LinksPoint White Paper

Wireless Data Update:
Beating the Technology Shell Game

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ABSTRACT

Listening to wireless service providers talk about the service that they and their competitors offer has become more and more like the old shell game. It's easy to get lost in a swirl of acronyms and unqualified statements about data rates and coverage. But with the pressure to deploy applications that deliver real productivity increases and measurable ROI, it's critical that you don't choose the empty "shell" that will commit your business to the wrong technology choice.

With confusion reigning around the competing wireless data technologies being brought to market and the specter of "3G" wireless appears on the horizon, you need unbiased answers to your questions about technology that promises be crucial to your business. This session is designed to separate the hype from the reality and provide a baseline working understanding of the wireless data options available to support mobile applications. This will be achieved by a clear and concise review of each of the major wireless data technologies including CDPD, Mobitex, GPRS/EDGE, 1xRTT and the emerging 3G technologies. These technologies will then be reviewed and compared in terms of data rates, coverage, compatibility and staying power.

WIRELESS TECHNOLOGY UPDATE

For over 100 years wireless data has intrigued both technologists and business people. In fact, around the turn of the last century, the inventor Nikola Tesla and financier J.P. Morgan were in discussions about using the new "wireless" technology to send data like stock quotes and weather forecasts to remote receivers. For the time it was an amazing application of the technology, but the project broke down when they couldn't figure out how to bill for it. A lot of things have changed over the past century, but we still face the same questions that stymied Tesla and Morgan: how can we leverage the power of sending data through the air and how can we build a compelling value proposition around it.

Today, we face another complexity that didn't exist a century ago – choice. Tesla and Morgan had one choice, which was to build their project from scratch. We have the added dimension of choosing which flavor from the alphabet soup of wireless data works best for us. Is it CDPD, GPRS, iDen, 1xRTT or one of the other options available today? Or should you wait for the brave new 3G world of tomorrow?

The goal of this paper is to de-scramble the acronyms of wireless data and set forth what choices you have in front of you today. But first, we'll get started with a brief review of the evolution of wireless data technology.

A BRIEF AND INCOMPLETE HISTORY OF WIRELESS DATA

Before there was data there was voice (well, actually data came first if you count wireless telegraphy, but since this is an incomplete history, we won't). We're also going to leave out proprietary data systems over private radio, pre-cellular voice platforms and all paging technologies except one.

Our history of wireless starts in 1984 with the introduction of the Advanced Mobile Phone Systems (AMPS). While no longer "advanced," it was revolutionary at the time. AMPS allowed mobile service providers (carriers) to provide a reasonable level of service to a much larger number of subscribers. At first, AMPS featured vehicle mounted and "bag" phones, but over time, handheld phones became available. The first ones looked more like slightly-smaller military walkie-talkies. With all the static, dropped calls and coverage "black holes," AMPS introduced America to the power of mobile communication. AMPS set the current wireless paradigm of a network of interconnected towers (cells) handing calls off from one to the next as the caller moved. However, AMPS was an analog technology not well suited to wireless data transmission. Almost nobody ever calls it this, but AMPS was the "1G" or first generation of cellular technology.

The next big thing in the evolution of cellular was the introduction of digital wireless or Personal Communication Services. The first commercial "PCS" call in the new 1900 KHz band was made in 1995 on the American Personal Communication Network (which became Sprint Spectrum, then Omnipoint, then Voicestream and is now part of T-Mobile). One of the best things about PCS (other than the digital security that made cellular "cloning" a thing of the past) was that it was data friendly. It offered Short Message Service (SMS) which allowed users to receive and (depending on the technology as originally deployed) send short text messages of 50-160 characters. Despite its success in Europe, there were all sorts of limitations that kept SMS from consumer success and enterprise viability. (In Europe, SMS is still the primary technology used to carry "mash notes' between teens.)

PCS or "2G" cellular also offered circuit-switched wireless data at blazing speeds of up to 9.6 Kbps, but it was expensive and often unreliable.

At the same time, new wireless carriers were rolling out digital services, several of the incumbent cellular carriers were deploying an upgrade to their analog (AMPS) networks called Cellular Digital Packet Data, or CDPD. An executive at a wireless carrier once described this as a technology for "squeezing the data in during the pauses in conversations." Regardless of where the data was squeezed in, CDPD provided the first reliable, packet data technology for cellular networks. CDPD became the workhorse of mobile data for much of the late 90's and early 00's.

