Synchrologic Executive White Paper

The CIO's Guide to Wireless

What's influencing wireless in 2003

Synchrologic™

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What's influencing wireless in 2003

Chapter 1- Introduction

As the dust starts to settle around wireless hype and viable wireless technologies become a reality for many corporations, it becomes increasingly important for enterprises to develop a comprehensive mobile and wireless strategy. Discussions around wireless networks, mobile device deployment and data security issues are necessary to fully comprehend the challenges and opportunities that lie ahead.

In 2001, Synchrologic authored the CIO Wireless Resource Book as a wireless primer for those in the middle of wireless deployments as well as those seeking a greater breadth of knowledge regarding wireless technologies. Today, we present an updated version of the award-winning executive overview incorporating the changes in wireless technologies over the last 18 months.

Our goal is to help address popular misconceptions, minimize the hype, and provide actionable insight. Each of the seven chapters serves to help further understanding of the wireless world and to offer practical recommendations and perspectives. Our focus is also on providing information and analysis to organizations that will be users of wireless data – and not to the telecom companies and carriers, which will obviously be profoundly impacted by increasing wireless adoption.

NOTE: Our many references to "wireless" are focused on Wide Area Networking technologies such as GPRS/GSM or CDMA, and not on Personal Area Networks such as Bluetooth or Local Area Networks based on 802.11b. These terms and many more are described in Chapter 7 – A Wireless Glossary.

Chapter 2- Perspective on Wireless Computing

In midst of the mobile frenzy, wireless computing was hailed as a revolutionary paradigm shift. As the true reality of wireless capabilities became clear, wireless is now seen as an extension of the current business tools we have in place. Cellular phones didn't fundamentally change the way people communicated…talking on the phone wasn't new, but the convenience and availability cell phones brought were. Our belief is that wireless data will bring corporations equally powerful benefits -- within the framework and business processes we already understand.

A more practical way to look at wireless is to put it in perspective within the overall context of building and delivering mobile computing solutions. The process of bringing mobile technologies to bear on business processes is nothing new. It requires disciplined review of the alternative technologies and architectures to determine those best suited to solving the business problem at hand. Wireless hasn't changed this.

New connectivity option

Any enterprise mobile computing solution will involve successive layers of technology, as shown in Figure 1 below.

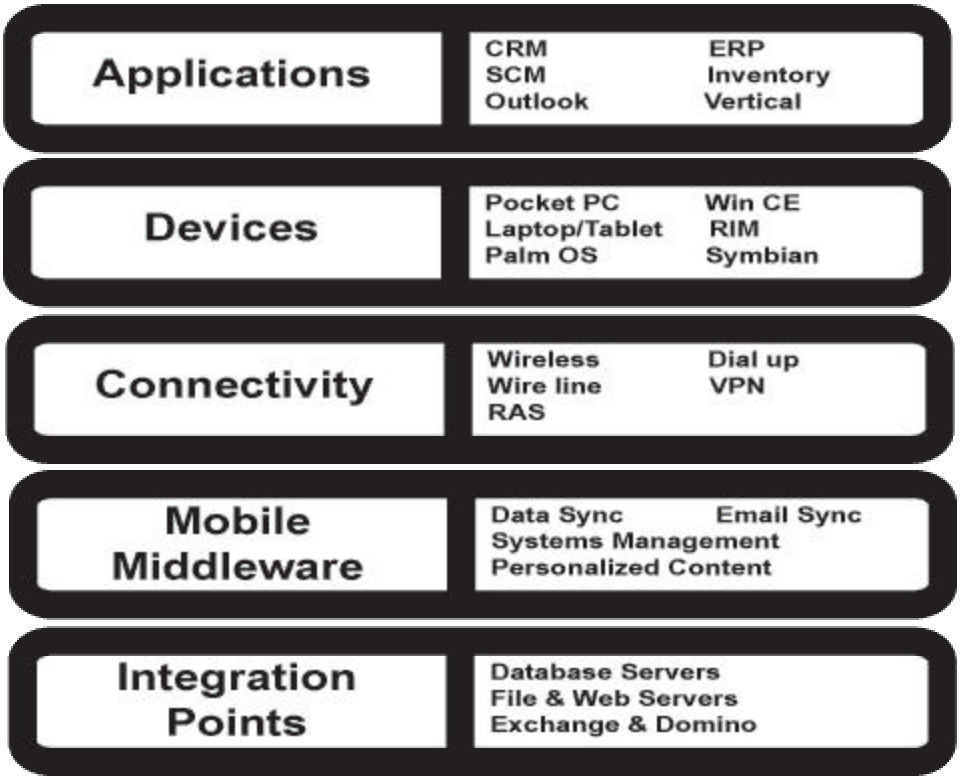


Figure 1. Component Layers for Mobile Solutions

Viewed from this perspective, we see wireless as just another connectivity option. This is obviously a bit understated, as the option for wireless connectivity definitely impacts your choices in the other layers.

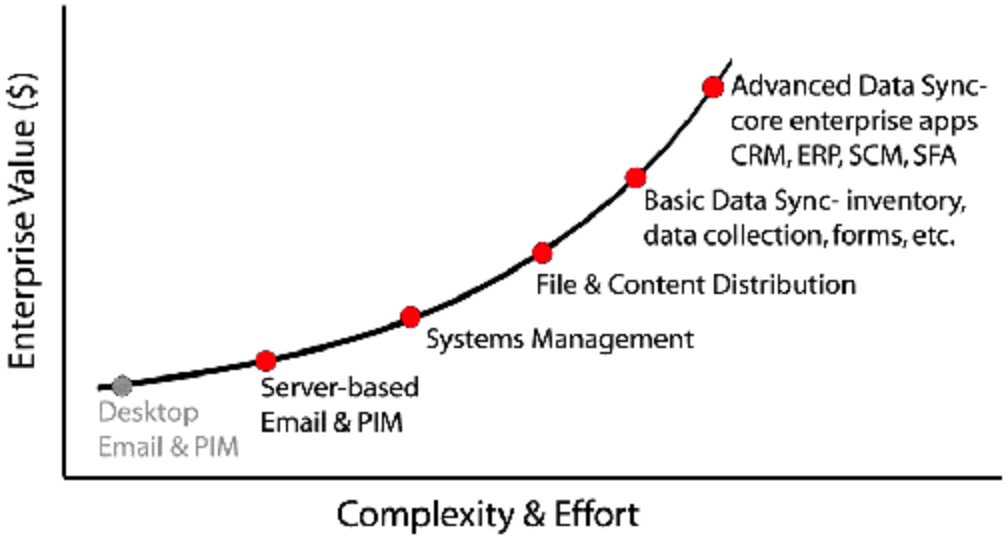
The important point is that wireless does not stand your whole IT operation on its head. It is merely a connectivity option, one that may allow you to add business value by extending existing systems or further automating business processes.

Another way of adding perspective to the wireless option is to look back at how mobile computing has evolved in the past ten to fifteen years. Seeing new options in any given layer is neither rare nor surprising.

Rapid change in mobile computing

"At the height of the mobile hype, there was little downside seen to mobilizing business processes and practices. However, time has shown that there are many aspects to mobilization that need to be considered."[1] In today's economic climate enterprises are forced to fully understand the return on investment (ROI) for mobile projects. Often the determining factor of a project receiving the green light from management, a solid ROI is the key to success. Companies are realizing that mobilizing email and PIM data is the quickest way to a proven ROI. "The sales force is addicted to email and relishes the ability to check messages throughout the day."[2] As value is derived through mobilized email, enterprises begin to move up the value chain. Investment in systems management tools, file and content distribution and enterprise data applications is the typical progression as shown in Figure 2.

