3G Wireless Systems Meet the Needs of U.S. Corporations Today!

A white paper

Prepared for:

QUALCOMM

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PREFACE

Andrew Seybold's Outlook 4Mobility is an affiliation of closely held companies founded by wireless and mobility expert Andrew Seybold. Together with his consulting partner Barney Dewey, and a team of strategic partners, Andrew Seybold's Outlook 4Mobility offers unparalleled analyses of technologies and trends impacting the international convergence of wireless, mobility and the Internet.

Known for their ability to cut through the hype and mitigate risk, Seybold and Dewey guide technology startups, industry players, investors and enterprises up the road to profitability with a comprehensive array of information, education and strategic consulting services targeted to and about the mobile and wireless technology industries.

Seybold and Dewey each bring more than 30 years of personal computing, mobile data and wireless technology expertise to the firm and all its engagements and information products. This real-world market experience is *the* differentiator that sets them apart. Their world-class, hands-on approach nets their clients the most intuitive, insightful counsel available.

As one of the most sought-after consultancies in the market, Andrew Seybold and Barney Dewey have led the industry with their ability to accurately visualize and articulate trends in technologies, services, devices and applications way ahead of the information curve.

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EXECUTIVE SUMMARY

There is a grass-roots movement in Corporate America today among mobile workers[1] to request that the enterprise implement mobility solutions that provide real-time access to Internet-based information such as email and corporate databases. Eighty-six percent of the mobile workers surveyed for a proprietary Outlook 4Mobility study conducted in April 2002[2] say wireless data access to their corporate data would be an invaluable addition to their mobility tools.

This movement is finding support throughout the enterprise, from the department heads of mobile work groups to their IT departments and CTOs. IT and CTO respondents to an Enterprise Wireless Survey conducted at CA World[3] in 2001 say they are extremely interested in providing wireless data services to their corporate mobility workforces. Eighty-two percent of respondents to that same survey say they have budgeted at least a pilot program implementation for their corporation this year. Not even the current state of the economy, say respondents, is standing in their way when it comes to moving forward with their wireless data initiatives.

In another proprietary Outlook 4Mobility study conducted this past April 2002[4] among department managers of mobile workers, respondents told us they're looking to add wireless data capabilities for the operational efficiencies that mobile technology would provide and the customer service benefits from mobile workers being able to access mission-critical information anywhere, anytime.

> *The only commercial digital voice-and-data technology that meets these requirements today is third-generation (3G) CDMA2000 1X*

The capability to wirelessly enable mobile work tools such as laptop computers, scanners and ruggedized PCs has been on the market for a number of years and supported by such technologies as Cellular Digital Packet Data (CDPD) and circuit-switched cellular. With the advent of handheld PCs, PDAs, Internet-enabled phones, Internet appliances and smartphones, the requirements for wireless accessibility have changed. So have the expectations of users. More importantly, so have the capabilities of today's wireless data networks.

[1] Defined as an individual who spends more than one-third of their average workweek away from a stationary base of operation.
[2] Proprietary market research, conducted April 2002. Email surveys with Mobile Workers.
[3] "Wireless Data Implementation Survey," a Mobiltorial® written by Andrew M. Seybold, December 10, 2001.
[4] Proprietary market research conducted April 2002. Telephone surveys with Department Managers of Mobile Workers.

For these new handheld, wireless-enabled information and computing solutions to have value and for them to be embraced by the enterprise, mobile workers, their bosses and IT managers tell us they want:

- Data speeds that are equivalent to or better than current wireline dial-up computer speeds (28.8K to 56K);

- Service coverage that is equivalent to or better than current wireless voice coverage with strong metropolitan coverage; and

- High-speed Internet access/Web browsing and access to corporate information.

If we compare the wireless data services presently available in the United States and Canada and map their systems' capabilities to the responses we received to these surveys, it becomes apparent that the only commercial digital voice-and-data technology that meets these requirements today is third-generation (3G) CDMA2000 1X:

CDMA2000 1X offers data speeds peaking at 144 Kbps with average data speeds in the 40-90 Kbps range, more than double the real speeds obtainable using GSM/GPRS systems. It provides the high-speed Internet access users seek to make wireless an efficient and cost-effective alternative to landline connections when away from the office. Verizon in the U.S. and Bell Mobility in Canada are already offering commercial CDMA2000 1X service with 144-Kbps-capable phones from Kyocera, PCMCIA cards from Sierra Wireless and PDAs from Audiovox. These end-user devices, when combined with the network speeds and coverage offered by the technology, provide mobile workers with a solution to meet virtually any application requirement.