Only now, with the carriers upgrading to "2.5G" (Second-and-a-half Generation) is wireless data over a digital cellular network becoming an attractive option for enterprise applications The technologies involved in 2.5G wireless data have exotic names like GPRS and 1xRTT and they promise to deliver data rates faster than wireline dial-up. They are also packet-switched data networks, not requiring a dedicated circuit to transmit data, meaning greater reliability. Just about all of the major carriers have begun their build-out of 2.5G networks (Sprint PCS is calling theirs "3G," but it uses 2.5G technology. This could be a result of the wireless carrier's propensity to "round up."). We will review 2.5G technologies in detail below.

While all this was happening several other technologies were also coming into their own for wireless data (which we'll cover below):

- **Mobitex –** The technology behind Cingular Interactive (originally the RAM Network). Mobitex drives the Blackberry messaging terminals used by Wall Streeters, and those with a low tolerance of email deprivation. Along with CDPD, Mobitex is another hero of the early mobile data story.

- **Satellite –** Great coverage, as long as you're outside. Generally more expensive than terrestrial (earth-bound) technologies, satellite is the "go-to-guy" when you need ubiquitous coverage.

- **802.11 –** A short-range wireless data technology generally used for wireless networking that can be a powerful complement to your wireless data application.

It's also worth noting that there are a number of additional technologies that, in some cases, can provide value to the enterprise user. However, for the sake of brevity we won't be discussing them here. These technologies include:

- **Bluetooth –** Named for the 10th century Danish king Harold Bluetooth, this technology was developed to connect devices over short distances without cables. It is very powerful and useful and can connect a mobile device to peripherals like printers, GPS receivers, etc… without the cost or trouble of cabling.

- **3G –** The "next big thing" in wireless or a "[fat] pipe dream?' 3G is still too far out on the radar screen to worry about now. In fact, there are those who believe 3rd Generation wireless data will never make it in the US, because 2.5G will offer capabilities that will be good enough for most applications.

- **Circuit-switched cellular data –** The need for a wireless "dialup" connection from a phone and rates ranging from 9.6 Kbps to 14.4 Kbps won circuit-switched data its place in this section.

- **Paging –** Savaged by cellular, paging is still hanging on in some quarters. The most attractive technology being ReFlex™, a two-way paging technology developed by Motorola, but the bandwidth is generally too low for serious enterprise applications.

- **Motient –** A combination of the American Mobile Satellite and ARDIS network. ARDIS was originally created for field service workers, and Motient offers functionality similar to Cingular Interactive's Mobitex network.

Now that we've walked down memory lane, let's examine some of the things you should consider when reviewing your wireless technology options.

WIRELESS APPLICATION CONSIDERATIONS

There are a number of factors you should consider when reviewing your wireless technology options. Here is a list of questions you should ask yourself:

- **What is my application supposed to do?** This is the first question you should ask yourself. You need to define each mobile user's needs and create a clear set of objectives. Look at the processes you will be mobilizing. Understand how they are

done now so you can contrast your new solution to determine the return on investment that mobility can provide. Some tasks are better left manual, but many will benefit from being automated.

- **Do I really need wireless?** This may seem like an odd question in the "anytime, anywhere" world we live in, but it is a significant one. There is a difference between mobile and wireless. A mobile application is one that can be used away from the office or plant. Mobile applications can bring huge improvements in productivity, with simple batch processing or synchronization of data at the beginning and end of a shift. Where wireless makes a difference is where real-time data is important. This can be in terms of messaging and work order delivery, access to back-end databases and Geographic Information Systems (GIS), or for the tracking of workers and vehicles in the field. You need to answer this question honestly, or you may end up with a set of expensive complex features that are not used, or worse still, an application that doesn't deliver the tools and information your mobile worker needs.

- **Do I need coverage everywhere?** Or, maybe a better way to phrase this is, "Am I willing to pay a premium to have coverage 100% of the time?" Reviewing the wireless data network coverage maps for your area and understanding the objectives of your application can answer this question. If you can live with units going out of coverage occasionally, you can use a terrestrial wireless data technology. If you can't afford to have a unit out of the coverage area for even a moment, then you can't afford not to use a celestial (satellite) network. These questions will weigh heavily on the ultimate return on investment your application delivers, and the cheapest solution often doesn't return the greatest value to your business.

- **What kind of device does my field worker need?** You need to consider the questions above and then think about how the mobile device will be used in the field. If the devices going to be used by sales personnel, you can often get away with consumer-grade hardware like Compaq iPAQs for mobile wireless applications. If your application is going to be used outdoors by a field worker like an inspector, lineman or meter reader you've got to go with ruggedized hardware. Remember, when your guy drops a consumer-grade device out of the truck into a puddle, you lose the device. Sometimes you also lose the data. But you always lose the productivity gains that the device was supposed to give you until you can get a new device into that worker's hands. Ruggedized devices cost more, but they can do a lot to preserve your ROI and decrease your total cost of ownership.