Figure 2. Enterprise Value Curve



[1] Gartner Group Research Note. Key Issues for Mobile Services and Markets, December 30, 2002
[2] Wireless Web Browser Ties Shipping Data, E-mail, *ComputerWorld*, February 24, 2003

Seen this way, wireless represents a new option within one layer of the very dynamic and fast growing space of enterprise mobile computing. What is driving this change? The business need for increased productivity, rapid advancement in technologies and the desire to create distinct competitive advantages. Wireless strategies merit cautious investigation and investment to determine the best fit for the enterprise.

The pros and cons of wireless

Wireless connectivity for corporate information access offers a variety of potential business benefits driven by user convenience, timeliness of information, and increased ability to transact business. There are organizations out there that have aggressively adopted wireless computing technology and seen the following types of benefits:

- Increased sales
- Decreased costs
- Improved customer service
- Competitive advantage
- Rapid ROI

But keep in mind that supporting wireless connectivity also has the potential to increase certain challenges. These challenges are central to mobile computing solutions in general – regardless of the connectivity option chose. However, the relative immaturity of public wireless networks does tend to exacerbate them. These challenges include:

- Coverage
- Reliability
- Standards
- Speed
- Costs

In many cases, the unique benefits wireless can bring make it worth dealing with the challenges. Your organization may find innovative ways to wirelessly enable existing business applications. You might find value in formally embracing handhelds and speeding deployment – with or without wireless. It all comes back to the business process being supported, and how that translates into the overall solution.

Keep in mind that next generation wireless networks will mitigate these challenges sooner or later, and that wireless will emerge a truly strategic enabling technology. As such, we believe that IT organizations are well served to cut their teeth on wireless today in order to begin building core competencies for the future.

Wireless impact on other layers

When building out your mobile solution with wireless communications, you should take into account the effect on the other layers in the model.

Applications. The application layer should be driven first and foremost by the business problem you are trying to solve that led you to mobile computing in the first place. As such, it is unlikely that choosing wireless is going to affect your choice of the application. However, wireless might let you revisit existing processes and applications to see if there are opportunities to seize competitive advantage by mobilizing or extending these applications.

Devices. All of the major types of mobile computing devices offer one or more options for wireless connectivity. However, not all devices have options for all networks, so the decision to support a specific device is usually made hand-in-hand with the decision to support a particular type of wireless connectivity. You can read more about devices, the networks they support, and key criteria for selecting devices in Chapter 4.

Integration points. The back-end integration points are largely determined by the application layer. However, you should consider the existing back-end systems within your environment such as relational database servers, file and Web servers, and Exchange or Domino servers. Look for ways to wirelessly enable them to solve business problems and build competitive advantage.

Mobile middleware. Ideally the mobile middleware you choose will help overcome many of the challenges of going wireless. Your mobile infrastructure platform should support whatever devices, networks, and integration points you wish to mobilize. It should be able to push out important, time-critical, relevant information to mobile workers. Thus, the choice to go wireless will indeed affect your choice of mobile middleware, which should be platform-agnostic and support all major standards.

More on the middleware layer

Remember that basic purpose of a mobile middleware platform is to…

- Authenticate mobile devices connecting to network resources through a single source
- Optimize for low bandwidth, intermittent connections
- Provide secure access only to users' authorized information
- Support all types of information – data, files, email, corporate intranet content, etc.
- Push contextually relevant data to the user based on the users' daily activities

Even if you are dealing with a very specific project for a specific device and network, it is important to plan for the future and choose a comprehensive platform to minimize costs of future deployments.

The alternative is buying and maintaining a portfolio of middleware solutions as you pursue future projects and support other devices and networks and types of information. This is not only more expensive and inefficient, but it creates integration nightmares.

Systems management for mobile and wireless devices also presents unique challenges. There are strong benefits to deploying one mobile middleware solution to meet the above requirements as well as providing specialized mobile systems management capabilities. Mobile systems management tools, which run quietly in the background allowing the user to concentrate on their job functions, are highly sought after by the enterprise.

Examples of strong wireless value

The following are examples of the types of solutions that companies have deployed today where wireless connectivity adds strong value to the overall solution.

Risk management & insurance. A large property & casualty insurer helps clients manage risk by sending risk engineers onsite to profile and analyze client facilities. Data is captured onsite on laptops, and synchronized back to a central database. An extranet site provides customers with access to their site reports stored in this database. The company uses wireless connectivity to make these reports available within hours – not weeks as was previously the case in their paper-based environment. This creates a huge service advantage. This project is very typical of a trend in service related industries, where providing information to customers about their own operations is just as important as providing the actual service performed.

Electric meter reading. A major electric utility company employs a large field-based workforce that captures billing information by physically visiting customer sites and reading the values from their electric meters. The historical way this information flowed into the billing process was that onsite the reading was recorded on a paper form, which was then forwarded to the corporate office for data entry, and only then could a bill be sent. Using today's wireless devices, the same utility captures the reading onsite directly into a handheld device, and periodically throughout the day the staff member uploads the day's readings from a wireless device directly into the billing system database. This knocks several days off the time it takes to collect receivables, and result in more accurate billing – two things any CFO is eager to do.

Wireless handheld Email. For executives of a large vehicle manufacturer, the ability to keep in touch with key partners and customers from anywhere is an important competitive advantage. Being able to pickup and reply to Email while on the go is just as important to this company as doing the same with voice mail. Wireless Email opens the door to increased productivity for these mobile knowledge workers who are now able to do work in a taxi, waiting in the lobby for a meeting to start, between flights, or over breakfast in the morning. This easily applies to knowledge workers in a wide variety of industries.

Contact Management / SFA. Sales reps in a large Oklahoma-based dental supply company get complete customer history data delivered to their handheld devices daily. Customer satisfaction increases when sales and service rep have timely, accurate information about customers. The ability to enroll customers in continuing education classes, view invoice details for the last two years and calculate key business statistics allow the reps to achieve a significant competitive advantage. The company expects to save over $100,000 per year and achieve a nine-month ROI with this project.

Clinical Trial Management. A wealth of data is collected during the phases of clinical trial management. For one of the largest global pharmaceutical manufacturers getting this data to a variety of internal audiences, and ultimately through to FDA reviewers is an expensive, mission-critical business process. Managing the cost of clinical trials by automating the collection and consolidation of this data, provides a significant competitive advantage.

Executive Information Systems. The speed at which the financial services industry moves creates challenges in keeping executives current with day-to-day operations. One of the leading wholesalers of mutual funds meets this challenge by providing an executive dashboard for up-to-the-minute market and product information. This instant feedback loop keeps executives in touch with the important metrics that influence key decisions.

Chapter 3- Introduction to Wireless Data Networks

The section is designed to provide a thorough introduction to the current state of the public wireless network infrastructure. It is comprised of four sections of which the first three address specific aspects of the global wireless infrastructure. The first section gives an overview of wireless networks defining speeds, protocols and types of networks. The second section discusses the worldwide allocation and roll out of the 3G wireless networks. The third section provides wireless coverage maps to better understand current coverage levels by network. The final section offers some practical insight and recommendations based on the current state of the networks.

Overview of existing networks

Although the majority of our commentary in this resource book is focused on wireless WAN technologies, other types are presented as well in Figure 2 below. Note that existing 1st and 2nd generation technologies are typically much slower than a 56Kbps dial-up line. And even yet-to-be delivered 3rd generation networks will not come anywhere close to the speed of the wired office LAN for which most corporate applications are designed.