CDMA2000 1X is also currently being deployed this year by other major North American CDMA-based network operators including Sprint PCS, Leap Wireless, Monet, Metro PCS and US Cellular. Combined, these carriers cover more than 90% of the North American population, providing the coverage advantage users seek, particularly in all of the nation's major and secondary metropolitan markets.

These devices will provide the mobile workforce with a number of different form factors designed to fit their needs:

- PC Cards that can enable existing PDA and notebook products

- PDAs with embedded CDMA2000 modules

- Phones equipped with browsers, large displays and more memory

This white paper discusses the bottom-up demand for wireless data that exists today among mobile workers, how IT departments are gearing up to meet that demand and why CDMA2000 1X is their strongest technology option.

WHAT MOBILE WORKERS WANT

When it comes to knowing what it takes to get the job done, how to save time and how the job can be performed more efficiently, the individual worker is in the best position to tell the enterprise what is needed. This is particularly true with *mobile* workers, who face a unique set of communications and information access challenges in the course of their workday.

Historically, corporate introductions to new business tools have come from the workers themselves—individuals who recognize the productivity benefits to be gained from using the solution and who are willing to bear the personal expense until the company recognizes the value and makes the investment. Certainly, that has been the story, starting with PCs, then notebook computers, pagers, cellular phones, PDAs and now wireless data add-in and add-on devices.

CDMA2000 1X offers data speeds peaking at 144 Kbps with average data speeds in the 40-90 Kbps range, more than double the real speeds obtainable using GSM/GPRS systems

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Today, business professionals, and especially mobile workers, have a greater range of work tool options with such handheld products as Pocket PCs, PDAs and two-way messaging devices. These products can be wirelessly enabled to add real-time value to the devices' basic functionality. More importantly, they can be purchased at retail and at "consumer" prices. This makes it easy and inexpensive for mobile workers and, increasingly, small businesses to take wireless technology to the next level of functionality.

In an Outlook 4Mobility study conducted in April 2002,[5] we asked mobile workers, both users and non-users of wireless data, what they're looking for in a wireless data solution and how they value and justify the added capability in their arsenal of mobile work tools. This is what they told us:

