo

3.4.1 Japan, the Leader

Users of the i-mode wireless service from NTT DoCoMo, by far the largest wireless network provider in Japan, can buy and sell stocks, reserve hotel rooms and airplane seats and entertainment tickets paying over the phone bill. The phone also serves as a tool for email, games and travel information and general news[12].

15-20 vendors are developing pure B2B solutions, present services include motorbike fleet management, group-ware, and access to Intranets. These types of services are increasing. News, banking and stock services are also popular, over 250 banks offer bill payment (checks are not in use in Japan). About 20 different games are available and a daily cartoon download service from a company called Bandai has 1 million users per month generating 1 million in revenues per month for the company.

The number of users of i-mode phones is rising exponentially every month and the number of "i-mode" friendly web sites has exploded since its launch in February last year. The service gained 4 million subscribers after one year of operation; the current growth rate is 1 million new customers each month! 30% of the new subscribers are new customers, either from competitors or people that did not have a mobile phone before. The adoption has passed the early adopter phase, the gender split now is fifty-fifty and the same split is found in terms of age (below and above 30 years).

As of April 16 this year, i-mode had 6.08 million subscribers and 450 providers were part of the Application Alliance Partners. This program features the partners on the official i-mode phone menu. In addition, more than 9,200 providers have independently created web sites or "i-mode enabled" their current HTML sites[13].

Becoming a part of the i-mode network is convenient and inexpensive since content and application providers do not have to convert their web site and setup a separate server. NTT DoCoMo does not charge anything from the content and service providers, but extracts a 9% transaction fee from m-commerce revenues if the vendors choose to let NTT handle the billing on their behalf.

The I-mode phones use two networks; one for voice and an always-on packet switched network for the data traffic. The phones have a button allowing the user to switch between data and voice communication. Most I-mode sites have a "phone-to" button on their I-mode page that automatically places a call to the vendor if the button is activated.

The user pay a flat subscription fee of only $3 per month in addition to a very small fee for every bit transmitted, on average adding up to $8 per subscriber per month. The "phone-to" button service generates on average $10 more airtime charges per month, in addition, users have to pay subscription fees for add-on services like an online address book ($3 per month), typically resulting in a near doubling of the monthly wireless phone bill[14].

A 3G version of the network will be launched next spring, this will require new handsets, but will offer richer media like newscast and other video-stream services.

I believe the tremendous success can be attributed to the following key factors:

1. Creation of demand by aggregating contents and services almost for free
2. Cost and time efficient solution for information providers through re-use of HTML
3. Billing services lower risk, reduce cost and enables profitable sales of cheap items
4. Affordable price, small subscription fee gave network effects and feedback loop
5. Attractive form factors; small phones for small hands, color screens, long battery life
6. Ease of use; no software installation, always on, email-address = phone number
7. Clever management of expectations, marketed as a unique service, not as the Internet
8. Demand due to the lack of privacy at home and at work, and long commutes
9. Convenience; information and services when needed, no time wasted in lines etc.
10. Weak competition, low PC penetration, few and expensive alternatives

Table 3 Success Factors for the i-mode Service

3.4.2 Europe, the Runner-up

Europe is blessed with a common network standard, however, cultural, historical and social factors means that the market conditions and characteristics vary from country to country. As seen in the figure below, there is a marked difference in mobile phone and Internet penetration between the wealthy Nordic countries and the southern and eastern part of Europe.

In Finland, the world's most wireless nation, everything from beverages, car wash and train passes can be purchased using a wireless phone. All you have to do is to call the service phone number of the vending machine, the service is then charged to the mobile phone bill. A wide range of transactions and services are also available using SMS messages. It is for instance possible to order chocolate to be sent home or to be alerted if the price of your stocks fall more than x %. The price structure is typically a quarter per message and a $5 sign-on fee.

MeritaNordbanken, the result of a merger of three banks from Finland, Denmark and Sweden, is the world's largest Internet bank in terms of number of customers. They have develop advanced financial services in cooperation with Nokia and claim they were the first to offer bank services, including bill payments, and stock trading via WAP phones. Bank transactions are free, but the user has to pay a monthly fee of about $1.

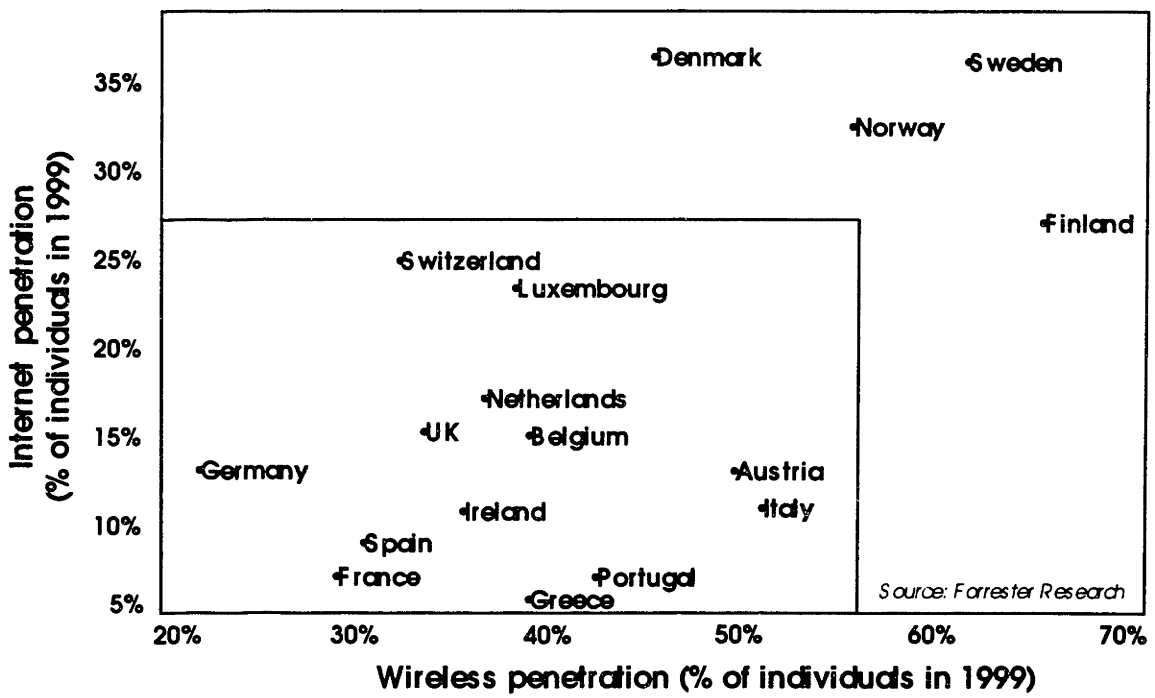


Figure 14 Penetration of Internet and Mobile Phones in Europe

In Norway, it is now possible to order movie tickets over the mobile phone using the SIM card technology. This service costs around $0.5 for each search, buying a ticket costs one dollar, included the search, the ticket itself costs normally six dollars. Additional services

like recharging the phone wallet, checking the balance of the account and to order a receipt, each costs a half-dollar each time in addition to airtime. There is no sign-up or service subscription fee. The widespread use of the SIM type of services is not hampered by the technology itself, as no special type of phone is needed, but by the slow adoption from the seller side[15].

UK subscribers can also use an advanced set of wireless data services, a result of fierce competition among the carriers. Several banks offer wireless financial services, please see the next chapter for further details.

Germany is also a big wireless market with two strong carriers in Deutche Telekom and Mannesman, recently acquired by Vodaphone, and large media firms like Bertelsmann.

Italy is Europe's largest wireless market due to a large population and a high penetration rate. The Spanish market is potentially as big, but the penetration has not caught up with Italy yet. Both of these markets have home Internet access penetration rates considerably lower than that of the North-European countries.

France had an early lead due to its Minitel system and have therefore several advance services. It is for instance possible to reserve train tickets using WAP enabled mobile phones, actual payment of tickets is on the way[16]. SFR, a French access provider, dropped its churn rate for subscription customer from 25% to 8% after introducing data services. This considerable when the average churn rate is 30% and a new customer cost on average $300[17].

Examples of a new generation of content and applications are the use of smart cards in conjunction with wireless handsets to download cash (BTCellnet, England), payment for car-wash using GSM billing (Telecom Finland). Others are the ability to download MP3 music (under development in Germany), automated customer service access through wireless credit card information (BTCellnet in England), and many more.

3.4.3 USA, the Laggard

The US market has seen a wave of large mergers lately as the big carrier and content players are wrestling to get the best start positions in the race for market shares. Nonetheless, the Palm community is growing stronger by the day. Palm has about 75% of the market for handheld computers and over 50,000 application and content providers develop for this platform, although less so on wireless applications.

Palm VII is the only wireless model and it requires that the user subscribe to the Palm.net service in cooperation with BellSouth. The service offers stock trading, book, movie and airline ticket purchases using BellSouth's two-way messaging capabilities.

All the major carriers offer some sort of wireless data services either via smart phones or PCs through wireless modems. A range of new offerings has been introduced recently; the overview here is not up-to-date. Nextel charges the user 10 cents per web page you browse or $3 a month for 100 pages, AT&T charges $4 per month for news sent to your phone, while Sprint offers a bundle of voice and information services for $59.99 per month.

Microsoft is of course not sleeping at the wheel; they are forging alliances on all fronts. They recently launched their PocketPC concept as described earlier in this document. AOL, the world's largest ISP, have also announced a broad range of wireless products.

Most of the large American Internet portals have their own wireless portal version offering a limited set of Internet content and services. Stock trading is a popular service and most large brokers offer solutions via palmtops, pagers or smart phones using software from W-trade or 724 Solutions, or applications developed in-house. Very few WAP based solutions have been released so far.

Red Herring, the business magazine, performed a study this February among 1000 randomly sampled Americans over 18 years old who own a handheld device[18]. They were interviewed about their use of different wireless applications; the result is given in the figure below. Less than one in ten American adults, just 7.5%, currently own a handheld device.

Most of them use their device daily, but as many as 20% use them just a few times per month or hardly ever. The vast majority of the persons that owned a handheld device also belong to what the magazine called the "connected segment", that is persons that have access to the Internet either at home or at work and that own a cellular phone.

The survey shows the dominance of the PDAs in the US and the low penetration of smart phones. Handhelds are for the most part used as nothing more than electronic organizers. Address books, calendars, notes and to-do lists are the most used features followed by access to reference materials (national/local white/yellow pages, local restaurant listings, city guides, airline schedules, and movie listings). However, the results suggest that the customers will adopt new services like wireless e-mail and Internet fast. About 25% of the handheld owners are already using these applications even though those features have only recently become available.