Figure 3. Theoretical vs. Actual Wireless Transmission Speeds

Source: Gartner

Generation	Technology	Theoretical Top Speed	Avg. Delivered Speed
1G	AMPS	19.2 Kbps	Less than 9 Kbps
1G	CDPD	19.2 Kbps	9.6 Kbps
2G	TDMA, CDMA, iDEN, GSM	19.2 Kbps	9.6–19.2 Kbps
2.5G	GPRS	115 Kbps	20-40 Kbps
3G	1xRTT	153 Kbps	60-80 Kbps
3G	EDGE Phase II	384 Kbps	80-100 Kbps expected
3G	1xEV-DO	2.4 Mbps	200-300 Kbps
3G	W-CDMA	384 Kbps	200-300 Kbps
3G	1xEV-DV	4.8 Mbps	200-300 Kbps

In Figure 3, the Wireless Generation is a function of speed and maturity of technology and is usually representative of a family of similar technologies, while 3G networks need to meet International Telecommunications Union specifications. Theoretical Throughput is the best-case attainable speed over the network, and is typically 50 to 100% faster than real-world performance.

When will we see 3G?

The deployment of 3G networks is just beginning in earnest. Japan's NTT DoCoMo has the only true 3G network commercially available today, however they are scheduled to be joined by Europe's Hutchinson Telecom in April of 2003. Why is it taking so long? Once the presumed viability of 3G became widely expected, each country initiated allocation of the 3G radio spectrum within their geography. You can see in Figure 4 that this has been an ongoing staggered process since 1999. In some countries the licenses were simply awarded (freeing capital for immediate build-out) while in others auction prices reached staggering proportions.

Figure 4. Status of 3G Spectrum Awards

Country	Allocation Scheduled For	Complete	Type	Comments
Finland	03/99	Yes	Beauty Contest	4 national and 2 regional licenses.
Spain	03/00	Yes	Beauty Contest	4 national licenses.
UK	04/00	Yes	Auction	5 national licenses.
Japan	06/00	Yes	Beauty Contest	3 licenses awarded.
Netherlands	06/00	Yes	Auction	5 national licenses.
Germany	06/00	Yes	Auction	6 national licenses.
France	09/00	Partial	Beauty Contest	2 national licenses, 2 pending licenses.
Sweden	11/00	Yes	Beauty Contest	4 national licenses.
Italy	11/00	Yes.	Hybrid	5 national licenses.
Singapore	04/01	3 of 4	No Contest	3 national licenses.
Australia	01/01	Yes	Auction	6 national licenses
New Zealand	07/00	Yes	Auction	4 national licenses
Taiwan	02/02	Yes	Auction	5 national licenses
Canada	01/01	Yes	Auction	5 national licenses
United States	To be announced	No	To be announced	To be completed

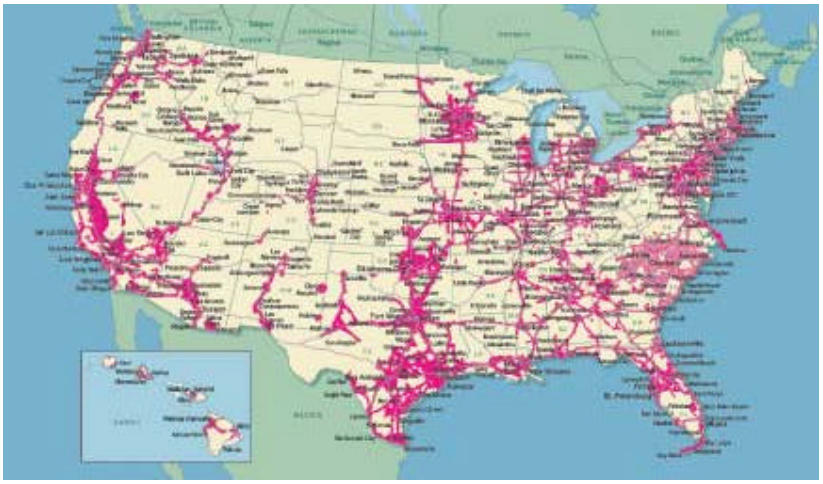
**Source: UMTS Forum, November 2002. (www.umts-forum.org).*

Standards and coverage in the US

The United States in particular faces heightened challenges related to a lack of standards, and a vast geographic area. Both factors impact coverage for any given network. The following maps, Figures 5 thru 9, show wireless coverage in the US for a variety of networks.