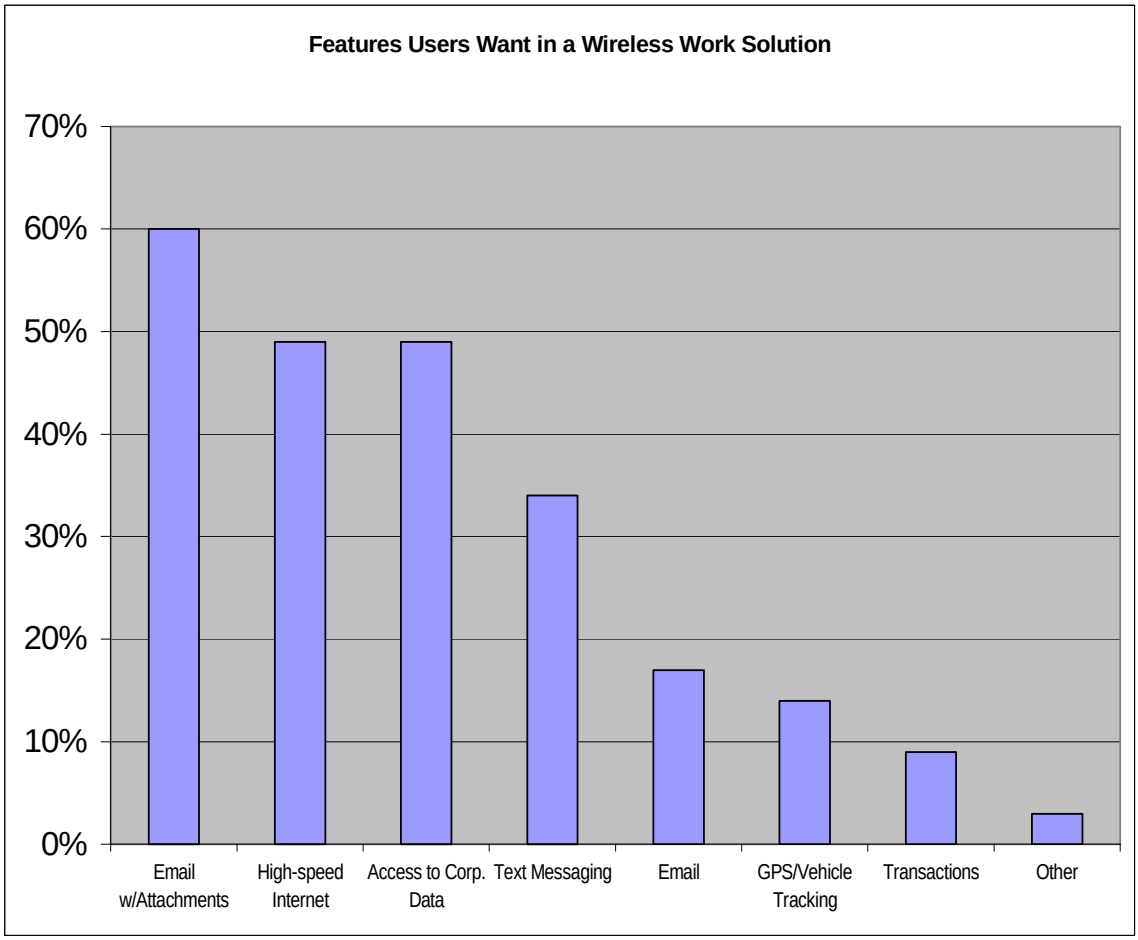
FEATURES

Mobile workers said the most important features to have in a wireless work solution are (Figure 1):

1. Email with Attachments (60%)
2. High-Speed Internet Access/Web Browsing (49%)
3. Access to Corporate Information (49%)
4. Ability to Send & Receive Text Messages (34%)

[5] Proprietary market research, conducted April 2002. Email surveys with Mobile Workers.

FIGURE 1. THE MOST IMPORTANT FEATURES IN A WIRELESS WORK SOLUTION



DATA SPEEDS MATTER

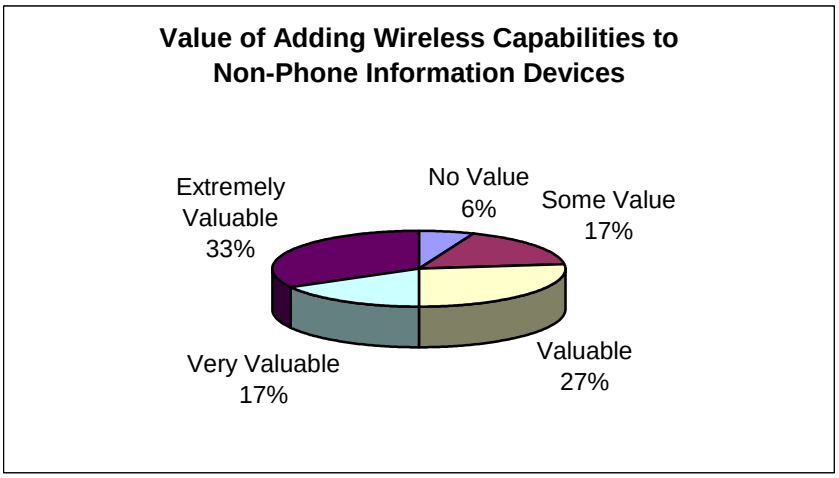
Ninety-seven percent of our mobile worker respondents told us they're looking for a wireless data solution that is equivalent to or better than current wireline dial-up computer speeds (28.8K to 56K). Current users of the technology tell us the single most frustrating thing about their wireless data solution is that speeds are too slow today on 2G networks.

97% of our mobile worker respondents told us they're looking for a wireless data solution that is equivalent to or better than current wireline dial-up computer speeds

VALUE

Seventy-five percent of our mobile worker respondents told us that adding wireless service to their existing mobile work tools would be Valuable to Extremely Valuable. More than 60% of current users said their wireless data solution is Very to Extremely Valuable to them in terms of increasing productivity, increasing sales, improving customer service, etc. (Figure 2).