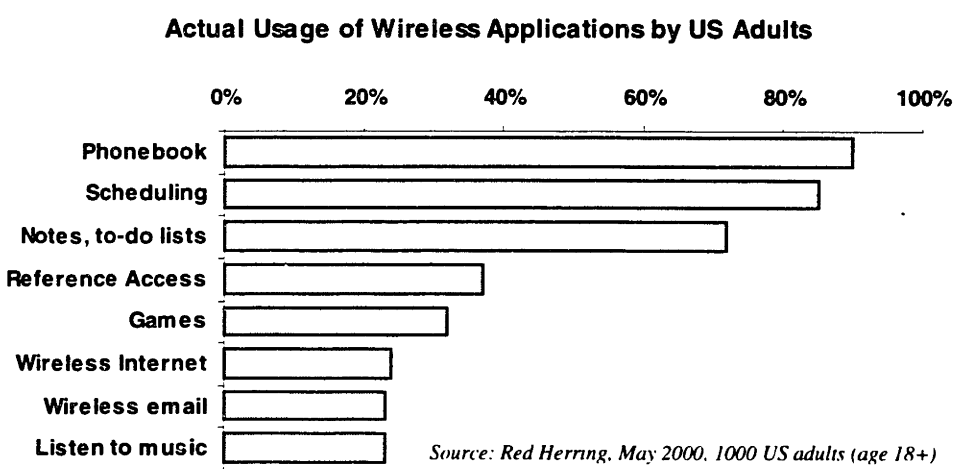


Figure 15 Usage of Wireless Applications

The world's strongest Internet brands are all American. Four of them, Amazon, AOL, Excite@Home and Yahoo, offer already their services over handheld devices, both PDAs and smart phones. Jeff Bezos, Amazon.com's founder and CEO, stated the following on the importance of m-commerce in a recent interview[19]:

"This is real stuff and no one is taking wireless commerce as seriously as Amazon.com. I think wireless is super important to Amazon.com customers, The defining characteristic of the 21st century is that people are busy. Wireless technology together with Amazon.com Anywhere lets people get their shopping tasks done, whether they are in

doctors' offices or airport terminals or wherever they happen to be. That's incredibly convenient."

Americans are advanced shoppers and Verizon Wireless announced last week that their customers will be able, through an agreement with BarPoint.com, to access comparison shopping information and product reviews based on a product's Universal Product Code right on their Web-enabled digital wireless phones. Verizon Wireless is the result of the merger between Bell Atlantic Mobile, Airtouch Cellular, PrimeCo and GTE. This is one of many recent moves by Verizon Wireless to bring world-class Internet-based information and content to customers on their handsets.

Many of the large US financial service firms, both the traditional and the new online trading houses, have pioneered the use wireless technology, I will discuss this further in the next chapter.

3.5 What does the Customer want?

What the customers want is of course the million-dollar question. This question is unfortunately very hard to answer since surveys asking consumers about preferences for services they have never used, rarely give accurate predictions. The forecasts for cellular phone sales by analysts and handset manufacturers have been consistently too pessimistic. The same is true for forecasts for Internet penetration and e-commerce market growth.

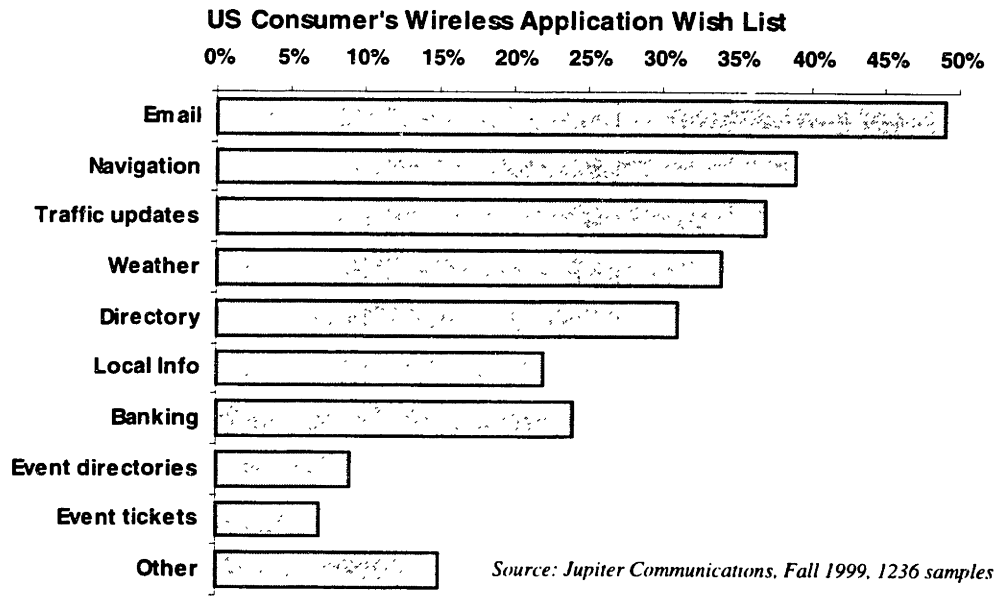


Figure 16 Wireless Application Wish List among online US Customers

Jupiter Communications, a market research company, performed a survey among 1236 online consumers in the USA during the fall of 1999, asking what kind of wireless Internet services they would be interested in. The results are shown in the figure above. E-mail comes out as the winner with 49%, followed by driving directions, traffic updates, weather news

and yellow pages, all with an interest above 30%. Information about local services, banking, entertainment and event ticket ordering followed next.

The customer needs vary from country to country because of economical, technological, cultural and historical reasons. The table below compares the wish list from second time phone buyers in Finland, according to a survey by Nokia[20], with that estimated for the US market by Forrester Research[21].

The most striking difference is in the popularity of bank services, however, this is no surprise when considering the deregulated, modern bank industry in Europe versus the strongly regulated, fragmented and old fashioned banks in the US. Internet banking is much more widespread in Europe and paper checks are very rarely used.

Finland, All Users	Finland, Executives	USA, killer apps
Banking	Banking	Yellow Pages
Phonebook	Remote Control	Navigation Aid
E-mail	Phonebook	Travel Information
City Navigation	Weather	Auction Updates
Remote Control	Yellow Pages	Stock Trading
Dial Tones	Dial Tones	Ticket Purchase
Yellow Pages	E-mail	E-mail
Weather	Travel Information	Ad coupons
Pizza Take-away	City Navigation	Weather
News	Pizza Take-away	Banking

Table 4 Comparison of Needs among US and Finnish Consumers

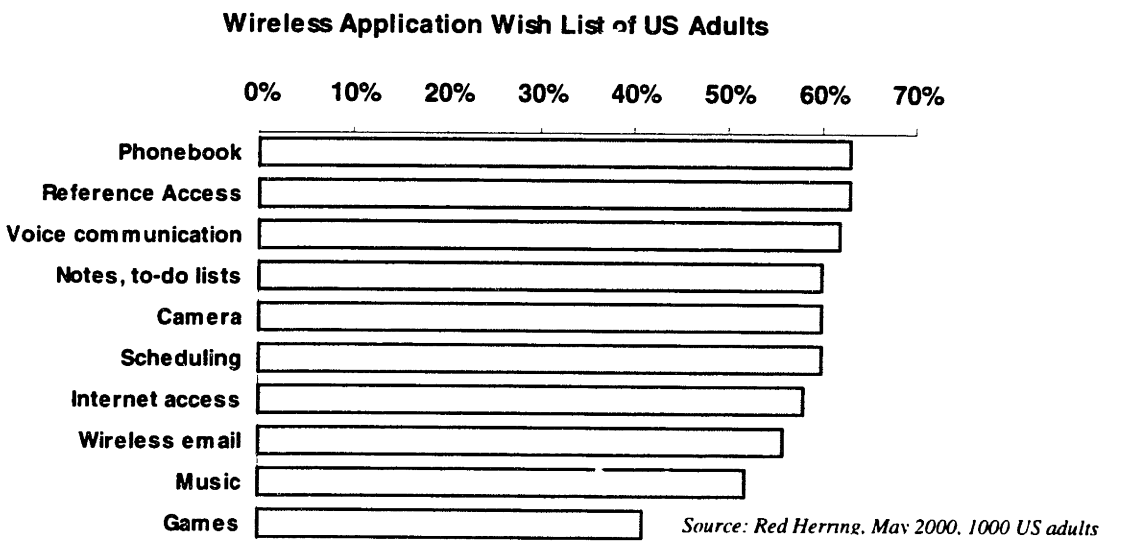


Figure 17 Wireless Application Wish among Consumers not owning Handhelds

Red Herring, the business magazine, performed a survey similar to that of Jupiter this February among 1000 randomly sampled Americans over 18 years old who did not currently own a handheld devices. They were interviewed about their interest in different wireless applications; the result is given in the figure above.

A personal address and phone number book and access to reference materials (national/local white/yellow pages, local restaurant listings, city guides, airline schedules, movie listings) are the two most popular services, with 65% being very or somewhat interested in them. Voice communication, the ability to make notes and to-do lists, camera functions and scheduling follow next, all with above or 60% interest. Wireless Internet, email and listening to music follows then, while playing games or watching TV are least popular. It is interesting to note that email does not come out as popular as among the people interviewed for this survey, while the opposite is true for the Jupiter survey.

The difference may be due to different demographic audiences, however; at least three interpretations are possible. People may be satisfied with the way they send and receive their email today because of the high penetration of PC and services like hotmail in the US. Or they do not believe it will be convenient to read email on handhelds (because they have not seen the newest devices). Bad network coverage experiences may also be the reason, if they are not guaranteed to be able to read and send email anywhere with a handheld device, they might not see the need for the option.

3.6 Service Infrastructure

In addition to the wireless network itself, a secure and 100% reliable transaction infrastructure must be in place to make mobile commerce a reality. Users may tolerate noise on their phone lines, but will not shop if credit card transactions are interrupted or diverted due to network problems. Two types of infrastructures are now available, transactions using the Internet protocols and network-specific transactions.

Internet-enabled mobile phones make it relatively easy to offer mobile commerce as one can apply the transaction standards currently available for the Internet. In most cases, this means credit card payment using the SET (Secure Electronic Transaction) standard for exchanging encrypted credit card information. Wireless versions of this protocol are currently in test mode through alliances between Ericsson, Nokia and Motorola on one side and VISA, American Express and MasterCard on the other side.

All the three large mobile phone manufacturers have allied with VISA to develop secure transaction services using credit cards applying the "Open Visa Platform"[22]. EMV, Europay-Visa-MasterCard is a joint industry group working on chip technology for electronic payments that will support this platform.

The Bluetooth technology opens up other possibilities, Ericsson is talking about developing an e-wallet with multiple smart (credit) card slots that can be in continuous wireless communication with the cellular phone[23].