Figure 5. Coverage Map for AT&T Wireless Network

Figure 6. Coverage Map for T-Mobile's GSM Network



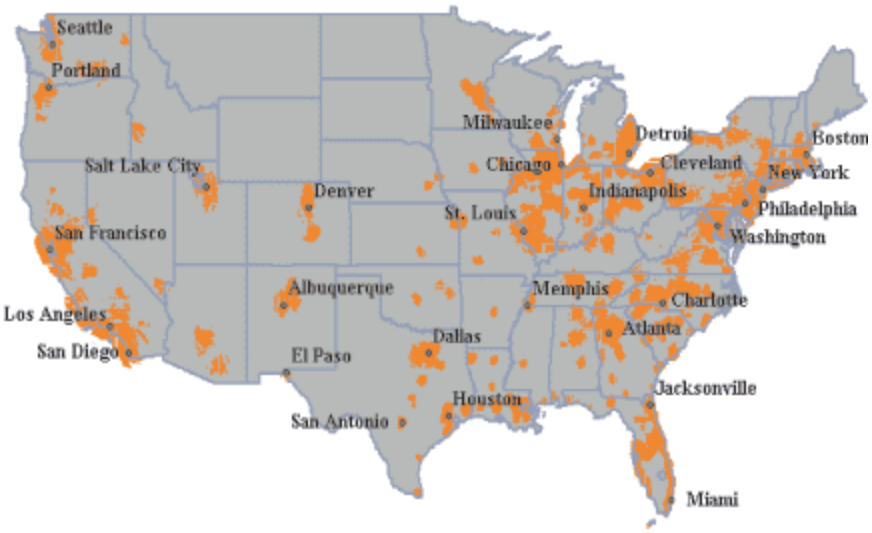


Figure 7. Coverage Map for Cingular Interactive Network Based on Mobitex

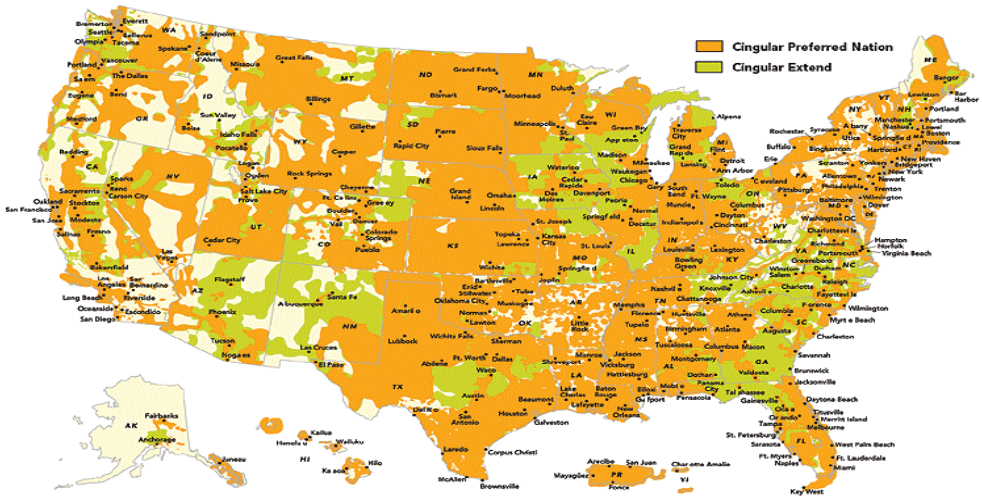


Figure 8. Coverage Map for Cingular TDMA Network

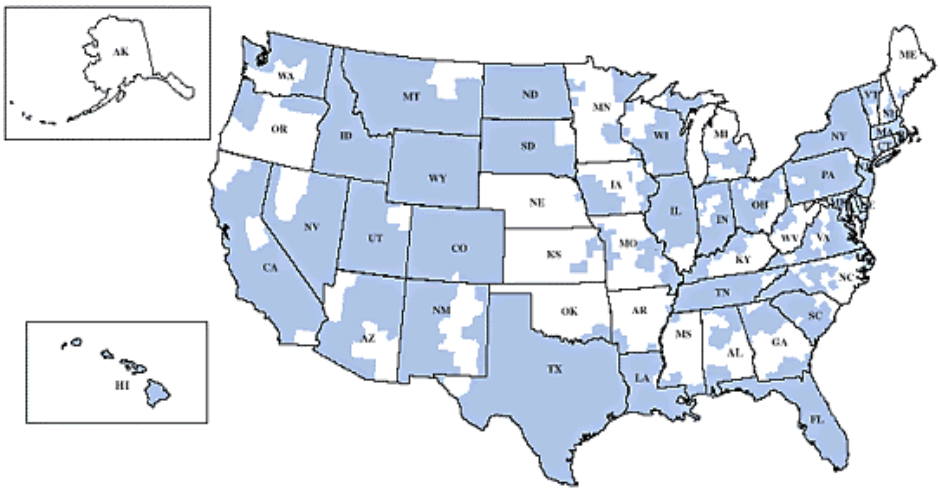


Figure 9. Coverage Map for Verizon's CDMA Network

Coverage in Europe

Compare the level of US coverage for any given technology with that offered in Europe where there is one standard. The maps in Figures 10 and 11 below are typical for other European countries in terms of coverage.

Figure 10. Coverage Map for the T-Mobile GSM Network in the UK

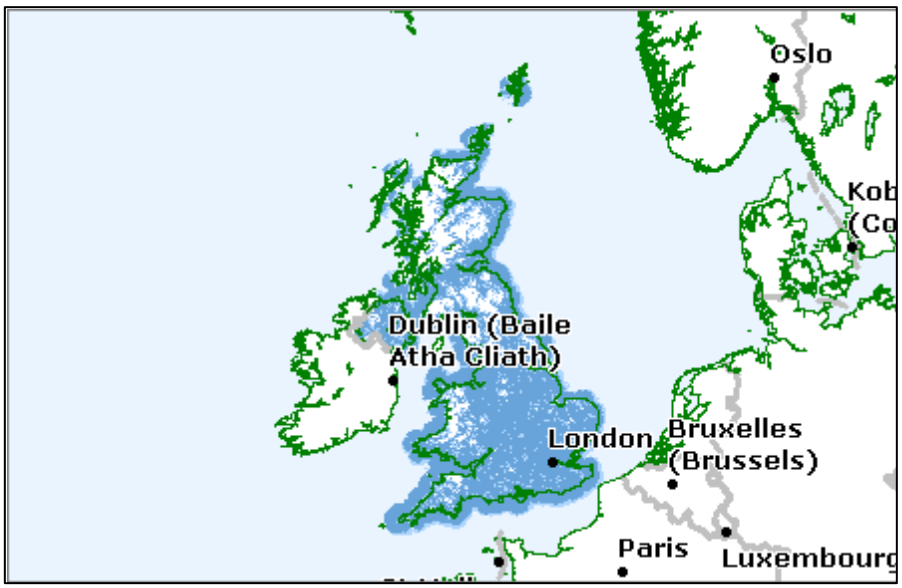


Figure 11. Coverage Map for the Telecom Italia GSM Network in Italy.

Coverage in Asian countries varies widely and no single map would be representative for that region.

Implications for the short term

Based on the above information, the following implications should be considered in planning your near-term wireless investments.

Value of 3G technology/spectrum is less than initially thought. The fees paid for 3G spectrum licenses have been trending downward signifying the reduced perceived value of the licenses. This is due to bidding telecomm firms questioning how they can commercialize the service and make a profit based on the cost of the spectrum and building out the network. Look back at the fees paid over time in the UK ($35 billion), then Germany ($45 billion), then Australia ($1.1 billion).

> *"..in the second half of 2002, the first installments of 2.5 GPRS handsets will be put to use, but Ollila, Nokia CEO, agreed that the service paradigm is not there. Technology does not bring anything unless real services are built upon that technology."*[3]

[3] Pinnacor Stockpoint, May 2002

While all purchasers still believe in the value of deploying the 3G networks, the potential revenue streams are being questioned, and overpayment for the spectrum has had major implications on deployment timeframes.

Deployment is likely to be delayed. "With the collapse of the global telecommunications market in 2001, battles over license cost, service launch timing and coverage are now being fought in the courts. This has led to an inevitable delay in the technology availability."[4] As previously mentioned the astronomical costs for the 3G spectrum, greater than $80 billion in the United Kingdom and Germany, along with stringent rollout limits requiring some operators to be 80 percent deployed by 2007 have many rethinking the potential success for these services.

Standards are still uncertain. While the 3G spectrum auctions continue and early deployments get started, there is a host of confusing 3G standards. The definition of 3G has changed since early 2001 and now includes technologies previously thought of as 2.5G. The lowered minimum network speeds of 3G from 384 Kbps to 144 Kbps, allows both CDMA2000 1XRTT and Enhanced Data for GSM Evolution (EDGE) to be considered 3G. The global 3G picture may wind up looking more like the standards mix that exists in the US today.

Coverage is incomplete. As the maps suggest, and as we experience in our daily usage of cell phones, coverage is not complete. Planned 3G rollouts are scheduled to be completed in the 2004-2006 timeframe. Additionally, sales of the infrastructure components to support the upgrade of technologies from 2 to 2.5G have remained somewhat sheltered from the downturn, revealing that network providers may suspect that 2.5G technologies may suffice until all the 3G issues are worked out.

3G networks wrap-up

The combination of these factors indicates that there is uncertainty around the deployment of the higher quality 3G wireless data networks. Organizations will likely have to live with the standards, coverage, reliability, and speed issues that exist today for at least the next couple of years. Of course, some companies have already proven its possible to be successful with today's wireless networks. We believe there is reason to be optimistic and proceed by cautiously applying wireless to your business model today … while we all wait for the exciting high performance networks of the future.

[4] Gartner Group Research Note. Wireless Technology: Cutting Through the 3G Hype, December 2, 2002

Chapter 4- Mobile Wireless Device Overview

Choosing wireless connectivity has implications for the specific mobile computing hardware you choose. While all types of devices support at least some types of wireless connectivity, the specific type of wireless network you choose will influence your hardware options, and vice versa.

There are many devices you can use to support mobile computing initiatives, with multiple manufacturers for each. Figure 12 shows some of the major manufacturers for each type of device.

Figure 12. Mobile Device Manufacturers

Laptop PCs	Dell, Gateway, IBM, NEC, HP, Toshiba, Sony, and many others
Tablet PCs	Toshiba, Fujitsu, ViewSonic, DT Research
Palm OS handhelds	Handspring, Palm, Sony, Symbol, HandEra
Pocket PC handhelds	HP, NEC, Casio, Dell, URThere, Intermec
Handheld PC handhelds	HP, Casio, NEC, Sharp
Other CE devices	Symbol, HP, NEC, Intermec
Email Pagers	Motorola, RIM
SMS-enabled phones	Ericsson, Motorola, Samsung, Nokia, and many others
WAP-enabled phones	Ericsson, Motorola, Samsung, Nokia, and many others
Palm OS smartphones	Handspring, Palm, Kyocera, Samsung, others
Pocket PC Phone Edition	Samsung, HTC, Siemens (AT&T, T-Mobile, O2)
Microsoft smartphones	HTC – SPV(Orange)

**Source: Device and OS Vendor Websites*

Adding wireless connectivity to traditional handhelds

Wireless connectivity with laptops employs fairly standard technologies typically using PCMCIA cards that are compatible with any machine. The situation with handhelds is more complex, with proprietary hardware and resulting limited network choices for most handhelds.