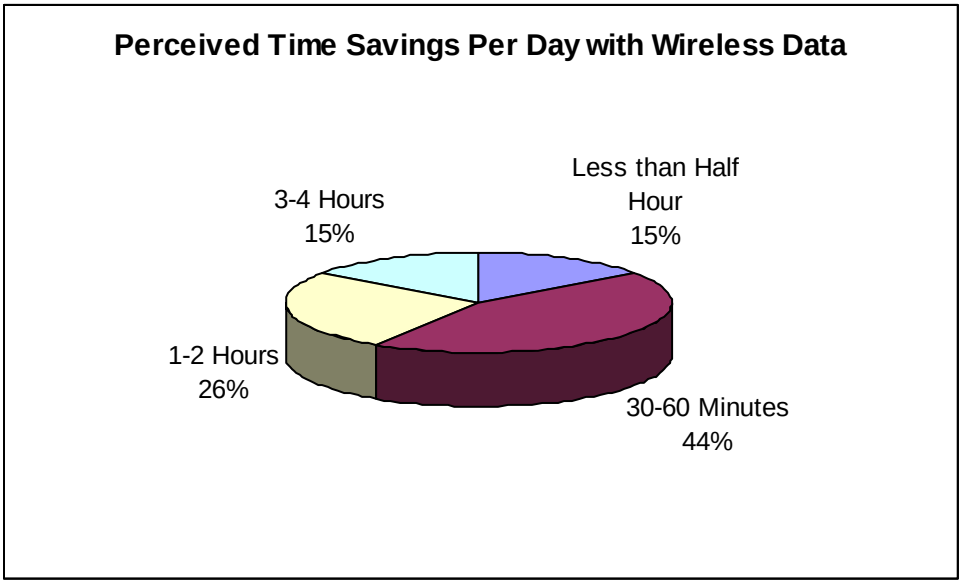
FIGURE 2. VALUE OF ADDING WIRELESS CAPABILITIES TO NON-PHONE INFORMATION DEVICES



THE ROI

Forty-four percent of mobile worker respondents believe a wireless data solution would save them up to one hour a day on their job. An additional 26% said their wireless data solution would save them up to two hours a day. When asked if their company would see significant financial benefits from implementing a wireless data solution other than in time saved, more than 60% said "Yes," particularly when it comes to "increased productivity" (Figure 3).

FIGURE 3. PERCEIVED TIME SAVINGS PER DAY WITH WIRELESS DATA



Cisco has calculated that an average "knowledge worker" costs the company about $2 per minute. This means that a savings of one hour a day saves the company $120 per employee per day. Calculated over a mobile workgroup, deploying a wireless data work solution could add up to significant savings for the enterprise and quickly generate a Return on Investment (ROI).

44% of mobile worker respondents believe a wireless data solution would save them up to one hour a day on their job

The Enterprise Focus on Wireless

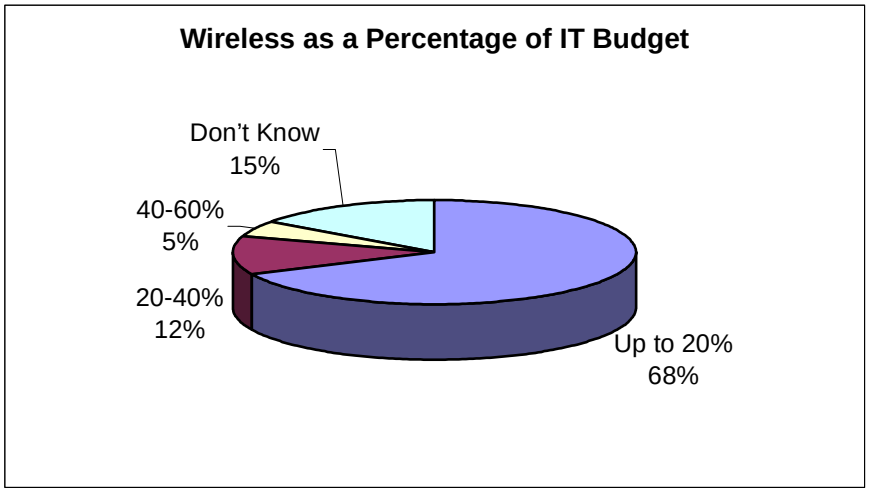
Within the enterprise organization, division mangers have traditionally led the search and made the business case for implementing a wireless solution. However, there is growing momentum in Corporate America today to make wireless a more fundamental architectural component of the enterprise's technology infrastructure. This is being driven by an almost organic movement within IT departments to centralize data and make it available and readily accessible throughout the enterprise to workers both behind the desk and on-the-road, regardless of the interface device.

In a study we conducted at CA World[6] among IT professionals and CTOs, we found respondents bullish on deploying wireless data with their internal customers. And they told us that their company has already budgeted funds to take the first steps toward this goal.

[6] RapiData® research conducted at CA World, July 9-10, 2001.

One of the most positive and important findings of this survey was that in a majority of cases there is now a line item in respondents' budgets for wireless data implementation (Figure 4). In fact, 68% of qualified respondents said they are committed to wireless data and have budgeted up to 20% of their IT budget for a wireless data initiative.