Two types of network-specific transaction methods are currently being rolled-out in the Nordic countries and Japan. The first use an enhanced version of the SIM (Subscriber Identification Module) card, which resides in the GSM mobile phones, as an electronic wallet. The customer charges the e-wallet from his bank account as needed by allowing the network provider to tap his account when he sends a SMS message demanding this. The other approach, used in Japan, is to let the wireless network provider invoice the user for purchases over her mobile phone bill.

Another important infrastructure requirement is the obvious fact that the online merchants must have one form of computerized purchase and order-taking system in place before launching an m-commerce service. For example, it was relatively easy to offer customers to buy movie tickets with mobile phones in Norway since all the cinemas already used the same order-by-phone system. Ticket services will probably develop more slowly in fragmented and heterogeneous markets like in continental Europe.

The three largest handset producers, Nokia, Ericsson and Motorola, announced last month that they have formed an alliance to establish standards and a platform for secure mobile commerce transactions. I believe this announcement both signals the pressing need for a secure transaction infrastructure, but also the large market potential these companies see in mobile commerce.

3.7 Current Revenue Models

There are at least four parties involved in wireless data services, the provider selling the service, the device maker, and the network provider offering its network as a distribution channel and the customer. If you pay by credit card, another party will be involved. A plethora of revenue models are therefore applied depending of the type of service, the number of players involved and the maturity of the offering (commodity vs. exclusive, novelty vs. traditional).

The network provider is currently the strongest player in the value chain as it "owns" both the customer and the distribution channel, i.e. the whole or a large part of the chain. The access providers normally obtain their revenues either from a subscription fee (for the mobile commerce services or for the bundle of voice and data communication), a flat fee per transaction or a percentage of the purchases, or through a combination of these models.

The most common models will be discussed briefly in the following sections.

3.7.1 Subscription Fees

Access to newspaper, TV and fixed-line Internet are usually paid for through a subscription fee, i.e. you pay the same amount no matter how much you use the service. This model is not common for wireless access and information services. The most popular model is a rate for access to the network or service and then a usage fee on top of that. Most market surveys show that the customers want a subscription fee for unlimited access like for local phone calls in the US, as this is a model that is easiest to understand and compare.

The majority of analysts believe we will see a trend towards flat rate fees for wireless network access, similar to fixed line. However, most believe this will be compensated and accompanied by charges on usage of value-added services and on transaction services.

3.7.2 Consumption Fees

A fee dependent on how much you use a service is common today for data services. Both i-mode and Palm.net charge a fee per byte transferred on top of the monthly subscription fee. The move to packet switched networks will probably make this model more

popular for the seller side, however, it remains to be seen how many unpleasant invoices surprises the user will tolerate before switching to providers offering flat rate services.

3.7.3 Transaction Fees

Transaction revenues are currently small because many of the services are subsidized in order to grow the market and the adoption of the services. This is the mutual goal of the device producers, the retailers and the content and access providers. However, mobile commerce is expected to grow fast, as mentioned earlier in this chapter. The shift from voice to data is already happening in Europe, the revenues from SMS traffic are already 10% of total airtime revenues for many European carriers. Transaction fees are typically used when retailers use credit card transactions to collect revenues and for profit sharing agreements between affiliated web sites.

3.7.4 Profit Sharing

Partnership deals are usually used in so-called win-win situations, typically between a portal and a retailer with a strong brand. The retailer will argue that without them there will be less traffic through the portal or network. The carriers or the portals may claim that without them the retailers will not be able to target the affluent mobile road warriors.

The split of the revenues between the parties is unclear even among the players currently trying to navigate in these unknown waters. Deals are currently signed on a case-by-case basis and everyone is watching each other closely[24].

3.7.5 Sponsorship

Portals or network access providers are likely to sponsor some particularly popular applications to increase the overall traffic and usage of wireless data services at least in the beginning of a growing market. The trick for these lucky service providers will be to keep on differentiating itself to prevent that the service becomes a commodity as the usage increases.

3.7.6 Loss Leader

Since the cost of operating a network is almost independent of the number of subscribers, the carriers have a very strong incentive to retain and acquire new customers since almost all charges for airtime and value-added services are pure profit, just subtracted for the acquisition cost.

A loss-leader approach to gain first-mover advantage, acquire customers and build online brands is likely until the dust has settled. This approach comes in many flavors from free services for a limited period via device subsidies to free Internet access. Giving away some inexpensive service to avoid a price war in high margin market is also among the tactics

3.7.7 Cost Savings

Services sold over wireless networks may offer a large cost saving potential both for entrants and incumbents. Some of the saving potential lies in the inherit benefits of the Internet, like an inexpensive and customized distribution channel without the need for physical offices. Services that can be delivered using simple transactions or distribution of simple messages have the largest potential for cost reductions. Large cost savings have been identified for financial services like bill payments and stock trading. Booking and re-scheduling of tickets for train and plane travels and other commodities requiring little value-added information, are prime candidates.

Customer support expenses can be saved if the simple, but must common problems can be channeled to automatic services offered over wireless devices. This has the potential nice effect of increasing the quality and the value to customer by being available anytime and anywhere, while at being less expensive to offer.

3.7.8 Complementary Services

Some of the participants in the race for market shares in the wireless Internet market, like AOL, may look upon wireless information services as a complementary service needed to drive customers to more attractive products like TV, video, audio or hardware. They will therefore be more inclined to bundle services than other players. They could for example give away some services for free to recoup the loss on other related services, like phone.com for its micro-browser.

3.7.9 Technology Driven Models

The popularity of the different revenue models is also a function of the network technology and the general price pressure. Billing by the bit requires that you use packet-switching network technology and a sophisticated billing system. If the price of wireless access falls below a certain level, it will maybe cost too much to operate an advanced billing infrastructure and thereby open up for a flat fee model[25].

Billing through the phone bill will probably disappear when the credit card infrastructure is in place since the access providers are not interested in taking on the risk of guaranteeing for big-ticket purchases.

Packet-switched networks also make it feasible to sell very inexpensive services like a daily joke or horoscope in a profitable manner, this is probably impossible through other distribution channels.

4 Case Study: Wireless Financial Services

4.1 Introduction

The migration of financial services to the wireless Internet is interesting for two main reasons. First, financial transactions are the backbone of online commerce and wireless transaction capabilities are therefore a prerequisite for the take-off of mobile commerce. Second, current wireless services are good examples of what type of services we soon could expect in other areas, since financial services normally do not required media rich content and applications.

The Yankee Group, a market research company, has this outlook for the market for wireless financial services in Europe, as of December 1999:

Operators and content providers, as well as smart card vendors and software developers, have finally begun to address the market and are teaming up to provide financial applications in a wireless environment. Aside from the plethora of content-based push/pull infotainment services that have become available during the past 18 months, there has been a growing interest throughout 1999 in the development of transaction-based services. Particularly in the form of mobile banking and brokerage applications; and to a lesser extent, wireless booking and retail purchasing facilities.

For banks and financial institutions, the Internet extends their reach to customers, while offering operational cost-saving benefits. From the mobile operator's perspective, banking services provide opportunities to increase SMS and WAP usage, while attracting and—more importantly--retaining customers.

Our main focus [in this report] is on mobile banking and financial services, as we believe these applications constitute the essential stepping stones toward a wider mobile e-commerce environment. As in the fixed Internet world, wireless e-commerce will necessarily evolve in tandem with the resolution of technical and security issues in the banking and financial sectors, which clearly play a pivotal role for electronic transactions.

Since most electronic retailing involves account crediting and debiting functions, confidence in the efficiency and reliability of banking and financial applications will be a prerequisite to the widespread adoption of mobile commerce.[26]

4.2 Market Drivers

A mix of competitive, economic and technological factors drives this market. The high mobile penetration in Europe offers the banks a wider distribution channel than PCs and bank branches. Wireless transfer of data and information enable simple and easy-to-use services, anytime and anywhere without any cumbersome installation and little need for training. In addition, many potential customers in many countries are more familiar with wireless services due to low penetration of PCs and the Internet.

Financial service companies want closer (more frequent) and broader use of services, (one-stop-shop) customer relationships to strengthen customer loyalty (read: increase the degree of lock-in). The advent of Internet banking has been a blessing to new aggressive banks since they therefore do not require an expensive branch structure to capture customers. However, online banking may also a curse because it is easy for the customer to switch to another bank. They therefore need online services that both attract and retain users. The

Cost of bank transactions:	
Teller:	$1.07
Phone:	$0.54
PC:	$0.24
Internet:	$0.13

financial transaction providers will also gain cost savings if more transactions are executed over the Internet. A leading expert estimates the cost of a bank transaction over the Internet to be 12% of the cost of a normal teller transaction, see the text box[27].

The network providers seek value-added services that will enable them to differentiate themselves to attract and retain subscribers. They are also looking for increase revenues from increased network usage and profit sharing from content partnerships. Habitual and repetitive services like banking and stock trading are therefore attractive services; money is after all more important to the customers than other more nice-to-have features like local entertainment guides.

WAP provides a simpler, more cost-efficient and network and device independent solution than older technology. Previous prototypes of financial services required specific technology to be implemented by all service partners; the network provider, the handset manufacturer and the financial institution. Most of the old approaches were based on SMS messages thereby limiting the services to push and pull of short and simple text messages.

The overall driver is the breathtaking speed of the evolution of information technology and improved handheld technology that enable more powerful and user-friendly products and services.

4.3 Services Types

Wireless financial services fall into two main groups, transactions and investment services. Transaction services are a broad group and one part of it, the electronic payment backbone, forms the basis for all wireless commerce. Transaction services also include normal banking services like account status information and transferals between accounts.

The payment services can be divided into indirect and direct methods. The indirect method is conventional debit and credit card payments, the other is direct billing over the phone bill when using wireless electronic ticketing for travels, entertainment and various services from vending machines (beverage, car wash, ATMs, train passes).

Investment services are here defined as the ability to retrieve information on and to sell and buy shares of stocks and funds using wireless devices. Financial information is already readily available, while purchases are just becoming available as secure standards for wireless payments become available.

The device makers ultimately want to turn the handsets into to electronic wallets that can be used to pay for both for services and physical goods in shops; this will create the highest degree of stickiness and lock-in.

4.4 Current Services

Japan and Europe are paving the way for mobile commerce for two reasons. First, these countries have the highest penetration of cellular phones and one common network type. Second, the majority of the banks in these regions have a modern information technology infrastructure and advanced services like online billing is already available.

4.4.1 Europe

The Nordic countries are leading then it comes to wireless banking services. Pundits attribute this to a high degree of automated bank services due to a severe bank industry crisis in the early 90s, high labor cost, a computer literate and highly educated population, and a high penetration rate of home computers and mobile phones[28]. Fokus Bank of Norway claim to be the first to offer banking services over WAP phones, however, few experiences can yet be drawn from this service due to a shortage of WAP phones.