WIRELESS DATA TECNOLOGIES

We've gone over more wireless history than you probably care to know. And we've briefly delved into the thought process that goes into planning and implementing your wireless project. Now we get to the fun stuff – technologies and hardware – but we'll temper the excitement of thinking about gadgets with some real considerations of coverage and cost.

CDPD

As noted, Cellular Digital Packet Data has been a workhorse of enterprise wireless data applications. It wasn't fast but coverage was pretty good. The ultimate fate of CDPD was sealed recently when AT&T Wireless announced in October 2002 that it would not be issuing any new CDPD IP addresses as of March 2003, and that the network would be decommissioned in March of 2004. This means, if you use CDPD, you better start thinking

about a migration plan now. Verizon, the other major CDPD operator has not announced plans to take down their network, but overall coverage will be highly diminished when AT&T sends this workhouse out to pasture. For reference purposes, here are the key statistics on CDPD:

Peak Data Rate: 19.2 kbps

Coverage: Good in many urban and suburban areas, poor in rural areas.

Pros: A proven, if pokey, wireless data technology.

Cons: CDPD's days are pretty much at an end.

Costs: Carriers are no longer accepting new CDPD customers.

CDMA 1XRTT

1xRTT is the 2.5G wireless packet data standard for CDMA cellular networks such as Verizon, Sprint PCS and Alltel. Carriers are involved in an aggressive upgrade of their networks for 1xRTT (sometimes called CDMA 1x) to provide better and faster wireless data options to their customers. 1xRTT mobile phones and wireless modems are available today, and the first ruggedized mobile data terminals with integrated 1xRTT radios will be widely available in early 2003. 1xRTT promises peak data speeds of 153 Kbps, which, at about three times 56K dialup, sounds impressive. However, as we'll also see with GPRS, the actual rate you experience in the field will probably not live up to the promise (Sprint PCS claims 50-70 Kbps as the "average"). That being said, 1xRTT runs circles around CDPD and is supported by the number 1, 4 and 5 US carriers, (Verizon, Sprint PCS and Alltel, respectively) according to The Yankee Group. Bell Mobility and Telus are providing 1xRTT service in Canada.

Peak Data Rate: 153 kbps (with an upgrade to 307 Kbps possible in 2003 if the carriers can get it up and running on schedule)

Coverage: Actually pretty good if you believe the coverage maps provided by carriers. The carriers are seriously committed to the build-out of the 1xRTT network. Sprint PCS has already upgraded their entire network with Verizon promising to have their's done by mid-2003.

Pros: Fastest potential speeds for 2.5.G wireless.

Cons: Coverage is still likely to be very spotty in rural areas, but getting better every day.

Costs: As of November 2002, Verizon sells 10 megabytes of 1xRTT service for $35 per month and Sprint PCS offers a 20 mb plan for about $40.

GPRS

GPRS is the 2.5G wireless packet data standard for GSM cellular networks, such as AT&T, Cingular (which are converting their networks from an earlier PCS technology called TDMA to support GPRS) and T-Mobile. GPRS stands for General Packet Radio Service. The battle between 1xRTT and GPRS is shaping up as a contest to rival the "cola wars" between Coke and Pepsi. Officially, GPRS is slower than 1xRTT, with a peak data

rate of 114 Kbps, but you may not see any real difference in the field. Just as CDMA networks are scheduled to upgrade to faster service, there is also an evolutionary path for GPRS to EDGE. EDGE stands for "Enhanced Data Rates for GSM Evolution," so it must be faster than plain-old GPRS. And it is, with peak rates of up to 384 Kbps. Again, real-world rates probably won't come near this figure. In Canada, GPRS is offered by Rogers AT&T and Microcell (Fido).

Peak Data Rate: 114 kbps (with an upgrade to 384 Kbps as part of the EDGE evolution).

Coverage: Again, coverage isn't bad, but that's on a national basis. For both GPRS and 1xRTT look at the coverage maps and call your carrier representative.

Pros: Services plans can tend to cost a bit less than 1xRTT

Cons: Some areas, like California, have great coverage. Other areas are still works in progress.

Costs: As of November 2002, T-Mobile sells 10 megabytes of GPRS service for $20 per month and AT&T Wireless has plans starting at $12.99 for 2 mb.

iDen

iDen is the mobile technology (called an "air interface") used by Nextel and SouthernLinc. iDen's peak packet-switched data rate is 64 Kbps with "real-world" rates expected to be in the 30-50 Kbps range.