FIGURE 4. WIRELESS AS A PERCENTAGE OF IT BUDGET



To put this in context, only a few years ago IT departments did not have any portion of their IT budget allocated for wireless data. The fact that they do now is a good indication that wireless has moved from the world of experimentation to one of implementation. And this implementation is taking place in larger size organizations (45% of the respondents to our survey are employed by companies with more than 5,000 employees) at a faster rate than small companies (less than 100 employees).

Respondents also told us that the downturn in the economy has not affected their plans to implement a wireless data initiative. Fifty-six percent of respondents said their plans and budgets remain unchanged and 12% said the economy is forcing them to accelerate their plans.

> *68% of qualified respondents said they are committed to wireless data and have budgeted up to 20% of their IT budget for a wireless data initiative*

In times of an economic downturn, communications capabilities become even more of a necessity. During the market downturn in the early 1970s, the sale of two-way radio systems soared across the United States as companies tried to do more with fewer feet on the street. In today's market, having more information available to a field force not only provides better customer service, it provides the ability to maximize the strained human resources trying to keep up with increased demands and competitive market pressures.

From the survey, we found that IT managers and CTOs are focused on basically the same wireless data applications as mobile workers. Respondents told us they've implemented, or are planning to implement within the next 12 months, wireless data solutions for sending and receiving email with attachments, sending and receiving email/text messages and access to enterprise data.

TABLE 1. TOP THREE WIRELESS DATA APPLICATIONS

Mobile Workers	IT Departments
1. Email with Attachments	1. Email with Attachments
2. High-Speed Internet Access 2. Access to Corporate Data	2. Text Messaging
3. Text Messaging	3. Access to Corporate Data

One third of respondents said they're pursuing wireless data for their internal customers to improve operational efficiency

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It is very promising to see wireless data coming into corporate alignment, with IT departments and mobile workers focused on the same applications and motivations for pursuing a wireless data solution.

One third of respondents said they're pursuing wireless data for their internal customers to improve operational efficiency. An additional 27% said providing better customer service is the prime motivator. These are also the same primary reasons cited by our mobile worker respondents for pursuing wireless data. It would appear both mobile workers and their IT departments recognize the benefits and value of the investment.

ANATOMY OF A WIRELESS DATA SOLUTION

There are three primary elements that comprise a wireless data solution, each highly inter-dependent on the others for creating a solution that meets both the functionality and performance requirements of mobile workers and corporate IT departments:

1. the end-user device,

2. the application(s),

3. and the network.

THE END-USER DEVICE

There is a range and growing number of handheld devices on the market today that can be wirelessly enabled to provide access to information in real time. Laptop computers provide users with the ultimate mobile desktop environment; Pocket PCs provide for desktop applications in a handheld configuration; PDAs provide for Personal Information Management and can be outfitted to accommodate a number of off-the-shelf and customized corporate applications; messaging devices enable users to send and receive email in real time; and smartphones give users access to a range of Internet-based information services and allow for text messaging. Some devices perform one specific application such as email or two-way text messaging, while others are based on an operating system that supports application development.

Beyond access to calendar and email applications, the Enterprise demand for wireless data is evident in the specific verticals

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THE APPLICATION(S)

Applications are typically grouped into three categories:

1. Groupware Applications, such as Email, Calendar, Contacts, Corporate Directory, Microsoft Outlook/Exchange and Lotus Notes/Domino;

2. Vertical Applications, such as those written specifically for users in specific vertical markets such as Insurance, Healthcare, Manufacturing, Finance & Banking, etc.; and

3. Horizontal Applications, such as Sales Force Automation (SFA), Customer Relationship Management (CRM), Field Force Automation (FFA) and Document Management.

What information do you want to be able to receive or access? Email? Email with attachments? Corporate databases? Text messages? Vehicle navigation and tracking information? Web sites? Online transactions? In the end, it is the application(s) that will dictate the product classifications for consideration.

The needs of these vertical markets demand real-time access to enterprise information and data from behind the corporate firewall

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Beyond access to calendar and email applications, the Enterprise demand for wireless data is evident in the specific verticals of Insurance, Healthcare, Manufacturing, Finance and Automotive. The needs of these vertical markets demand real-time access to enterprise information and data from behind the corporate firewall. Throughout these verticals, enterprise applications are traversing consistent horizontal markets. Sales and field force automation, customer relationship management, supply chain management and document management applications are proving a steady and measurable ROI.

THE NETWORK

In the mix for consideration when identifying a wireless data solution is the wireless network that will be handling the transmission of and real-time access to information. Here, the considerations fall into three basic categories:

1. service coverage
2. cost
3. data speed.