MeritaNordbanken, a Finnish-Swedish-Danish finance house, is the largest Internet bank in the world in terms of number of online user and the bank is aggressively expanding into wireless services. In fact, MeritaNordbanken is offering their services on all kinds of devices including phones, web-TV, PCs and smart phones. They believe this increases the convenience and value of their services to the customers and also enables a closer and more personal relationship.

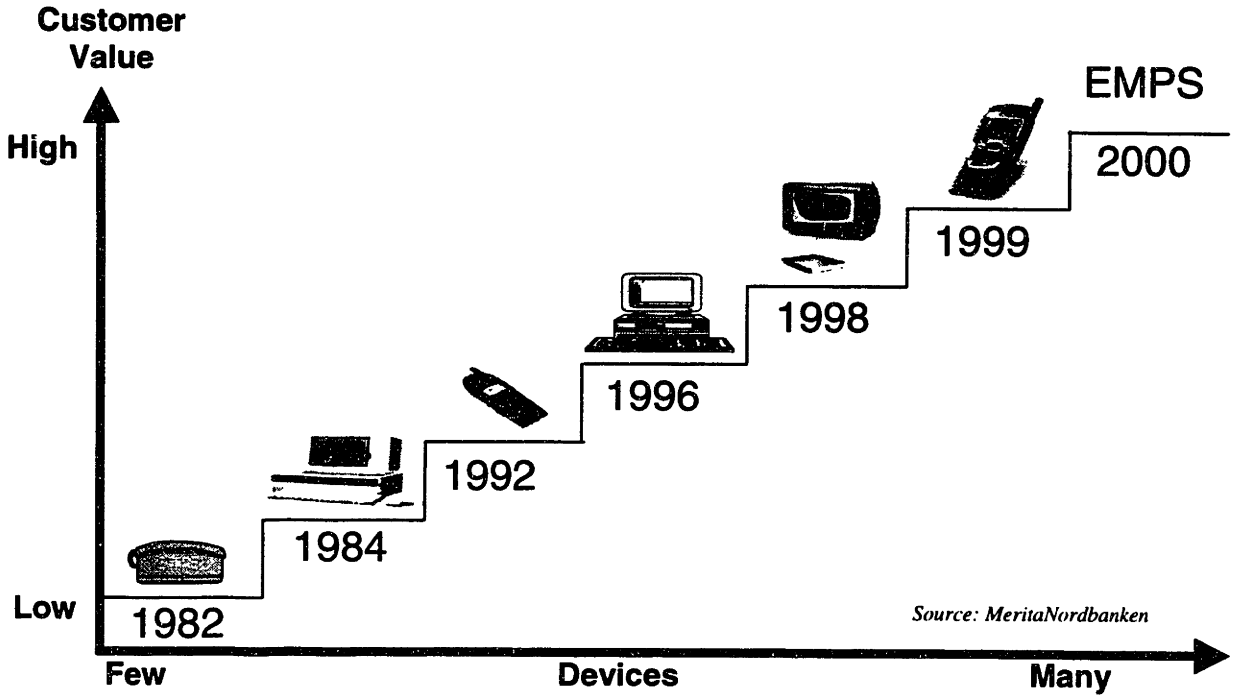
Using a WAP phone, customers using the Solo service can trade stocks and funds, pay bills, transfer money between own accounts, query and receive account and stock information. SMS messages are used to send receipts to the handset confirming the transactions. The user just need to visit a bank office once to sign a contract and get a personal PIN code, this code can then be used to access the services on all devices. This also means that the customer does not have to install anything more than once since MeritaNordbanken's Internet services are transparent across device platforms. The valuable effect of the common password is that it increases the switching cost to go to alternative banks, as it will be more inconvenient. The service has a monthly subscription fee of three dollar, but the bank does not charge transaction fees.

The bank has also a shopping mall, called Solo Mall, on their web site that bring together private and corporate customers. MeritaNordbanken figure they have a role to play as a portal since the customers want a one-stop-shop for their regular financial transactions. MeritaNordbanken's Solo shopping portal is Finland's largest e-commerce web site in terms of number of retailers and customers. The retailers pay $1.5 per month to join the online shopping mall, but no transaction fee. However, they want to do so in the future, since the bank is considering spinning out the portal as a separate business.

The bank acknowledges that it is in a fortunate position due to its market dominance and the modern bank system in the Nordic markets[29]. The Nordic countries have stopped using paper checks and have among the smallest cash versus GDP and largest credit card payments per capita ratios in the world. In addition, the high Internet penetration and the bank's large market share create a critical mass of Internet traffic. MeritaNordbanken has 40% of the private and 50% of the corporate customers in Finland, slightly smaller market shares in Sweden, and considerably less in Denmark. They are not sure whether the business model will work in countries they currently are considering to enter.

The main drivers behind MeritaNordbanken's Internet strategy are to retain and acquire customers and simultaneously save costs. 60% of the stock trades, 10% of mutual

fund transactions and 13% of credit applications are now executed online[30]. The private online customers visit their web sites on average 5 times per month to pay their bills. The



bank estimates that online transactions cost them about half of conventional methods. It also reduces credit risk, eliminates the float and mistakes due to typing errors, as most of the transaction information can be pre-filled into the online bills and invoices.

MeritaNordbanken is also adding value-added services like e-salaries and e-invoices to its corporate products, building on its IT infrastructure, large customer base and close customer relationships. The next step is EMPS, Electronic Mobile Payment Services, a joint project between the bank, Nokia and VISA. EMPS uses an extra SIM card slot in the phone to enable secure payments, electronic cash, management of loyalty points, download of electronic tickets etc.

Included it the ability pay instantly for goods in shops using the e-cash in the phone and a Bluetooth module to communicate with the cash register. It will also make it possible to order movie tickets over the Internet using your WAP phone, download the ticket to the SIM card and printing it as a proof of purchase at the cinema using Bluetooth to communicate between the phone and the ticket counter.

The Woolwich bank in UK was the first British bank to offer its customers secure access to Internet banking services from their mobile phones, using a WAP server solution. Customers of the bank's personalized banking service, Open Plan, are able to run their accounts, no matter which mobile phone network provider they use, by using their phones to dial-up their Internet service provider at their usual call rates. They can be confident of complete security as their transactions are transmitted from the WAP phone to Woolwich's exclusive WAP server.

The first group of customers was offered a free Nokia 7110 phone with one year's service contract in return for taking part in a market research program. They are able to check balances on all of their Woolwich accounts, move funds between accounts, view current and

investment account statements, pay bills and issue instructions. The knowledge gathered as a result of this exercise will be used in planning the rollout of the service to all Open Plan customers[31].

UK's BTCellnet has run trial projects together with the Barclay bank using the Barclaycard to make purchases. They offer micro-payments using e-cash download to the card using Motorola's dual-slot handset with a credit card reader. This service show the potential of wireless banking, the turnover rate among the users of this service is only 7%, compared with the average of 35%[26]. Two other large carriers in the UK, Vodaphone and Orange, have been on the sideline, but are now offering WAP-based solutions.

Most wireless banking services in Germany, like Deutche Telekom's T-mobil and Mannesmann's D-2, are SMS based limiting the functionality to account inquiries, making it hard to compete with the popularity of Internet banking. Deutche Bank (DB) launched a WAP service in March in cooperation with Nokia. DB is betting on the same portal strategy as MeritaNordbanken and is planning to offer a full suite of financial transaction over WAP devices.

France is strong on smart card technology and the former telecom monopoly, FTM, offers applications using technology similar to the dual-slot approach by BTCellnet and Barclaycard. The other large carrier, SFR takes a more open and WAP oriented approach.

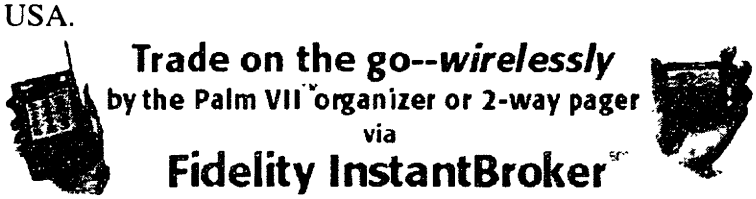
4.4.2 Japan

As described earlier in this document, NTT DoCoMo's i-mode service has taken Japanese consumers and corporations by storm. They have actually been forced to stop taking on more subscribers and to stop adding more web sites to their partner site. Over 250 banks offer online bank services in Japan over the i-mode network. The services are the same as European banks offer over WAP phones. Insurance companies, lending institutions and brokers also offer part of their services over i-mode.

4.4.3 USA

USA is behind when it comes to wireless banking services, but ahead with respect to wireless brokerage services. Online trade pioneers like E-trade and traditional institutions like Fidelity Investments offer wireless trading.

In fact, wireless trading has been possible over dedicated pagers for quite a few years for heavy traders. New two-way alphanumeric pagers from RIM and Motorola offer traders higher bandwidth and far superior coverage compared to the cellular phone networks in USA.



Fidelity investments launched a pilot for wireless trading on a subscription basis for its best customers nearly two years ago. The service, called InstantBroker is now available for free for all customers. Different plans are available and you get a free pager if you enter into a one-year contract with BellSouth for the paging services at $50 per month. This service, although still small in volume, grew 104% last quarter and may hint at a very rapid adoption of services like this[32].

The brokerage companies are very active in forging alliances with the network providers and ISP so that their services are sported on the top-level menus for wireless data services. They have considerable bargaining power since market surveys in the US consistently show that financial services are the most desired wireless service together with e-mail.

Similar to Europe, the financial services companies want to grab the best real estate in the wireless Internet space before the competitors. They also want to differentiate themselves as a leader and pioneer among the wealthy early adopter segment that are very attractive, but not loyal customers. The brokers are going wireless also to retain their current customers and to save cost. They save cost by shrinking call centers or charge for this kind of services to guide the users to the most cost-effective customer interaction from the broker's point of view.

Wireless banking is becoming popular too, Bank of America, the largest bank in the US, offers Palm VII users in California to check their account balances and review other account activities, true transactions are planned for this year.[33]

Last summer, W-Trade Technologies announced the release of W-Bank, a "complete wireless banking solution". W-Bank offers the user to; access real-time to checking or savings account balance information; transfer funds between different bank accounts; pay bills electronically; create intelligent alerts that inform of when deposits have cleared, checks have been paid, or when there are any other changes to their accounts.[34] The same company pioneered in 1998 wireless stock trading services over pagers by launching the W-Trade application used by stock brokerages like MyDiscountBroker.com.

5 Scenarios

5.1 Original Scenarios

This section contains the original scenarios that I used during interviews with leading experts on the market for wireless information services. Please refer to appendix 7.2 for a list of the persons I interviewed for my thesis project.