The table in Figure 13 summarizes this information for the most popular handhelds:

Figure 13. Device Options for Wireless

Handhelds	Networks	Modems	Available From
HP iPAQ H3600	CDPD	Sierra Wireless Aircard 300	HP
	CDPD	Novatel Wireless Merlin	Verizon, Novatel Wireless Direct
	CDMA	Sierra Wireless Aircard 510	Sprint
	Ricochet	Novatel Wireless Merlin for Ricochet	HP (Denver, San Diego only)
	GPRS/GSM	Sierra Wireless Aircard 750	T-Mobile, Verizon
HP Jornada 540	CDPD	Novatel Minstrel 540	HP, Novatel Wireless Direct
Palm VII	Mobitex	(built in)	Palm.net
Palm m500	CDPD	Novatel Minstrel m500	Verizon, Novatel Wireless Direct
Palm V	CDPD	Novatel Minstrel V	Verizon, Novatel Wireless Direct
Palm III	CDPD	Novatel Minstrel III	Verizon, Novatel Wireless Direct
ALL PALMS	CDMA	Palm Mobile Internet Kit (requires data enabled phone)	Verizon, Sprint
RIM Blackberry	Mobitex, Datatrac, GPRS	(built in)	Cingular, AOL, Verizon, Nextel and many others

**Source: Device, Carrier, and Modem vendor websites.*

Smartphones, WAP phones, and SMS phones all offer inherent network connectivity if they operate using digital technology. The wireless service provider the phone is configured for must also offer wireless Internet service.

The device wars

Laptop PCs have largely become commodity items, similar to the PC, with recent ultra-slim highly stylized notebooks being the exception. Tablet PCs have yet to become very popular, though many organizations that have adopted them are having very positive experiences.

The "handheld wars" for market share are widely reported on. The once dominant Palm is seeing steady erosion of market share to their own operating system licensees, such as Sony and Handspring. Hewlett-Packard continues to lead the Pocket PC charge with very rapid increases in share principally through enterprise sales. With the number of vendors who distribute PDAs increasing rapidly from only two years ago, it is difficult to predict how the market will evolve. Other factors that will have an impact on PDA market growth include the economy, smartphone adoption rates and the cost of PDAs vs. the cost of Notebooks. See Figure 14 for greater detail of worldwide handheld market share.

Figure14. Handheld Market Share
Based on Estimated New Unit Shipments

Manufacturer	**2Q02**	**2Q01**
Palm	30.3%	32.1%
Handspring	7.8%	10.7%
Sony	10.2%	2.2%
Hewlett-Packard	16.0%	22.4%
Research in Motion (RIM)	2.1%	2.6%
Others	33.6%	30.0%

** Source: Gartner/Dataquest Alert. August 1, 2002.*
** Does not include smartphone devices.*

There is a lot of commentary on the pluses and minuses of the different handheld platforms in the industry press. The major points we see repeated are that Palm's battery life, simplicity, small form factor, and consumer appeal are that platform's historical draws. Meanwhile Pocket PC devices are rapidly gaining ground due to better display quality, integration with MS Office, suitability for enterprise applications, and innovative functionality such as support for rich media files. And the RIM Blackberry devices are adored for their small form factor, integrated wireless capabilities, and small keyboard that all contribute to making "Email anywhere" an enjoyable reality.

In any initiative, carefully consider the business needs and investigate the appropriate choices against the criteria above before choosing a device.

Smartphones and futures

When doing long term planning, don't forget about smartphones based on Microsoft and Palm OS's. This is an emerging category that holds great promise. Devices such as the Handspring Treo and any of the new Microsoft smartphones from vendors such as Orange, Samsung and the soon-to-be-released AT&T Wireless version will give users many more options to choose from.

The emergence of smartphones has sparked a wide-ranging debate on the future of mobile devices – with two camps emerging. One believes in device convergence and sees smartphones as harbingers of the death of pure phones and pure PDAs. The other sees smartphones as proof of the ongoing proliferation of new device types and the trend towards users having more and more devices.

Choosing the right device

It is important for corporations looking to contain the costs of procuring and supporting devices to standardize on a small portfolio of devices. The selection of these devices should take into consideration these factors:

- length of battery life
- size of the display area
- readability of the display
- mechanisms for data input
- cost of procurement and support
- overall form factor
- processing power
- 3rd party application availability
- amount of local storage
- available connectivity options
- security factors
- supporting application development tools

Different groups of mobile workers may be best served by different devices. For each user community, you need to consider their usage patterns and the business processes that are being facilitated, and determine the appropriate devices to support them.

Make sure to budget for a short lifespan, keep plenty of spares on hand, and train your helpdesk staff on how to support the devices. And don't rely on your existing LAN based systems management tools to do a good job of servicing these highly mobile assets. Like all assets, look to manage the Total Cost of Ownership, in this case by utilizing specialized mobile systems management software.

Device selection examples

Below are some typical examples. They will give you a feel for how to relate business needs to the selection factors we've listed.

Warehouse inventory. One large shoe manufacturer uses simple ruggedized handhelds for capturing inventory information – a basic data collection task. Symbol Corporation manufactures the units that include a built-in bar code scanner. The manufacturer uses a mix of Symbol units based on both Palm OS and Pocket PC. Handhelds in general are very well suited to simple data collection tasks, and the decreased cost of handhelds makes it possible to cost-effectively automate a wide variety of process that have been paper-based until now.

Document authoring. A large law firm in Southern California has a very mobile workforce that typically works from home or at client sites. For these professionals, the laptop is still the device of choice for extensive document authoring – legal briefs, client memos, etc. Creating lengthy materials, or files rich with graphical content, is typically more appropriate for PCs than handhelds.

Getting through daily Email. Many high technology companies do large amounts of their business through channel partners that are managed by groups of business development staff. One software manufacturer armed their staff with handhelds for keeping up with the daily flood of Email. When staffs are traveling they typically recover one to two hours of productivity each day. After returning to their hotel room each night, they have prescreened all their Email, and don't have to wade through 50 to 100 messages before getting onto the real work of in-depth responses to key communications.

Sales force automation. For a large specialty chemicals manufacturer, one device wasn't enough. Their traveling salespeople needed a laptop for creating Powerpoint presentations and answering RFPs. The laptop keyboard, large display, and ability to manipulate graphics make it the required tool for the job. The sales people also benefit from a handheld-based SFA application that allows easy access to basic customer and order information. Being rarely in the office, long battery life proved to be key criteria for the handheld, and Palm Powered devices were chosen.

Healthcare application. The small form factor of handheld devices made them ideal for busy health care workers that visit patient after patient moving throughout a large hospital in London. They can carry along a wealth of reference material, and directly record patient information, eliminating the need for all those illegible paper charts. In this case, the users stop by their desk to start and end each day, so battery life was less of an issue since they could recharge overnight. However, the amount of

local storage and quality of display were critical given the large volume of reference material being accessed, and the importance of acting on correctly read information. A Pocket PC device was chosen.

Supporting multiple devices

In each of these cases, the usage pattern and processes being automated made some of the device characteristics listed above more or less critical. The business drivers should thus lead you toward the most appropriate device for the task. In some cases you will need to support multiple devices for different user communities.