A single nationwide network with a single technology is one of the most crucial factors for an enterprise to consider.

A single nationwide network with a single technology is one of the most crucial factors for an enterprise to consider

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CHOOSING A WIRELESS DATA NETWORK

There is a standards debate that is taking place in the wireless industry today among network operators over which third-generation (3G) technology to deploy to provide for increased voice capacity, data speeds and multimedia applications.

Carriers such as AT&T Wireless and Cingular Wireless, which operate networks based on Time Division Multiple Access (TDMA) and GSM digital technologies, have announced plans to upgrade their networks and data speeds with General Packet Radio Service (GPRS), an interim (to 3G known as 2.5G) overlay technology that promises data speeds up to a theoretical peak data rate of 115 Kbps but a "REAL" proven, throughput of between 20 and 40 Kbps (less than many users obtain using standard wired dial-up modems). These carriers will operate parallel GSM and TDMA networks for some years to come until they cover the United States with GSM.

On the other hand, carriers such as Sprint PCS, Verizon Wireless, US Cellular and Bell Mobility in Canada that are operating wireless networks based on Code Division Multiple Access (CDMA) technology have announced plans to upgrade the capabilities of their networks with CDMA2000 1X.

CDMA2000 1x is a direct and cost-effective migratory path for CDMA and other wireless network operators wanting to deliver 3G data rates and services today

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Both sides of this standards debate have two things in common: one, they recognize the market requirements for faster data speeds over wireless networks; and two, they recognize the inadequacy of today's second-generation digital networks to deliver those speeds and still meet the capacity requirements of voice users. Wireless operators are implementing these network upgrades in an attempt to provide a richer, faster and more robust wireless experience for data users. However, their approaches are distinctly different and provide different value propositions.

GPRS VERSUS CDMA2000 1X

GPRS is an overlay technology developed for network operators of GSM systems as a way to combine voice and data services on the same network and provide for faster and more robust data transmissions (than circuit-switched cellular at 14.4 Kbps). GPRS will be the first step until they are able to invest in and build out their EDGE or WCDMA-based 3G networks and realize the faster data speeds required by mobile workers.

Because TDMA operators Cingular Wireless and AT&T Wireless have to build a new national GSM network and then add GPRS capabilities, these networks will not be able to provide full, nationwide coverage for some period of time. In the interim, they will have to support roaming services between themselves and VoiceStream, the only completely GSM provider in the United States today. This could mean higher data costs and spotty coverage until GSM/GPRS construction is complete. In order for current TDMA subscribers

to take advantage of packet-data services, they must purchase a new GSM/GPRS device, as TDMA does not support packet-data services. If these subscribers want nationwide coverage along with data they must purchase multi-mode TDMA/GSM/GPRS devices, which are interim solutions for roaming—but they will not be able to access data services in TDMA regions since, as previously mentioned, TDMA does not support packet-data services.

CDMA2000 1X, on the other hand, is a direct and cost-effective migratory path for CDMA and other wireless network operators wanting to deliver 3G data rates and services today. CDMA carriers are upgrading existing base stations, resulting in 3G coverage rapidly becoming equal to their current 2G coverage. Of all of the 3G technologies being considered by wireless network operators worldwide, CDMA2000 is much further ahead in terms of product development, commercial deployment and market acceptance. Once a network has been upgraded to CDMA2000 1X, existing cdmaOne voice-and-data devices will still be able to operate on the network. Single-mode CDMA2000 devices will be able to access packet-data services across most of North America.

CDMA2000 1X technology supports both voice and data services over a standard (1.25 MHz) CDMA channel and provides many performance advantages over other technologies. First, it provides up to twice the voice capacity of earlier CDMA systems (with even bigger gains over TDMA and GSM), helping to accommodate the continuing growth of voice services as well as new wireless Internet services. Second, it provides peak data rates of up to 144 Kbps or 153 Kbps as a raw data rate (and up to 307 Kbps in the future). This combination of increased voice capacity and fast packet-data services appears to be an ideal mix, providing high-speed data capabilities while maximizing voice capacity. Moreover, it is fully forward and backward compatible with today's cdmaOne voice-and data systems (14.4 Kbps dial-up) as well as the new, higher speeds that are on the horizon, providing an easier and more affordable upgrade path for both carriers and consumers.