5.1.1 Assumptions

When developing these scenarios, I envisioned a not-to-distant future of wireless network access, with speeds comparable to that of cable modems, available anywhere in the developed regions of the world. Macro economic factors are disregarded to simplify the discussion, but will of course have a large impact.

These assumptions are made to be able to look at the competitive landscape and the power of the different players in terms of their positions in the value chain, installed customer base, closeness to the end customer, alliances and competitive advantages. This may be an oversimplification since important first-mover advantages can be gained by faster uptake of new technologies or service innovations.

5.1.2 The Wireless Network As A Toll Road

This is the pessimistic case, from an end user point of view, in which the network access providers leverage their ownership of the customer base to offer wireless information services only through their preferred content and application partners. Furthermore, no open standard has been established for the operating system of wireless information devices resulting in a slow growth of available applications and in sales of devices and services. The slow subscriber growth discourages the applications developers from offering new services and the carriers from updating their networks to 3G, thereby reinforcing a vicious circle.

The established network providers, e-commerce players, Internet content providers and handset producers with strong brands and strategic partnerships get the largest pieces of a slowly growing pie of affluent users.

5.1.3 Internet and Commerce Without Wires, Why The Hype?

This is the status quo case in which the wireless aspect is seen as just a natural transition from one network type to another without changing the playing field dramatically. Several software and infrastructure standards co-exist, favoring development of high-end and vertical applications. The portals and content providers balance their customer bases against the market power of the network providers and device makers to enter into profit sharing alliances. The market grows steadily as the new network infrastructure are deployed and more and more workers and professionals hit the roads, but m-commerce does not penetrate the consumer market as they prefer the comfort and security of the home-PC or digital TV.

5.1.4 New Unique and Value-added Offerings Create New Markets

This is the optimistic case both from the consumer and seller side. The global UTMS network offers access anytime and anywhere for any kind of compliant device. The industry has also agreed on a standard OS and set of APIs, fueling development of services and applications. This creates strong network effects and tips the markets from fixed line and PC to wireless devices and applications.

Strong competition results in affordable prices feeding a reinforcing feedback loop of rapidly growing markets resulting in more competition, innovation, add-on services and thereby more growth. This creates economies of scale and scope and paves the way for new affordable appliances combining current stand-alone devices and services. Personal information management tools (video, voice and text messages, phone and address book, yellow pages, organizer, phone, pager, answering machine) and entertainment and infotainment features (walkman, radio, game console, photo, video, TV, news, travel guide, baby sitter) morph into multi-functional or specialized devices.

Dominant form factors and designs for devices coupled with secure transaction methods give the offerings credibility and lower the risk for the customers, fueling a strong growth in demand for wireless information and commerce services. Companies that move their offerings to the new channel increase their market share while the slow movers suffer declining market share and revenues.

The customers are faced with a range of competing offerings, as it is easy to switch from one operator to another. Internet surfing is as easy as it is today on PCs thanks to a standard and improved user interface. The winners are players with strong brand names, a compelling value proposition and superior customer service.

5.2 Feedback on Scenarios

There was a general consensus among the experts and managers I interviewed that my most optimistic and pessimistic scenarios represent the likely range of possible future outcomes. The majority believes we will move from the current closed (i.e. the pessimistic) case to the open model (i.e. the optimistic scenario) ending up somewhere close to the open case. The experts believed that the open model would eventually "win" due to technical improvements and competitive pressure.

Today, the user interface of handheld wireless devices is too cumbersome to encourage Internet browsing and navigation the way we know it from the fixed-line Internet. In addition, some network providers use their market power to confine the customer's choice to a predefined set of partner sites and services hard-coded into the handsets. Palm applies the same approach for their wireless handheld. The handset producers have also few incentives to provide open and flexible phones that can be upgraded via downloads over the Internet since a large part of their revenues are from replacement purchases.

However, there is a general believe that the proprietary model is not sustainable as it only takes one runner-up carrier who open for "free" wireless Internet access to force the rest of network providers to follow suit. Of course, this assumes that Internet navigation is in practice possible and user friendly enough and that a critical mass of non-exclusive sites and services exist.

Another common theme was that no one knows what kind of business models that will be sustainable. This is not surprising for an industry or market in the beginning of the adoption curve. During this period there is a lot of uncertainty and experimentation and many participants join the battle to grab a piece of the market.

According to the theory[35], we will in a situation like this first see an era of rapid growth. This period is marked by a lot of innovations leading to improved products and offerings. The next phase is consolidation resulting in less product innovation, more process improvement, but fewer players.

The winners in such markets will often be the first-movers that are capable of remaining nimble and innovative while protecting their early strong-hold in a rapidly growing market. Other winners are typically new entrants that are overlooked by the incumbents since their offerings in the beginning do not appear to be a threat to the big players. However, as the technology develops the innovation proves to be superior to the incumbents[36].

The case of the CDMA technology may serve as a good example. The founder of Qualcomm, tried, for over ten years, to persuade the wireless industry to apply the old CDMA technology that could transfer three times more of traffic than the dominant TDMA technology. He was met with almost zero interest until the growth of data traffic made capacity into an important issue. Qualcomm is now may be on a fast track to become the Intel of the wireless Internet because the next network generation (3G) will probably use CDMA and Qualcomm owns over 300 patents for this technology[37].

In the case of wireless information services we also need to take into account some special characteristics of information markets[38], the network effect and tipping of markets.

The network effect refers to the fact that the value of a smart phone is zero if no services are available, on the other hand, the more services that become available the more useful and valuable the phone becomes.

Tipping happens when one product or technology is perceived to (either true PR and marketing or technological superiority) be the standard the majority prefers, thereby greatly increasing the value of this product or technology compared to other offerings. This creates a self-enforcing feedback loop that tips the market towards the standard or winner and this can create so-called natural monopolies.

Examples of this are the Betamax versus the VHS videotape technology and to a certain extent Microsoft Office compared to equally technically advanced products, but with much smaller user bases.

A similar effect is seen in many markets for wireless communication. When the market penetration of mobile phones reaches a number between 20 and 30% the handset sales growth accelerates. This is believed to be the result of a fear of not being connected, when "everyone" else has a phone I also need one to be a part of the loop.

One aspect that was stressed by everyone I talked to is the fact that the mobile Internet is not one global market, the markets are very different from region to region.

5.3 Revised Scenarios

5.3.1 USA

The US market is the most fragmented and open market. It is therefore very hard to predict how the wireless Internet will evolve in this region. Given the recent merger and acquisition frenzy, the only certain prediction is that a lot will happen, but how and when is unclear.

The lack of a standard wireless network, expensive bids for licenses, incomplete network coverage, inferior quality of services, roaming charges and the fact that the receiver pays for incoming calls to a cellular phone, slow down the growth of wireless services and the move to new network generations.

The growth in the market for wireless information services in the USA are dependent on the development and diffusion of systems that enables the user to navigate the mobile Internet and execute transactions using their voice rather than a pen or a keypad. This is needed since Americans spend a lot of their time in cars. This technology will probably not be available on a commercial scale before 2002 according to Andy Seybold[40], a leading expert.

USA also lacks a vibrant teenage segment of mobile phone users that can drive the market for services like instant messaging. Prepaid SIM cards have been a great a success in Europe, especially among parents, as a way of controlling the cellular phone bill, this service is currently only available for analog phones in the US.

We might see a temporary setback in the US for wireless Internet services since the PC and Internet penetration is higher in the US than in the rest of the world. This is quite likely when the "spoiled" Internet user discover that the hyped wireless Internet is nothing more than four short lines of text on a tiny screen over a very slow network. This valley of disillusion may delay the uptake of the wireless Internet in USA for a couple of years[39].

On the other hand, USA has the largest customer base of time-critical transactions like stock trading and online auctions and a large work force working outside of the office.

This summer there will be an auction of new frequencies that might alter the competitive landscape in the US. It is rumored that players like AOL, Microsoft and Cisco may bid for licenses with the aim of offering new services circumventing the old network providers. If for instance 25% of AOL's subscriber base join a wireless service, AOL will suddenly be the 5th largest carrier in the US[40].

As the cost of new spectrum for 3G networks is skyrocketing at auctions around the globe, there is a fear that companies will overbid each other so that they will not be able develop the network rapidly (or not all) or let the customers pay for their frenetic bidding.

I predict that USA will continue to lag behind Japan and Europe in developing the wireless data services market, but not then it comes to innovation. Wireless PDAs will dominate over smart phones since the form factors are better and because the majority of the potential customers, the early adopters and business people, already are used to these devices and spoilt by the Internet over PCs at home or at the office.

Simply put; USA has the venture capital money and the innovative software and hardware companies, while Europe and Japan have the markets, the standards and the infrastructure.

We will see a flood of new applications for vertical markets to target the profitable market segments. The winners will be companies offering data services combining the strengths of the different devices to deliver a compelling integrated product over the Internet. Personal information services that save time and organize the life of busy business people will continue to grow in popularity and eventually become a standard feature.

Applications for teenagers and student will be the key to cross the chasm to penetrate the consumer market. Wireless access must become cheaper to attract these customers; cheap MP3 players as add-on modules, flat rate, caller-pay and prepaid services are vehicles to achieve this.

5.3.2 Europe

The market for wireless information services is more promising in the near term in Europe for many reasons. A larger market penetration, a common network standard, modern infrastructure, good coverage and quality, an upcoming number portability regulation and calling-party-pay schemes are part of this picture. Fierce competition further fuels a growing market and innovation of value-added services, as the carriers need these services to get additional revenues and to retain and acquire new customers.

Prepaid calling and SMS messaging have created a growing market among teenagers changing their habits and communication and buying patterns for life. Decreasing calling rates make it cheaper to use a wireless carrier than fixed line in many countries. Mobile communication is becoming so popular in some countries that some network providers simply have to upgrade their network to 2.5G and 3G to gain enough capacity.

If we look at mobile phone penetration against Internet subscription penetration, see Figure 14, a two-part segmentation becomes apparent. Northern Europe is characterized by high penetration of both phones and the Internet, while the Southern part has much lower penetration of the Internet. France is, as in most other cases, a special case, partly due to the Minitel network.

This means that the services in northern Europe must add more value, must be more content rich and tighter coupled and synchronized with conventional and complementary Internet services. Service providers should therefore concentrate on value-added transaction services taking advantage of the unique properties of a 2.5G wireless device, i.e. the fact that it is (almost) always on and the location and the user identity are known.

It also implies that simple, but useful or entertaining services like the i-mode concept probably would be popular in the southern part of Europe. The novelty effect may also be used profitably to introduce low-cost, high-fun or high-value services like gambling results and stock alerts.