Peak Data Rate: 64 Kbps.

Coverage: Nextel has announced full nationwide roll out by January 2003. Nextel coverage is great in some areas, no-so-great in others.

Pros: Can be a migration path if you are already tied into Nextel hardware for voice.

Cons: So far, no ruggedized mobile computers incorporating iDen packet data have been announced. Cabling a phone to a handheld or laptop can be kludgy.

Costs: Prices are in line with other wireless data technologies.

Mobitex

Mobitex is the data technology used by the Cingular Interactive network. It's well known for powering Blackberry mobile email terminals (although GSM and iDen versions of the Blackberry are now available). There are a number of modems and cards available to use Mobitex with laptops and handheld computers. Like CDPD, Mobitex was an early workhorse of enterprise mobile data applications. Mobitex is better at transmitting text data

and doesn't have the bandwidth for graphical applications such as mobile GIS. It still offers benefits depending on your location and needs.

Peak Data Rate: 9.6 Kbps.

Coverage: Nationwide coverage (…one thing to remember is that when carriers say "nationwide" they mean at places spread out across the nation, not that every part of the country is covered).

Pros: Proven technology for text data transfer

Cons: Again no ruggedized handheld data terminals and not enough bandwidth for graphics like maps.

Costs: About $40 a month for unlimited email service.

Satellite

In some places, the only way you're going to be able to communication to a mobile unit is with satellite mobile data. There are a number of choices for satellite data services including geo-stationary and Low-Earth Orbiting (LEOS like GlobalStar and Iridium), but unless your mobile workers are never going to be within a terrestrial network (do you do business at the South Pole?), you should think about a blended solution offering celestial and terrestrial data services. It works like this: the unit uses a cheaper, land-based network whenever available, and only uses expensive satellite airtime when it has to. Wireless Matrix is an example of a blended service provider.

Peak Data Rate: 6.75 Kbps when bouncing off the "bird," terrestrial network data rates otherwise.

Coverage: Ubiquitous coverage (unless your vehicle is in a tunnel in the wilderness).

Pros: Never lose connection to your mobile units.

Cons: Can be expensive.

Costs: Base plans can look competitive with terrestrial data plans, but the prices for satellite over-charges can be celestial.

802.11

802.11 is a wireless local area network (LAN) standard for transmission of data over unlicensed spectrum. In its two most popular flavors, "b" and "a," 802.11 is used for home and office networking and provides data speeds of 11 mbps to 54 mbps. An 802.11 network consists of an "access point" connected to a LAN plus 802.11 wLAN cards in the devices connected wirelessly to the network. Most people think you can't take it with you, but 802.11 is a great platform for supporting both mobile and wireless applications. In mobile applications that don't require real-time data in or out, 802.11 can provide automatic synchronization of data when a unit comes back into the office or yard and registers on the network. This saves the time and effort of having to cradle a handheld data terminal in order to synch data. 802.11 can also be used side-by-side with terrestrial and celestial mobile data solutions to save costs. Like the blended satellite solution, you

can configure your application to use free 802.11 airtime when possible and switch to commercial airtime when necessary. This is an especially useful technique when you need to download routes or GIS maps to a handheld device at the beginning of the day and then upload collected data at the end. Just make sure your network is secure. Otherwise you might find a bunch of scruffy-looking hacker types camped outside your facility taking advantage of free internet, and who knows what, else at your expense.

Peak Data Rate: 11 mbps (802.11b); 54 mbps (802.11a)

Coverage: 802.11 networks can be installed inside or out and has a range, in some cases of up to 1,000 feet or more.

Pros: Free airtime from a technology your IT staff probably already understands.

Cons: Short range keeps it from being used away from your facilities.

Costs: Hardware has come down in price to where an access point can cost less than $200 (if you want a weatherproof, outdoor access point it's still less than $1,000). Cards for laptops and handhelds cost less than $100

CONCLUSION

Wireless data is like the "old shell game" for a few of reasons. First, there's a lot of fast-talking rhetoric about which technology or network is better. Second, if you don't keep your focus in the right place (in our case, understanding both your needs and the capabilities of competing systems), you could end up making the wrong decision. And in the end if you choose the wrong shell, you lose your bet. But you're not betting a some spare changel, you're betting the success of your mobile data project, so the stakes are higher on both the upside and the downside.

The information contained in this paper is meant to serve as an introduction and provide a framework for further learning about wireless data technology. The key to making the right choice is understanding your business processes first and the technology second. If you can do this, don't worry, you'll pick the shell with the pea every time.