Reliable data speeds on CDMA2000 1X networks are 3 to 4 times faster than GPRS networks

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DATA SPEEDS

Reliable data speeds on CDMA2000 1X networks are 3 to 4 times faster than GPRS networks. In addition, some CDMA2000 1X operators plan to increase their data speeds to a peak of 307 Kbps sometime in 2003. This upgrade will only require an upgrade in end-user devices *if* the customer wants to take full advantage of these new data speeds. These new devices will still work on the previous 144-Kbps infrastructure.

DOWNLOAD TIMES

Once their networks are deployed, Cingular, AT&T Wireless and VoiceStream will have data networks with usable data speeds in the 10–40-Kbps range, while carriers deploying CDMA2000 1X, including Sprint PCS, Verizon Wireless, US Cellular and Bell Mobility, will

be able to provide usable data speeds of between 40 and 90 Kbps, with data bursts of up to 144 Kbps (Table 2).

TABLE 2. USABLE DATA SPEEDS

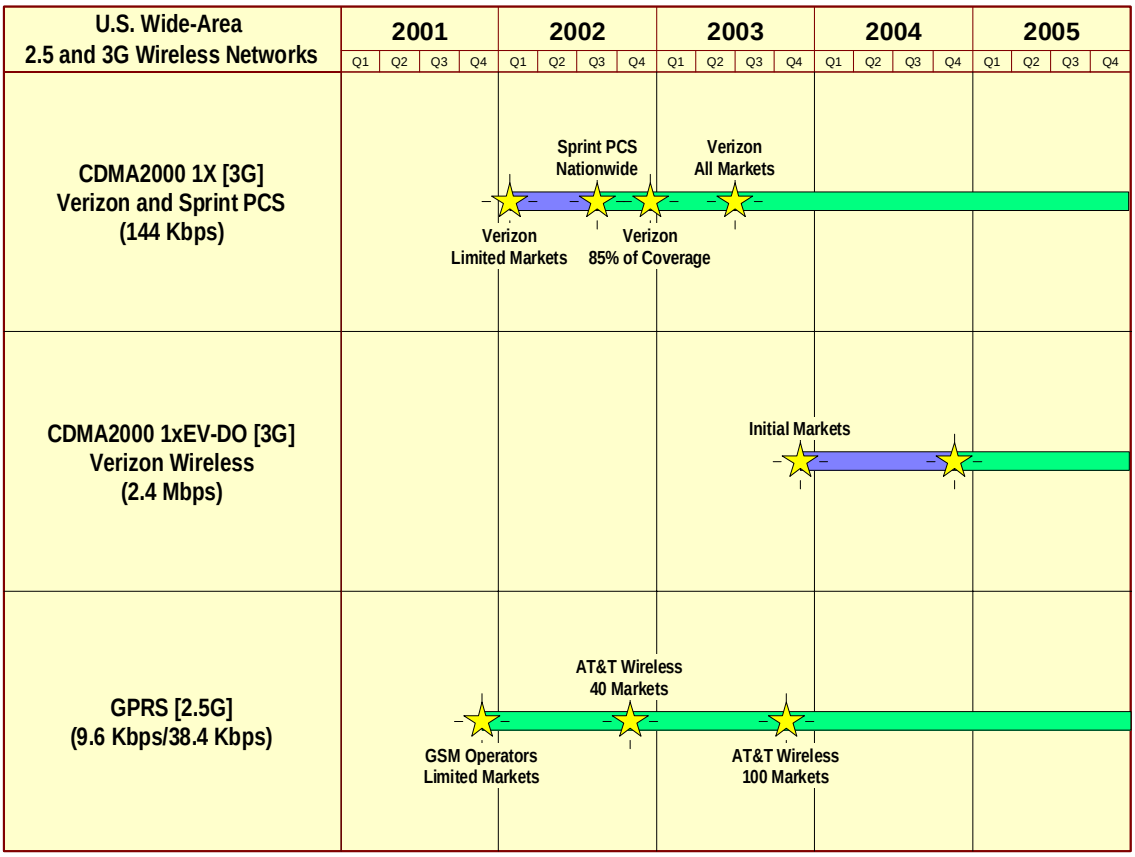
	Dial Up	GPRS	1X
Peak Speed	56 Kbps	40 Kbps	153 Kbps
Average	20-40	10-20	50-90

COVERAGE

Figure 5 shows that two of the country's largest nationwide wireless network operators, Verizon Wireless and Sprint PCS, will roll out CDMA2000 1X service faster and across more markets than network operators deploying GPRS services. Because the CDMA network upgrade to 1x is efficient, Sprint PCS plans national 1x coverage by summer 2002 and Verizon expects this by the end of the year.