In Europe, we will continue to see a tremendous growth in consumer applications over WAP phones, the focus will shift from the teenagers to young families since they have more buying power and less time. However, B2B services will follow shortly as this is probably a much larger market. The key to the growth will be the deployment of secure payment methods. The industry should work together to agree on open standards that can open up the market for m-commerce.

If the mobile phone becomes your wallet, the industry has reached its ultimate goal; the creation of a mass-market product that is with the customer anytime, anywhere. The market opportunities for this marketing real estate are mind-boggling.

5.3.3 Japan

The Japanese market is characterized by high fixed line calling rates, no receiver-pays billing, low penetration of home-PCs and Internet connections, and one dominant carrier (NTT DoCoMo) that has launched the highly successful i-mode service. The i-mode has a unique always on, pay-per-bit-transferred concept.

i-mode has been particularly popular with teenagers. This popularity is believed to be the result of social and market factors typical of the urban regions in Asia. Since families in Japan normally have just one fixed line and one phone located in the main living room, a mobile phone gives a very valuable privacy. It is also a symbol of independence and status, both important to grown-ups.

Even though ATMs are commonplace in Japan, the banks charge a fee for withdrawals during weekends. Over 250 banks are i-mode partners offering electronic payments eliminating costly and time-consuming visits to the bank or the ATM.

Even though the Japanese are famous for their conservative banks and a high degree of saving and risk adverse attitude, stock trading is becoming more and more popular. However, Internet banking is not common place, but the success of the I-mode service has increased the use of wireless financial services.

As mobile phones become ubiquitous the demand for wireless bank increases, this may create an interesting market entry possibility for new nimble banks to outsmart the incumbents. Several Internet bank initiatives have been launched recently and a group formed by Sony, Softbank and the 7-eleven store chain will shortly launch a pure Internet bank in Japan.

Long work hours and long commutes on public transportation increase the need and opportunities for mobile communication in Japan. Some commentators attribute the success of i-mode to the fact that DoCoMo has marketed it as a distinct service, not positioning it to be the wireless Internet[41]. This is a clever way of manage the customer expectations.

The i-mode success seems to prove that an open model is the most profitable way of growing the wireless Internet market. A large number of i-mode-enabled web sites and services has been launched, further increasing the value of the service creating a positive feedback loop with network effects gaining all parties. NTT DoCoMo is very well positioned as the company extract revenues both from the content and service providers and the phone callers.

Download of cartoons and pictures are among the most popular i-mode services, this may suggest that the i-mode service may act as a test bed for media-rich advertisement models. The i-mode handsets have screens with colors and better resolution than European and American counterparts and the user is always connected. This opens up new arenas for advertisements, for example using the screen picture or messages to send targeted offers and coupons.

As the customer acceptance of the i-mode services continues to grow, the number of services and sites and increased bandwidth will increase the value and sustainability of time and location dependent information services. DoCoMo must be careful so it does not become too greedy since its strong position makes it tempting to rise for instance the transaction fees.

Japan will be the first country to deploy a 3G network next spring and this will probably give NTT DoCoMo and its suppliers important first-mover advantages and

experiences. If the current growth in the subscriber base continues, the market in Japan and China will be 1.5 times that of Europe in 2006.

I predict i-mode will continue its explosive growth in number of subscribers and services for some years to come. DoCoMo and its content partners will pioneer the use of 3G-network technology. We will see innovative applications taking advantage of the higher bandwidth and handset with GPS, color screens and video capabilities. i-mode will be so popular that it probably will reduce the need for home PCs, making the Japanese market even more special.

Other countries should watch this development carefully despite that cultural and competitive differences will not guarantee the success of every copycat. DoCoMo should expand outside of Japan, leveraging their unique experience and expertise; I will not go into details about how since this is the topic of another MOT thesis this year.

DoCoMo's strategy is risky because by applying the open HTML standard, they basically rent out their bit pipe to anyone without providing value-added services beside the billing option.

5.4 Technological Factors

The table below is an optimistic attempt at relating future profitable information services with future wireless technology and network improvements. The upper part shows when different technology developments reach the mainstream market and the resulting benefits thereof. The lower part shows how new services emerge as the technology improves and evolves. This is a broad picture since local market conditions will play a significant role. Note also that the timing of the deployment of these different technologies will vary around the globe.

	2001	2002	2003
Network	GPRS	EDGE	UTMS
Operation Sys.	Proprietary	CE + Epoch + Palm	Open standards
Data Formats	web clipping, SMS	WAP, syncML, WML	Open standards
Main Benefit	Always On	Increased Speed	Ubiquitous Bandwidth
User Interface	Keypad, menus	Pen, keyboard, links	Voice and handwriting
Communication	Voice, SMS	Email and chat	Video-mail, data transfer
Transactions	Bills, trades	Tickets, map downloads	Video/audio previews & ads
Information	Headline news Reminders	Video/audio-streaming Yellow pages, guides	Localized, timely, media-rich Info, news, alerts, reminders
Entertainment	Joke, horoscope	Cartoons, gambling + games, streaming audio	Multimedia network games + Real time video and audio
B2B	Email, alerts	Collaboration, intranet	Extranet, network terminal
Advertisements	Text messages	Picture coupons	Audio and Video

Table 5 Roadmap for Wireless Technology and Services

Today, we see the growth of simple transaction oriented services compatible with the network speed and the handset form factors, keypad user input and a handful of lines of text on a black and white screen. We also see a race to grab the best land because it is so crucial to have your services on the top-level menu of the wireless device.

The main drivers for this are the urge to build the wireless brand; to shape customer habits and the fact that current technology does not allow for easy personalization and easy navigation. Today, the carriers control the menu content of the micro-browser either by "burning" (also called hard-coding) it into the handset before shipping or by downloading and updating over the air the menus via the SIM card in the device.

The move to an always-on mode when GPRS becomes available will open up for value-added alert, reminder and push services of all sorts, like we have seen in Japan.

Over the next few years, we will see services like dictionary services, Intranet communication, video and audio streaming enabled by increased network bandwidth and more user-friendly and standardized micro-browsers. A move to open standard for micro-browsers, application program interfaces and network protocols are crucial to achieve this.

However, the mass-market breakthrough will not take place before high-speed networks with voice recognition and GPS functionality are in place. The mobile device will then replace the PC as the main terminal to widespread networks (Internet, Intranets and Extranets) delivering information and media rich content and services anywhere, anytime. Since these technologies enable targeted advertisements, prices for network access, devices and services will decrease causing a positive feedback loop fueling more growth.

5.5 Nokia's Phone Scenario

Nokia concludes, based on a market study[42] that the future phone might be capable of performing quite a few tasks:

According to consumers, the future mobile phone is not just a phone anymore, it is also a digital camera, a video camera, a tape recorder, a TV, a video recorder, a tamagotchi, a karaoke with a songbook, a mini-stereo with mobile loudspeakers, a play station, and a GPS-navigator. It contains an electronic dictionary for twenty languages and an automatic word translator. It is very small, quick and light, and it can be totally controlled by voice.

The ideal phone contains maps of the world's most important cities, and you are able to scan more of them. The mobile phone tells your location if you are lost, or advises you about local services. It also informs you about traffic jams, bus timetables, menus of the nearest restaurants, and TV programs. The SIM-card is also a bank- and VISA-card, a driving license, a passport, and a key to your car and home. You can control your home electronic appliances with the mobile phone. The mobile phone's battery can be charged by solar energy.

The phone has a connection with a printer, and it contains a text and photo-editing program. You are able to compose ringing tones. The phone includes a schedule, an address book, and a more advanced calculator, for example, for engineers. It is possible to receive phone calls only from certain numbers, for example, during a meeting. When it comes to Short Messaging, it is possible to write bold, italic, and underlined text, and one short message can contain at least 300 characters. The Short Messaging Service also includes the symbol of heart, and ready-made electronic postcards.

5.6 Long Term Scenarios

5.6.1 The disappearance of the Internet

I predict that, as the bandwidth increases and the cost of RF chips decreases, more and more devices will be hooked up to the Internet, eventually becoming so pervasive that no one will notice. An illustration:

It is April 27, 2006, and you are coming home after work. To enter your house, you scan your smart card through the reader of the home access control system. Hungry you rush to the microwave oven to get the warm pasta meal you had ordered. While driving home from work, you talked to your car PDA and instructed it to send a message to the oven. Before you left in the morning, you checked the home server for emails from your co-workers overseas. You also looked up the new recipes that you grocer had sent you and decided to go for pasta and put the meal in the oven before you left for work.

On your way home that day, you stopped by your favorite grocer and picked up the stuff your home management system had ordered by sending an email with a shopping list. The home management system is a device and software from SoNok (the result of the recent merger between Sony and Nokia) that link the information system of your fridge; temperature controlled storage room and home access control system.

The mundane task of running a family became much easier two years ago then the UN agreed on expanding the bar-code system to include a little Bluetooth chip attached to all kind of merchandise. This enables your home access management system and fridge to automatically scan new groceries entering or leaving the house or the fridge. As new information is beamed to the home server, it will automatically update your shopping list based on the inventory status and your preferred recipes for the week or the day.

5.6.2 D2D - the next Big Thing

I believe we will see an explosion in applications for corporations and businesses, so-called B2B services. This will happen after the Internet and associated information services have successfully migrated to wireless networks, due to increased bandwidth and standardization. The network will indeed become the computer and the value of the network, and the market for these services, will grow according to Metcalfe's law. All kinds of services for corporate database connections and marketplace interactions will be commonplace.

Current PC and Internet applications focus on the knowledge worker, the data interpreter and the content creator. A move to wireless computing will shift the focus to the content consumer, the data and information collector and the transaction worker that need to execute immediately together with the customer.

The next big thing after B2B will be D2D, device to device. D2D services will make a plethora of applications more automatic, cost-efficient, and time and location independent. Prime candidates are inventory management, supply chain optimization, remote control and monitoring together with management of fleets, assets and people.

Interconnected, smart devices will also enable a breed of new applications that are not feasible, imaginable or profitable with current technology and networks.

Look to Finland for signs of future applications, a prototype of a new smart parking meter has just been put on trial. You pay the parking meter with your mobile phone and the parking meter will call your mobile phone 5 minutes before your parking time expires. You may then opt to pay more to extend the parking time or acknowledge that you will be there on time.

That is what I call a convenient, location dependent and time-critical service with a superb customer service, however, the market potential remains to be seen.