In addition to supporting different types of devices for different classes of user, industry analyst META Group predicts "By 2004, each corporate knowledge worker will have three to four different computing and information access devices that will be used to access various applications."[5]

Do not be overly concerned on this point … instead look to the application development tools and mobile middleware solutions you choose to remove a majority of the challenges of integrating multiple mobile device platforms.

[5] META Group. Entering the Mobile Millennium. Presentation 2/14/2000.

Chapter 5- Wireless Architecture Options

Any mobile computing project can be based on two basic architecture models – Synchronization and Real-time access. This is equally true for both wire line and wireless connectivity. Let's examine the two models, the challenges that created the need for wire line synchronization, and reasons why synchronization is even more important in the wireless world.

The two models reviewed

Real-time access. The mobile computing device connects to the network whenever the user needs information, a query is sent to a communications server, and the requested information is located and transmitted back to the device for viewing. The user can interact with the information on the server only when a connection is available.

Synchronization. The mobile computing device connects occasionally to the network when possible, and synchronization middleware keeps information on the device in sync with that on the server. The user can interact with information on the device anytime regardless of connection availability, and sync up when possible. Synchronization is also referred to by many as offline access or store & forward technology. Push technology is a real time approach to sync, which combines real time activity with offline access. It allows you to receive email, files and data when inside wireless coverage areas and gives you the flexibility to have offline access when outside of coverage range.

Why synchronization?

Many people mistakenly assume that wireless applications must automatically have a real-time access or thin client model. In fact, synchronization technologies originally developed for wire line-based mobile computing are even more applicable in the wireless world of heightened challenges.

The factors identified in Figure 15 have led corporations to demand mobile middleware solutions with synchronization capabilities. These factors are relevant to discussions of both wire line and wireless mobile computing.

Figure 15. Challenges to Real-Time Access Model

Challenge	Notes
Coverage	Users need to ensure coverage or track down a phone line or network port to connect. Big impact on convenience and usability.
Speed	A function of throughput and latency. Users have to endure idle time while the query is transmitted, while the server searches for information, and while the information is transmitted back. Likewise for stored changes to be applied.
Communications costs	Store and forward sync can offset the added costs of mobile computing. The real-time model means repeat downloads of information, must send query to server and retrieve data each time the same info is accessed.
Reliability	The mobile worker is dependent on the reliability of network connections to accomplish tasks. Work can continue when connections drop with synchronization.
Standards	Wired standards are well established, with a variety of options. Wireless standards are still emerging – increasing total costs to support mobile computing.

In the past, most corporations had already pursued mobile computing leveraging wire line connections such as dial-up, WAN, VPN, or high-speed dedicated lines to remote locations. Many of these implementations relied on synchronization middleware from vendors such as Synchrologic, designed to help overcome the challenges of real-time access.

Wireless makes sync even more appropriate

The same architecture considerations must be weighed today when considering wireless solutions. While the availability of wireless networks undoubtedly adds convenience to the end user, as well as potentially increasing the timeliness of information the user interacts with, the challenges of mobile computing still exist in the wireless world. *In fact, they are generally exacerbated and have a far more pronounced effect.* Thus, the same factors that made synchronization a great technology for managing mobile computing with wires, make it even more appropriate for many wireless applications.

Corporations will have to make well-reasoned choices between wire line and wireless communications, and between synchronization and real-time access. In fact, many organizations today are choosing to pursue hybrid models that support multiple options in order to serve different users in different geographies at different times.

We see enterprises demanding a mobile computing infrastructure that supports all mobile computing devices, provides comprehensive mobile infrastructure functionality, and supports both architecture models. Figure 16 summarizes the spectrum of mobile computing architectures, or "ways of working", that Synchrologic believes it is necessary to support:

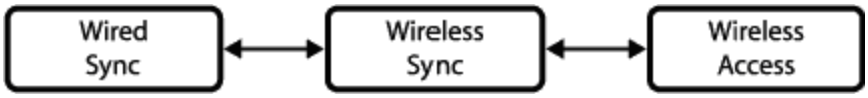


Figure 16. Options for Mobile Systems Architecture

How do I choose which model for my wireless app?

To select the most appropriate model, you will need to consider the following questions:

- Do users live and work in areas of ubiquitous wireless coverage?
- Will work site building structures cause interference to wireless?
- Will users wait for the query & response period?
- How important is guaranteed access to information stored locally?
- How often does the referenced information change?
- How much more will real-time access cost for communications?
- Does real-time access add business value beyond synchronization?
- How granular is the information brought down with each query?
- Is instant access more or less valuable than up-to-the-second data?
- How long will users wait to download large attachments?
- Is lack of access to data acceptable if coverage is not available?

Again, many times a hybrid model might be appropriate where the solution must support both real-time and synchronization architectures, for different groups of users or for users to use selectively at appropriate times.

Decision examples for each model

CPG route sales. This major consumer packaged goods company uses a route-sales based model. When visiting retail outlets salespeople check on stock levels and coordinate restocking orders with store management. Orders placed can easily be synchronized periodically via wireless connectivity. The cost of the real-time access model would be significantly greater. It takes 5 minutes to work through the order entry with the store manager online, but only 30 seconds to synchronize that order back to the server once entered offline. Multiply that times the typical 15-20 store visits per day and the synchronization model shows significant costs savings, while the business process is streamlined by

automation. There is no real benefit in this case using the online access model, so the cost savings drive the decision.

Email for knowledge workers. Operations managers for a large oil and gas company spend most of their time traveling to remote sites. Email access from handhelds is quite handy. However, users are not always near a phone socket and spend lots of time in rural areas where there is no wireless coverage. It was important that the Email be actually synchronized to the device. This is almost universally true for all mobile Email solutions, except where the device employed has no local storage or no ability to support an Email client application – such as most current WAP phones.

Stock quotes and trading. Stock prices change rapidly, and accurate information regarding stock prices has significant impact on ability to make investment decisions. For potential investors, getting up-to-date stock prices immediately prior to trading is critical. The real-time access model is the only acceptable choice. A large brokerage house that offered wireless trading to their customers had no choice but to offer a real-time access solution.

Sync as default option

The bottom line is that you need to look at the business drivers behind the mobile computing project, consider the types of factors above, take a look at how dynamic the information is, and carefully weigh the usage patterns for the application. Only then can you select the appropriate model. For practical reasons, synchronization should be considered the default option, unless a compelling reason for real-time access is forthcoming in your review.

Chapter 6- Summary Guidelines for Wireless Success

The Gartner Group aptly describes the confusions around wireless computing with their Mobile Technology Hype Cycle where technology advances through five levels of maturity – Technology Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment and Plateau of Productivity.

3G and 2.5G wireless WAN technologies are descending from the Peak of Inflated Expectations into the Trough of Disillusionment. The only wireless technology to be ascending up the Slope on Enlightenment are Wireless LANS, with users beginning to see real competitive advantages from their deployment.[6] Not much has changed in this regard since these comments were published by Gartner in 2001

Yet despite this, early adopters are building the momentum that will take the marketplace onto the Slope of Enlightenment. How can you successfully build competitive advantage and core competencies in wireless today?

Based on our discussions with hundreds of senior level IT executives, we have identified the following guidelines as representative of the attitudes and policies of the industry leaders successfully deploying wireless solutions today. This chapter of the resource book presents these strategies, some of which are purely related to wireless, and others that apply equally well to all types of mobile computing.

Figure out where to start

With all the attention on wireless there are lots of "coolness" driven pressures to take organizations wireless immediately. We recommend careful consideration of three different approaches being undertaken in companies today:

- Building a new wireless app from scratch
- Extend an existing enterprise application
- Enterprise-wide dedication to wireless

Regardless of where you start, ensure that the business benefits and criteria for success are well defined while enforcing existing business rules, policies and security requirements. We will examine the distinctive benefits and drawbacks of each approach.