Contrast this with the market-by-market GPRS availability of TDMA carriers AT&T Wireless and Cingular Wireless, which are working hard to convert their TDMA markets to GSM/GPRS, and VoiceStream, which is challenged in its upgrade to GPRS because it does not have the market ownership to provide national coverage. Sprint PCS and Verizon Wireless, on the other hand, will be offering nationwide CDMA2000 1X services without requiring roaming agreements with other carriers to fill out coverage gaps for the new technology. This makes connectivity easier and more reliable, and pricing more consistent. GPRS operators typically charge one rate for subscribers on their network and another when a subscriber roams.

FIGURE 5. COVERAGE BY TECHNOLOGY



Note: There are other 3G technologies that are being developed: EDGE, UMTS/WCDMA and CDMA2000 1xEV-DV, which is a follow-on phase to CDMA 2000 1X. At the present time these technologies are still in the standardization, development or early trial stages and no specific launch dates have been announced. Therefore, we have chosen not to include them in our roadmap.

69% of respondents said CDMA2000 is the network technology that will have the economy of scale advantage to drive handset prices down and stimulate market demand

INDUSTRY SUPPORT

Historically, new wireless technologies have been hampered as they come to market by an inadequate supply and limited choice of end-user devices. Such was the case when wireless operators upgraded their networks to digital from analog, and when carriers introduced their wireless Internet services without an adequate supply of wireless Web-browsing phones. In part, this time-to-market delay is the result of reluctance on the part of hardware manufacturers to commit to multiple technologies before the market

shakes out. This has not been the case with CDMA2000 1X. Because the three South Korean wireless operators have had their CDMA2000 1X networks up and running for nearly two years, with more than 10 million customers, the number of CDMA2000 1X devices has increased dramatically with more than 150 devices already introduced by 25 vendors. (See www.3GToday.com for the latest device information.)

Outlook 4Mobility conducted a survey at the CDMA Americas Congress 2002 show among hardware manufacturers to find out what 3G technologies they support and how they plan to approach the market.[7] Eighty-five percent of respondents said CDMA2000 offers the best capacity (over WCDMA) for voice over the next three years, and 67% said CDMA2000 offers the best capacity (over WCDMA) for data over the next three years. Moreover, 69% of respondents said CDMA2000 is the network technology that will have the economy of scale advantage to drive handset prices down and stimulate market demand.

[7] Outlook 4Mobility RapiData survey at CDMA Congress Americas 2002, November 9, 2001.

SUMMARY

It is evident from all of our surveys that the only digital wireless technology that meets the wants and needs of both the corporate mobility worker and IT professionals is CDMA2000 1X.

CDMA2000 exceeds in the three major categories that have proven to be vital for enterprises to successfully launch effective mobile data strategies:

1. Speeds in excess of a dial up 56k modem

2. Commercially available devices

3. Commercially launched networks

The data speeds are equal to or greater than dial-up data speeds, there are a number of different device types available for these networks—everything from a simple wireless phone with a browser to a "smartphone" that uses either BREW and/or Java as an application layer, to PDAs with and without small keyboards, to PC Cards that can be inserted into PDAs and notebook computers—and CDMA2000 1X networks are the only 3G networks available today in the United States. CDMA2000 networks will be the only nationwide 3G networks that are available in the U.S. for the foreseeable future.

The technology is working today. The applications and devices are available now. The networks are turning on. The reality of reliable and cost-effective wireless data is available immediately.

In fact, for the next few years, CDMA2000 1X networks are the only networks that will provide high-speed data access to corporate information as well as data speeds fast enough to provide users with access to the Internet that is equal to or greater than those that can be achieved using wired dial-up services.

Further, as CDMA2000 1X systems are upgraded to the next release of CDMA2000 1X, which will double the peak data speeds available, and then to CDMA2000 1xEV-DO users will be able to experience DSL-like data speeds with peak data rates of 2.4 Mbps. CDMA2000 is the only technology that provides backwards capability so that existing customer devices do not have to be discarded and replaced.

CDMA wireless operators have the ability to meet the stringent requirements demanded by corporate users (today's customers) and a solid migration path into the future. The competitors are faced with having to build out GSM/GPRS systems, then move to EDGE (an as yet unproven 3G data system) and finally to UMTS or WCDMA. Each of these migrations will require corporations to upgrade wireless devices and outfit their entire fleet of mobility workers with the new devices. Corporations that choose to embrace the CDMA networks can upgrade their users on an as-needed basis.

The technology is working today. The applications and devices are available now. The networks are turning on as you read this document. The reality of reliable and cost-effective wireless data is available immediately.