6 Conclusions

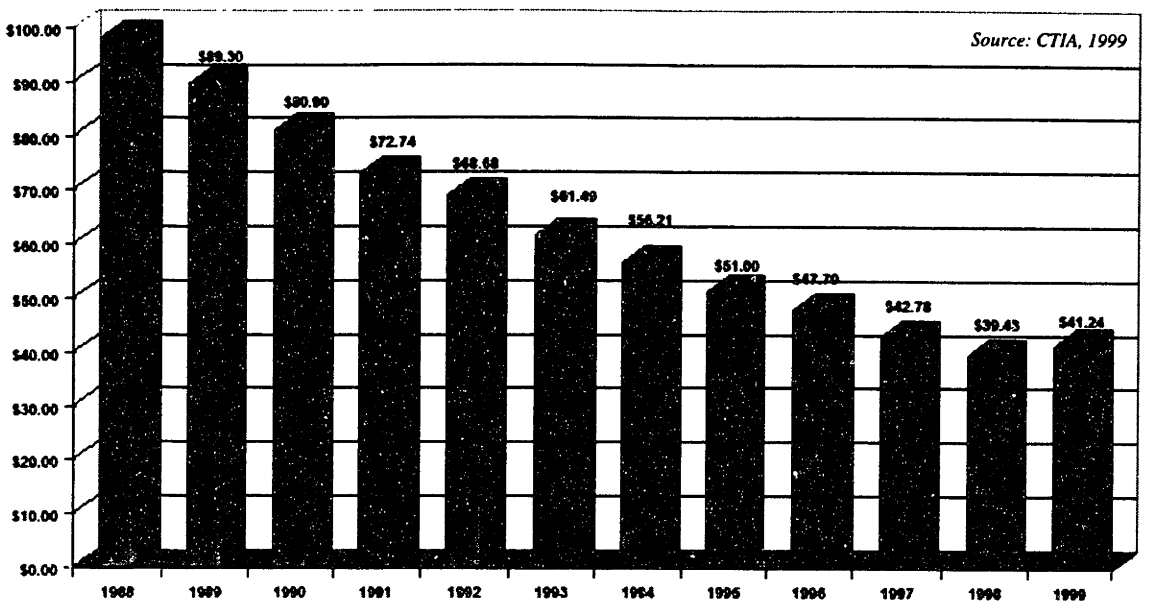


Figure 18 Average Monthly Local Wireless Bill, USA, 1988 - 1999

6.1 Market Drivers

6.1.1 Price and Price Structure

Price is of course an important driver and the structure of the pricing is often more crucial than the price level itself. The voice of the customers is pretty clear; they want a flat rate for unlimited access to the wireless Internet. They will be willing to pay small fees for transactions, but not very inclined to pay for content, as they are used to get this for free, at least in the US.

6.1.2 Closer Customer Relationships

The main driver for the wireless data market is the quest for increased revenues by building a closer and richer customer relationship through anytime, anywhere services. The players believe they will be able to extract more ad, transaction and subscription revenues by becoming an ever more important and frequent part of the customers everyday life. What we see is fight for the "belt space", the little device(s) that we carry with us around the clock.

6.1.3 Convenience

It is hard to beat a service that does not require you to be at a specific place at a specific time. This is especially true for commerce, the old brick and mortar regime centered

on the "we will sell you what we have at our places when we are open" paradigm which will have to compete hard against the "I will buy what I want when I want to" attitude.

6.1.4 Convergence

The convergence aspect has many dimensions; here I will just point out two of them. The first is the convergence of voice and data networks, enabling text, audio and video to be transmitted over the same networks and being received on the same device. The other is value added through the convergence and synchronization of services across multiple hardware platforms.

A prime example of this is personal information management services like MyYahoo that offers access to a central database of addresses, phone numbers, to-do items, reminders from any device in a customizable fashion. The inconvenience and inconsistency of having both a Palm, a phone and contact manager on the PC will hopefully vanish, but this requires the definition and adoption of a full suite of standards and protocols for interoperability and synchronization.

6.1.5 Competition

It should not come as a surprise that a large part of the activity within the wireless Internet space is driven by the fear of being left behind. This market is regarded as a first-mover opportunity. The fear is further fueled by the heavy up-front investments in infrastructure, customer databases and licenses that have few alternate applications, creating a win-or-die attitude.

6.1.6 Commerce

All players have a common interest in growing the use of mobile data services as they hope that the convenience and added value will lure the customers to perform more of their purchases through this channel, thereby creating transaction, profit sharing and ad revenues.

6.1.7 Customization

Phones and PDAs are very personal devices and since always-on services will know the identity and the location at any time, it opens up many avenues for personalization and customization of the services. This will increase the value of the offerings to the customers and enable the network and content service providers to charge higher prices to customers, partners and advertisers, provided that the privacy protection issues are solved.

6.2 Strategies

The most striking observation from my study of the wireless information business is the fact there is no consensus on a recipe for success. Everyone readily admits that they do not know which strategies and business models that will work. The majority of the players

are therefore hedging their bets by testing different approaches and establishing a row of partnerships. However, due to the nascent stage of the market, some approaches are more viable than others are and they are outlined below in order of importance.

6.2.1 First Mover

The development of the Internet and e-commerce show how important it is to quickly grab the opportunities that open up as the wireless Internet come of age. The special characteristics of information markets, i.e. high up-front cost, low variable cost, tipping, network effects and lock-in, makes it even more important to establish a strong fort as soon as possible since the barriers to entry are few and small in the beginning.

6.2.2 Profit Sharing

The Internet is a network and m-commerce is accordingly only possible through an intricate maze of access and content providers, and software, hardware and transaction infrastructure vendors. Nonetheless, many corporations in this space behave like they can act independently, like the old "I set up my store front here and do not care about the rest" attitude. This will not work when the competitor is just a call or a click away. Profit sharing agreements are therefore instrumental in ensuring that your offerings are present at the hot spots of the wireless Internet. Sharing the same incentives also means that every party involved, work in a coherent way to offer the best user experience. Aligned goals are instrumental since no single company has control of the whole customer experience.

6.2.3 Meet unspoken and subtle Needs

Why have the mobile phone and data services become so popular among teenagers in Europe and Japan? The answer is probably that they meet a range of needs important to this group. I believe the most important is the need for independence from the parents and self-recognition as they move from being children to adults.

Since most teenagers continue to live longer with their parents due to longer education and thereby are financially dependent on them for a longer period, a mobile phone give them their own private and personal sphere. One reason why we have not seen the same trend in the US may be that the car fulfills the same need for independence.

Having a mobile phone also serves the old and strong need for being part of the gang. The needs to own a status symbol, to be accessible anytime, anywhere and the inherent increased security are also powerful arguments for buying a phone, not only among youths. These arguments are supported by recent research[43].

The security argument has been used successfully in Europe, people feel more secure than they can reach or be reached wherever they are. The poor network coverage in USA weakens the security argument in this region; however, the E911 requirement will probably rectify this by the end of 2001.

As wireless information services move more and more mainstream, the service providers need to address the needs of time-starved families and business people. A variety of alert services and location dependent products have therefore a great future.

6.2.4 The Marketing must be Right the First Time

Your never get a second chance to make a first impression. It is therefore extremely dangerous to promise more than you can deliver. Since most information products are not independent of other partners and complementors, it is extremely difficult to quality control the user experience. Marketing partnerships with aligned goals are therefore a must.

The demand for some of the wireless services is so large and so inelastic that it is easy to run into capacity problems. AT&T did not anticipate the popularity of its one-rate plan, resulting in poor customer services. Handspring did the same mistake when they launched the Visor PDA, causing production and delivery problems. Telenor, the leading Norwegian carrier gave away the SMS messaging service for free then they launched it, but had to start charging for the service when the whole wireless network broke down because of traffic overload due to SMS messages sent by teenagers.

Marketing via email or SMS will probably be important before 3G networks are widely deployed. These ads and alert services must be matched to the form factors of the available devices at any time. Email ads with lot of text and graphics will create more resentment than business on four line screens.

6.2.5 Create Barriers to Entry

Smart companies protect their turf by forging alliances or acquire companies backwards and forwards in the value chain and by creating lock-in features. AOL is a prime example of this strategy; they have in-depth software infrastructure knowledge true the acquisition of Netscape, ICQ and other software companies. The have a vast array of content, media and broadcasting options trough the TIME-Warner system. AOL have for a long time tried to lock-in their customers by providing proprietary content to their subscribers.

The AOL Anywhere continues this trend, they want the users to use AOL as their personal information and communication center by providing personalization functions like address books, organizers and buddy lists, that makes it very inconvenient to switch to another ISP and content provider. Many carriers are trying to copy this strategy by aggregating content and services on their own portals, like DoCoMo and the Department of Future service from Telia, the largest Swedish carrier.

6.2.6 Give away Baits to get the Customer on the Hook

When a service is new, the majority of the customer would not know that he/she needs it before he/she has had a chance to try it. The proven method to solve this problem is to give away the service for a limited period. The trick is to encourage a lot of activity in this short period so that the consumers change his or her behavior. We see many variations of this model, ISPs giving away the two first months of access, Netscape and Microsoft giving away their browsers, carriers offering the first 50 SMS messages for free etc. These teasers must be targeted at the right customer segment; you do not want to give away perks to customers that would have bought the service anyway.

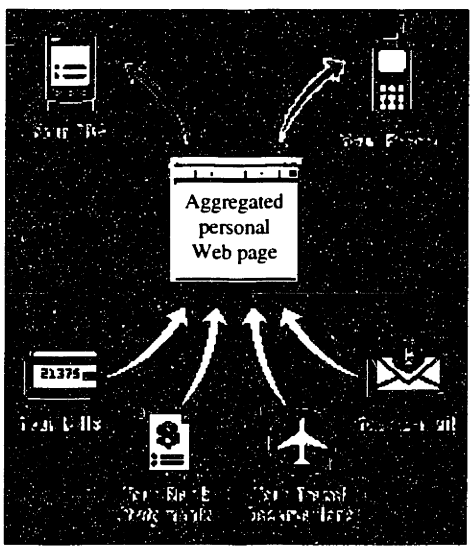
6.2.7 Control the Bottlenecks and the Crossroads

The wireless industry has probably learnt a lesson or two from the history of the PC. Consequently, I do not think it will be possible for a company to gain a monopoly for browsers, (WAP) servers or operation systems for mobile phones. However, it will be possible to gain at least temporary near-monopoly positions along the value chain since the market and the technology are immature.

Successful companies need to innovate relentlessly and constantly be looking for such opportunities. Monopolies are most likely to arise in the content aggregator and content provider arena since we all are prisoners of our habits and maybe because the anti-trust focus is on the technology side. Surveys of how people use the Internet show that people end up visiting only a handful of web sites frequently and people have normally a very small consideration set when deciding to try out new products or services.

6.2.8 Bundling of Services

Bundles are powerful for two main reasons, it offers increased convenience for the buyer due to the one-stop-shop effect and often results in higher sales as the customers buy the bundle because of the higher utility compared to buying just some of parts of the package. Some horizontally integrated network providers have started to offer Internet access, wireless voice and data services together with SMS, email and fax forwarding on one bill, literally offering a virtual information management service.