[6] Gartner Group. Article Top View, July 12, 2001.

Building a new wireless app from scratch. To buy or build a new application could provide the cleanest approach since you can design the complete solution from the ground up for wireless. This can actually result in the fastest time-to-market.

The drawbacks to this approach are that the effort may require larger scale change management due to the fundamental changes to business processes you are making. More over, starting from scratch on a new application might make it more difficult to integrate into existing systems and leverage your wireless success across the enterprise.

Extend an existing enterprise application. This approach can also provide good time to market and tends to be lower in cost. Typically you are leveraging fundamental components of existing systems where expertise is high, and integration is less of an issue. Data and business requirements tend to be better known so deployment and user acceptance are greatly facilitated. And since this approach capitalizes on existing large-scale investments, the ROI on these projects is maximized with rapid payback.

The main drawback in this area tends to be centered on whether the existing system and information can be optimized for the wireless user experience. Another potential issue is whether the form factor and usability of available devices will support the targeted application. Our experience suggests that, assuming expectations are reasonable, the majority of enterprise information systems can be optimized for wireless connectivity and mobile devices.

Enterprise-wide dedication to wireless. This strategy is one for highly risk-tolerant organizations. It is a way for your organization to anticipate the trends, commit to wireless as an imperative business strategy, invest early, and focus the entire organization on rapidly reviewing, understanding, and addressing all aspects of the wireless organization.

The drawback of an enterprise wide approach is that it is a complex, time consuming, and expensive undertaking. Additionally, finding experienced vendors and managers capable of driving the effort is extremely difficult, as no true domain experience has been built on how to accomplish this. Finally, the current lack of standards and rapidly evolving technologies make for high risk for any large-scale investment.

We recommend the middle ground. We tend to see most organizations take the middle ground and extend existing applications. The decision is typically based upon balancing risk and reward, and investment with ROI. Additionally, many companies have already mobilized the applications

through dial-up connections and synchronization, and as such adding wireless is less difficult.

The other way we have seen wireless computing deployed is in initial automation of existing paper-based processes. Whether for time reporting, inventory and logistics, form completion, or basic data collection… automating these processes with wireless connectivity tends to improve process integrity and provide a quick wireless success for the CIO.

Select best-of-breed components for each layer of the solution

Once you have determined the type of wireless initiative you would like to pursue, you can look at the Component Layers for Mobile Solutions model discussed at length in Chapter 2. Even if you deal with a solutions provider that pulls together a complete solution for you, you will want to be aware of and involved in decisions at each level.

Applications & integration points. The very nature of the project you are pursuing will determine the front-end application and back-end integration points that will be part of the solution. Typically you are enabling access to corporate data, corporate files, or the corporate intranet. Very few projects based on access to information found outside the corporate firewall (such as web access or news delivery) show significant ROI.

Devices. Always focus your device selection on the needs of end-users, business processes, and information requirements. For instance, we worked with one large city newspaper that armed their route drivers with Palm devices because they felt they offered the greatest simplicity for the users – who were not sophisticated computing users.

Connectivity. Choose wireless connectivity for the right reasons…because it supports the business process and provides an advantage in your specific circumstances. Choose your provider wisely based on costs, coverage, and speeds that support your goals. In many cases, you will have to provide multiple connectivity options to different user communities – including a mix of wireless and wire line. Try not to make investments or commitments to failing standards.

Mobile middleware. Select open platform middleware solutions that can support future growth. Look for a comprehensive solution to move all types of information and also help manage the devices. All communications should be totally optimized for mobile computing, and provide the support tools and scalability you require. This component will also manage security, user authentication, and profile-based data access.

By reviewing all these components of your project upfront you gain a better view of the complexities, timeline and costs . . . positioning yourself for success.

Understand and manage all the costs

Based on recent reporting published by several analyst groups, the cost of supporting mobile workers is significantly more than that of desktop users. Estimates of two to five times are common when comparing mobile users to desktop users. These estimates include equipment, connectivity and providing help desk support. The cost of the wireless connection is just one small part of the overall cost of wireless computing.

In order to manage the ongoing cost the following steps should be incorporated:

Take advantage of mobile systems management. Make sure your mobile middleware platform includes systems management capabilities. This will help ensure that your users have up-to-date applications in a very cost effective manner. You can also track devices and capture device inventory (hardware and software) at the server to facilitate end user support.

Plan for intermittent connectivity. Make sure your applications and mobile middleware platform are designed to manage intermittent user connectivity. This protects users with offline access to key information, and cuts down communication costs. Forrester Research estimates that doing this can reduce mobile computing cost by as much as 22% over five years.[7] By incorporating an application or technology that manages disconnected activity you will realize significant cost saving.

Default to handheld devices. Use handhelds instead of laptops when possible. Industry analyst Forrester Research estimates that this can drive a reduction in deployment costs of up to 46%.[8] When doing this make sure your mobile infrastructure can support both laptops and PDAs so that both can be managed effectively. You don't want to rely on different synchronization and device management technologies to support different hardware platforms.

Insist on proper support tools. Ensure advanced session tracking and logging is available to help deal with problems and react to requests for assistance from users. A detailed log of the activity within communications sessions is key. And device tracking allows the mobile

[7] Forrester Research. The Real Cost of Mobility, May 2001.
[8] Forrester Research. The Real Cost of Mobility, May 2001.

middleware solution to note potential problems or device failures and proactively alert the IT department.

Mobile solutions are different

Mobile and wireless computing is a relatively new area, but technologies have been created to specifically address the challenges of meeting the needs of mobile users. Products and solutions that were built for LAN environments will not meet the needs of mobile or wireless computing.

As noted above, going mobile introduces a variety of challenges – speed first and foremost, but also reliability, competing standards, and the challenge of finding network access points or coverage areas.

In wireless environments, core technologies such as check point restart, compression, bandwidth throttling, file differencing, and offline synchronization processing become absolutely vital to success. Moreover a very robust set of administration controls is necessary to monitor, identify and resolve issues within the wireless network.

Due to the wide variety of users, applications, and devices you will likely need to support, having advanced user profiling to filter information is important. The technology needs to be extremely bandwidth sensitive and do everything possible to minimize traffic and maximize the value of the specific information delivered.

Plan for both wireless and wire line connectivity

It makes good business sense that when your mobile worker is in a company office or in their home office that they use the local network or their land line. When they are on the go and need timely information they can connect very conveniently via wireless.

When building applications that will support multiple connection modes, make sure that users are protected from any complications related to switching back and forth between modes. If it requires user effort, you will likely face one of two outcomes: either the users will not bother to reconfigure or will always sync wirelessly, or there will be an increase in the calls to your helpdesk. Either way your costs will rise. Once the device has connected itself to the network, the application should automatically utilize whatever connection is available without requiring user configuration.

Think sync

Synchronization offers a proven, mature technology that evolved to meet the needs of cost-effectively delivering corporate information to mobile and remote workers. Do not fall into the trap of assuming that wireless connectivity means you should automatically pursue a real-time access model. This architecture typically results in higher communications costs. In addition the high latency and low throughput of wireless networks means that mobile workers may reject your solution due to the length of time necessary for query and response cycles for each new screen they look at.

Synchronization ensures that even when they are away from a phone port or outside wireless coverage cells, that users are able to get the information they need and to continue to transact business. This type of reliability is of paramount importance to many business applications.

Never think you are finished

The type of applications and information that can be mobilized with wireless will grow as wireless networks mature, gaining speed and coverage. Once users begin to receive some information on mobile platforms they will want more. Think about everything the typical desktop user needs to do their job that they have on their machine or a click away on the network. As mobility increases and you support more mobile workers, you'll need to find a way to keep all those resources available on mobile platforms.