Wireless information service providers should, if possible, leverage their current Internet and expand that product to increase the value of both the fixed-line and the wireless service. Yodlee.com is good example; they offer a personalization solution that enables consumers to simplify their online lives with one-click access to all their personal online accounts.

They enable the user to aggregate himself all of his Internet accounts and personalized web sites including their associated passwords and settings into one private home page. It is sort of a virtual cut and paste of different web pages into one customized page. Just recently, they expanded their service be letting the user define when and what kind of information that should be forwarded to wireless devices.

6.2.9 Do not Bet on a specific Technology or closed Standard

As discussed earlier, the wireless Internet market is in its infancy. Future advancement in network, memory, battery and user interface technology will enable products and services that can not be imagined at this point in time. The current devices satisfy and appeal only to the technology addicts and the early adopters. It is therefore very dangerous to

be locked-in by a certain standard or technology. Instead, open and flexible standard and technologies should be promoted and applied.

6.2.10 Split the Buyer and the Payer

No one knows this trick better than the airline industry. They know that the motives of the receiver of the frequent flyer points are seldom aligned with that of the payer, the corporations. The players in the wireless Internet market should take advantage of the same effect as the wireless phone or PDA becomes more and more useful and indispensable as a business tool. Content providers must therefore bundle information that is useful from both a business and leisure point of view.

6.3 Future Business Models

I do not believe that radically new revenue models will emerge, however smart phones represent a new channel both for retailer and advertisers. However, the relative strength of the different competitors, complementors and partners is likely to change dramatically over time. Two opposite forces are active; the strongest is probably the consolidation wave among the players. The other force is the technological evolution that forces the value chain to dis-integrate, creating new players that want their share of the pie.

Profitable business models will vary from region to region because of differences in market conditions. DoCoMo is regarded as one of the pioneers and they are able to charge both a small subscription fee ($3 per month) and a data usage fee (on average $9 per month) for their i-mode service. They would therefore of course like to see increasing air traffic and have accordingly chosen an open model that make it easy and inexpensive for content providers to adapt their current web site to i-mode.

In USA, most of the customers are used to paying a low flat rate for cable, local phone, wireless and Internet access, because they tolerate to be bombarded by advertisements. There are, however, many variations around this theme. The flat rate model creates an initial barrier to service adoption, but as soon as the customer has decided, or been persuaded that he or she need this service, the flat rate encourage the user to use the service frequently as it does not cost more. The increased traffic is then used to sell more advertisement space.

For wireless communication, the situation is a little bit different since per-minute plans are prevalent for access, while the content providers prefer subscription fees, as the advertisement space is very limited with current technology.

The future business models must therefore converge so that the different players together can grow the market to the benefit of all involved. Advertisements will not play a large role before the 3G-network technology has been implemented.

A circuit-switched network motivates a bill-per-minute structure, while a packet-switched network makes a subscription model combined with transaction fees logical since the always-on feature enables new products provided the users stay online.

The situation in Europe is somewhat mixed, with comparatively high pay-per-use calling rates, while free Internet access is becoming common to balance the increase in phone charges.

6.3.1 The Micro-Browser as Advertisement Real Estate

So far, customers have been saved from the usual overflow of advertisements, largely because the size of the mobile phone screen and its resolution have prevented this, but also because of lack of bandwidth. With the advent of higher bandwidth, the road is open for advertisements. One may envision customers allowing the network provider to use the "screen saver" as a location for advertisements in exchange of cheaper services. This could be images and/or messages flashing as you transfer data or while you fire-up, connect or shut down the device are other possibilities.

6.3.2 Reselling Customer Information

When the E911 technology is in place, the network providers will have a unique possibility to gather extremely valuable market data that can be resold. Imagine Bell Atlantic offering data on daily/weekly travel patterns, amount and types of purchases for all persons in zip code 02136 with a phone costing more than $500 and a phone bill over $100 per month.

Privacy is of course an important issue, however, the network providers do know more about their customers than others, so their data is valuable even though they do not reveal the customer's true identity. On the other hand, carriers or ISPs may offer customers a premium service that guarantees for instance that email messages are not stored on the network nodes after having reached the receiver.

6.3.3 Location and Time Dependent Services

An improved type of location and time dependent services will emerge, but they will probably not use business models other than described elsewhere in this document.

6.4 Main Challenges

6.4.1 Sharing the Customers

The fiercest battle will probably be over the ownership of the customers. The problem is that all the participants in the value chain have arguments supporting their claim for the customer relation. The carriers argue they are the owners since they provide the initial (the network) and final access point (the network bill). The content providers will argue they are the owners as their services trigger the user to connect to the network and since they know what the customers actually are doing, i.e. where they click, buy and interact.

The number of customers each party brings to the table will determine the outcome. Independent content creators without a large following have little leverage against the carrier's large customer base. Portals and aggregators will be able to argue that their customers and/or brand will drive more traffic to the network and potentially give the carrier new customers and/or transactions.

6.4.2 Standards

The lack of common and open standard are present along the whole value chain and this may potentially act as a barrier preventing the mobile internet services to cross the chasm from the techies and affluent road warriors to the mainstream customers. Even though history should tell the players that agreeing on a set of base standard will increase the potential market for all, the complexity of the marketplace and the share number of competitors and partners involved make it difficult to craft and coordinate standards. Competing regulators from different corners of the world do not help either.

I predict Europe will be able to define standards through EU regulation efforts and a "we have to be united against the rest of the world" attitude, while NTT will drive these efforts in Japan by virtue of its strong position. The situation will get worse in the US before the biggest players get together due to market pressures.

6.4.3 Timing

Both the telecom and the computer industry have a bad track record when it comes to balancing the customer expectations and actual deliveries. The coming of 3G networks and services have been touted for a while, but are still many years ahead. WAP is hyped as the wireless Internet enabler when is nothing more than an HTML translator removing the rich media content of web sites. The WAP phones are promoted as Internet devices while they currently are only capable of showing a handful of text lines.

6.4.4 Business Transformation

Wireless data services may seem like a natural extension to the telecom industry from the point of view of carriers or handset manufacturers. It may also look like the Internet land grab over again for the content providers, just on another hardware platform. Big mistake, everyone can sell air minutes, but it is a whole different ball game to sell wireless data services. The re-training and re-focusing facing the carrier's distribution and sales organizations are daunting.

Wireless information content is not a matter of stripping current web sites down to structured text pieces, the winner will be the content providers that take advantage of the anytime, anywhere value and who leverage this to invent a more compelling product. A bundled service offering a content service both on the PC and wireless handheld platform will in most case increase the value of both services and increase the switching cost.

6.5 Final Remarks

The only certain about wireless information services is that we will witness a tremendous evolution of new products. The wireless Internet will eventually become so pervasive that people will not notice. We will see companies rise and fall as the customers decide what kind of offerings that add value. We will see consolidation and innovation, and the winners will be companies with the right partners with the right product using the right technology at the right time. Definitely easier said than done.

7 Appendix

7.1 MIT Thesis Survey Questions

If several options are valid, please rank them, 1 being the most important.

1. Based on your experience and knowledge, how will your company profit from offering or enabling wireless financial services?

- ☐ Getting access to new customer through a new channel
- ☐ Keeping customers by providing them with 24 by 7 accessibility
- ☐ Reselling access to my customer base to other players
- ☐ Adding new profitable services to present customer relationships
- ☐ Getting customers by offering services not provided by the competitors
- ☐ Increasing overall communication or web site traffic
- ☐ Getting fees from transactions
- ☐ Saving costs compared to other channels
- ☐ Acting as an aggregator or portal for these services
- ☐ Selling the tools that enable these services
- ☐ Selling the devices that offer access to these services
- ☐ Getting advertisements revenues from this new channel

2. Who will be your toughest competitor(s)?

- ☐ The network providers
- ☐ The device manufacturers
- ☐ The wireless portals
- ☐ The wireless content providers
- ☐ The wireless application providers
- ☐ The wireless transaction providers

3. Who will be your most valuable partner(s)?

- ☐ The network providers
- ☐ The device manufacturer
- ☐ The wireless portals
- ☐ The wireless content providers
- ☐ The wireless application providers
- ☐ The wireless transaction providers

4. Who will be your most valuable customer(s)?

- ☐ The network providers
- ☐ The device manufacturer
- ☐ The wireless portals
- ☐ The wireless content providers
- ☐ The wireless application providers
- ☐ The wireless transaction providers

5. How important will wireless information services be for you in 2-3 years?

- ☐ Very important, a large part of our revenues
- ☐ Important, one of our main revenue streams
- ☐ Moderately, one of many businesses, part of a complete package
- ☐ Minor, this is a small part of our revenue

6. Which complementor(s) must be in place to enable your service?

- ☐ The network providers
- ☐ The device manufacturers
- ☐ The wireless portals
- ☐ The wireless content providers
- ☐ The wireless application providers
- ☐ The wireless transaction providers

7. What will be the most important factor(s) in order to succeed in this market?

- ☐ A strong online brand name
- ☐ A strong offline band name
- ☐ A large installed customer base
- ☐ Flawless, cost-efficient execution
- ☐ Negotiation and deal making skills
- ☐ A successful "push to end-user" marketing strategy
- ☐ A successful "pull from end-user" marketing strategy
- ☐ The right technology and services at the right time
- ☐ The establishment of open or de facto standards and formats
- ☐ The emergence of a dominating player that can drive the market
- ☐ Business and technology knowledge or the ability to hire or acquire this
- ☐ Partnership(s) with the most important network provider(s)
- ☐ Partnership(s) with the most important device manufacturer(s)
- ☐ Partnership(s) with the most important wireless portal(s)
- ☐ Partnership(s) with the most important wireless content provider(s)
- ☐ Partnership(s) with the important wireless application provider(s)
- ☐ Partnership(s) with the most important wireless transaction provider(s)

8. How will you price your services?

- ☐ Flat monthly subscription fee, no transaction fee
- ☐ Flat monthly subscription fee + small fee per transaction
- ☐ Free access, small fee per transaction
- ☐ Free access and services, revenues from advertisements
- ☐ Free access, transaction fee based on volume (# $, # bits, # transactions)
- ☐ Cut of partner's profits
- ☐ Other:.....

9. How will your partners most likely price the services they offer to you?

- ☐ Transaction fee based on volume
- ☐ Flat transaction fee per transaction
- ☐ Cut of my profits
- ☐ Flat (up-front) access fee, no transaction fee
- ☐ Flat (up-front) access fee + transaction fee based on volume
- ☐ Flat (up-front) access fee + flat transaction fee per transaction
- ☐ Other:.....

10. What are your top three priorities for the next two years?

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