Eventually the entire spectrum of mobile computing needs will be totally wirelessly enabled. Plan ahead for this day and do not invest in throwaway technologies. You want to work with vendors that see this vision and will be able to support you over the long haul.

Plan ahead for the wide variety of technologies you will need to support, and make sure your infrastructure is geared to handle them. You want to avoid duplicate systems and the added support and integration costs they entail. Remember that in the long term you will need to provide support for:

- Multiple devices
- Multiple networks
- Multiple integration points and applications

Synchrologic hopes this white paper has equipped you with the critical information needed to deepen your understanding of the mobile and wireless landscape. As well as, present a comprehensive overview of issues and opportunities involved with mobilizing your organization.

Chapter 7- A Wireless Glossary

1XRTT — A 2.5G network standard that has been adopted by Sprint and Verizon in the US for initial deployments in test markets towards the end of 2001.

2.5G — Faster than today's wireless networks, but slower than 3G, 2.5G technologies face limited trial deployments in 2001, and are promoted by carriers as stepping stones to eventual 3G deployments.

3G — An industry term used to describe the next generation of public wireless voice+data networks. To qualify as 3G, a network must meet certain requirements for speed, availability, reliability and other criteria set forth by the International Telecommunications Union. There are many 3G network technologies being developed, generally they are packet-based "always on" networks.

802.1x — A family of Wireless Local Area Network specifications. The 802.11b standard in particular is seeing widespread acceptance and deployment in corporate campuses, and at commercial facilities such as airports and coffee shops that want to offer wireless networking to their patrons.

AMPS — Advanced Mobile Phone Service. A term used for the first generation of analog wireless technology. It is based on waveform transmission unlike digital technologies, which broadcast ones and zeros.

Bandwidth — The size of the network "pipe" or channel for communications in wired networks. In wireless networks, it is determined in part by the range of frequencies that can carry a signal, as well as efficiency of the wireless network for supporting multiple "conversations" on any given frequency. Measured in Kbps or Mbps.

Bluetooth — A short-range wireless specification that allows

	radio connections between devices within a 10 meter range of each other. Bluetooth is designed as a Personal Area Network technology with a wide variety of theoretical uses … though few products have been released which incorporate the technology.
Broadband	Descriptive term for evolving digital technology that provides consumers a single switch facility offering integrated access to voice, high-speed data service, video demand services, and interactive delivery services.
CDMA	Code Division Multiple Access. US carriers such as Sprint PCS and Verizon use CDMA technology to power their wireless networks. CDMA allows for multiple transmissions to be carried simultaneously on a single ireless channel. CDMA is a 2G wireless technology that is an alternative to GSM – the standard in Europe and Asia.
CDPD	Cellular Digital Packet Data. Allows telecommunications companies to transfer data over existing cellular networks to users. CDPD is a common choice for wireless data in the US currently.
Cellular	General name for analog and digital networks that divide large areas into smaller coverage areas called cells. As a user moves from cell to cell their connection is theoretically handed off without interruption.
Circuit Switched	A classification for networks where the device connects to the network only when placing or receiving a call, such as with a traditional phone line. Next generation wireless networks will use packet-based networks, which are "always connected."

Dual Band Mobile Phone	A mobile phone that picks up analog signals when a digital signal fades. The handset operates on both 800 MHz cellular and 1900 MHz PCS frequencies.
EDGE	Enhanced Data for GSM Evolution. A faster technology for GSM and TDMA networks that may offer wireless data transfer of up to 384 Kbps.
GPRS	General Packet Radio Service. A 2.5G technology being implemented in GSM networks. It is a packet-based "always on" technology with data transfer speeds of up to 114Kbps.
GSM	Global Systems for Mobile Communications. A digital cellular or PCS standard for how data is coded and transferred through the wireless spectrum. It is the 2G wireless standard throughout the world – except the US. GSM is an alternative to CDMA.
HDML	Handheld Device Markup Language. Technology based on HTTP, the underlying Web protocol, that allows for the display of text versions of web pages on wireless devices.
I-Mode	A very popular service in Japan for transferring packet based data to handheld devices. It is based on a compact version of HTML and does not use WAP standards. AT&T Wireless and the creator of I-Mode – NTT DoCoMo – may bring the I-Mode service to the US in the future.
iDEN	Integrated Digital Enhanced Network. A TDMA based technology that allows users to access phone calls, two way radio transmissions, paging and data transmissions on one device. Developed by Motorola, the Nextel service in North America uses it, as do some carriers in South America and parts of Asia.

Packet — A way of organizing data for transmission to break larger data streams up into smaller bundles that are pieced back together by the recipient based on header, text, and trailer information in each packet. Packet based networks are typically "always on" and do not require the user to initiate a dial-in to connect to the server.

PCS — Personal Communication Services. A general category for two way digital networks with integrated voice, data, and messaging capabilities.

PDA — Personal Digital Assistant. A small computing device based on the Microsoft Pocket PC standard or Palm OS. Generally PDA means the same as "handheld," a term that is more frequently used as the devices have taken on a growing role in corporate computing. Typically available with embedded Email, calendaring, address book, tasks, and memo applications. 3rd party and custom developed software can extend the functionality of the device.

Smartphone — A combination of a mobile phone and a PDA. Smartphones differ from normal phones in that they have an open operating system and local storage, so that the user or corporation can add information and applications to the phone as they could with a PDA.

SMS — Short Messaging Service. A service through which users can send text based messages from one device to another. The message is limited to 160 characters. This is typically the delivery mechanism for "Email" to digital phones today. The Email is converted to an SMS message, truncated to 160 characters, and delivered to the user's handset.

TDMA	Time Division Multiple Access. A wireless technology that allows for increased bandwidth over digital cellular networks. Similar to CDMA, the call stream is broken into fragments so that multiple calls can take place over a single frequency.
WAP	Wireless Application Protocol. A set of protocols that provide optimized web access on digital wireless devices such as mobile phones. WAP is designed to work over existing wireless networks including CDMA and GSM, and typically involves a WAP microbrowser on the device and a WAP gateway server at the carrier facility to connect to the Internet.
Wireless Spectrum	A band of frequencies where wireless signals travel carrying voice and data information. Wireless spectrum is typically auctioned or assigned to carriers by each national government.
WML	Wireless Markup Language. A version of HDML, WML is based on XML and will run with its own version of JavaScript. Wireless application developers use WML to re-purpose content for wireless devices. WML is the markup standard associated with the WAP protocols.
XML	Extensible Markup Language. A technology that is rapidly becoming the global method of choice for creating web content. It operates over multiple devices and network platforms.

About Synchrologic

Synchrologic's mobile infrastructure software solutions create competitive advantage by increasing mobile worker productivity and decreasing cost of ownership of mobile devices. Synchrologic Mobile Suite mobilizes enterprise email and applications, automates the delivery of documents and Web sites, and provides mobile systems management tools – for laptops, tablets, handhelds, and smart phones.

With Synchrologic, mobile device users have access to the information they need – wherever and whenever they need it. System administrators benefit from a central administrative console for securely managing mobile devices and the information they receive. Synchrologic Mobile Suite provides uniquely comprehensive capabilities to help organizations achieve success.

Synchrologic's unparalleled technology is the winning product of over 7 years' experience supporting mobile and wireless initiatives for over 150 world-class corporate and OEM customers including 3M, Accenture, Casio, Citicorp, Domino's, Hertz, Nintendo, Microsoft, NEC, and Pfizer. The company is privately held with headquarters in Atlanta, Georgia, and European offices in London and Milan.

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