Enterprise Wireless Data Network Options: The Next 3-5 Years

by Brenda Lewis

INTRODUCTION

Enterprise wireless data has gotten a bad rap in the last few years. It has been lumped in with the vaporware and hype surrounding the cellular networks' transition from digital circuit-switched (2G, second-generation) to digital packet-switched (3G, third-generation) networks.

But wireless data is not the same as the mobile Internet, nor is it limited to cellular networks as the transport layer. Enterprise wireless data applications predate the advent of the World Wide Web by 30 years and the cellular network by 15 years. Moreover, while IT officers may appreciate the considerable future benefits of cellular digital packet-switched networks (rated capacity of 144Kbps driving and 2Mbps standing), evidence suggests that the perils of implementing *mission-critical* enterprise wireless data on cellular networks in the next three to five years may outweigh the advantages.

An in-depth study found that 79% of *Fortune* 1000 IT officers were not waiting for 2.5G (the transition cellular networks between 2G and 3G) to deploy enterprise wireless data initiatives [1]. The same study found that 57% of the *Fortune* 1000 have already deployed wireless e-mail. But beyond wireless e-mail and wireless LANs, *Fortune* 1000 priorities center on critical corporate functions: field service, remote access to LANs, and customer relationship management (CRM) — see Figure 1. These applications will need to be deployed on wide area wireless data networks that are ubiquitous, reliable, redundant, and secure.

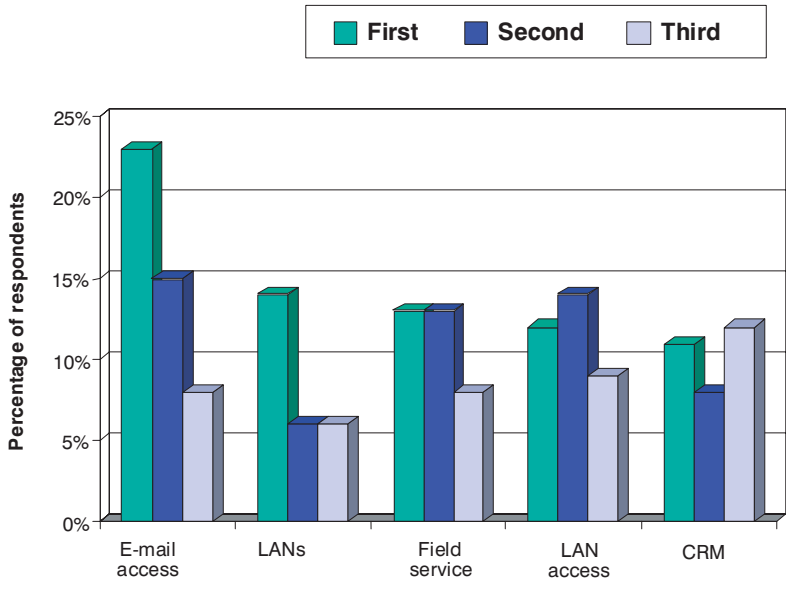

Figure 1 — *Fortune* 1000 wireless data deployment priorities.

In North America, however, the cellular carriers are performing an IT transition no CIO would contemplate: they are moving to unproven technologies, on the fly, without a redundant network running. Add the risk of migration to unproven technologies to a lack of network interoperability, a lack of redundancy, and a lack of industry wireless systems integration skills, and you have serious impediments to near-term enterprise use of cellular networks for mission-critical applications.

Fortunately, there are other options. This article explores those options for near-term deployment of enterprise wireless data applications on cost-effective shared and managed satellite networks, public packet networks, specialized mobile radio, analog voice control channels, WLANs (wireless LANs), and, in select cities, wireless MANs (metropolitan area networks). This

article will also focus on issues that may impact future enterprise wireless data network options, offering suggestions to the cellular carriers, the US Federal Communications Commission (FCC), and industry vendors on how better to support the enterprise wireless customer in the future.

SELECTION OF A WIRELESS DATA NETWORK

The Yankee Group estimates that today fewer than 20% of cellular carrier business customers are part of centrally managed corporate accounts [3]. Yet the carriers are counting on generating profits from enterprise data applications, especially horizontal solutions like wireless e-mail, to pay for their new digital packet-switched broadband networks. Unfortunately, beyond e-mail lie mission-critical enterprise data and industry applications that are largely vertical. Cellular carriers have limited experience with needs-based, solution-driven enterprise IT processes. They have even less experience with the traditional selection criteria for mission-critical applications networks:

- **Availability:** must meet the application footprint required
- **Reliability:** must have 99.999% uptime (the wired telco standard)
- **Redundancy:** must have alternate transmission paths and recovery systems
- **Security:** must permit control of access, authentication, and authorization
- **Viability:** must be a financially stable vendor, a long-term partner

There are numerous noncellular wireless networks available to fulfill these requirements in each of the likely "footprints" needed for mission-critical enterprise wireless data applications:

- Wide area networks (WANs)
- Metropolitan area networks (MANs)
- Local area networks (LANs)

WANs

Satellites

Today, thousands of enterprises receive data via high-speed satellites utilizing third parties to manage the radio frequency (RF) links. These shared and managed services are excellent choices for enterprises seeking cost-effective wide area wireless data transmission. For example, Intelsat Ltd. provides real-time financial data to 1,200 VSATs (very small aperture terminals) serving Reuters' 627,000 customers worldwide. An enterprise may choose from a wide array of national, North American, or international satellite footprints, as well as from a variety of bandwidth solutions. Established vendors include ARINC, OmniTRACS, and Outerlink Corporation, but IT officers should not overlook experienced new entrants like now-private Intelsat Ltd., newly merged Mobile Satellite Ventures (Norcom merged with TMI Communications), and federal systems contractor Telecommunications Systems, Inc., now offering commercial services from the Baltimore Teleport. To achieve redundancy, an IT manager may select a satellite transponder on a different "bird" (i.e., satellite) as a hot link to protect against disruption from meteors, space junk, and other hazards.

Cellular carriers have limited experience with needs-based, solution-driven enterprise IT processes.

Public Packet Networks

Thousands of business professionals today receive their e-mail on BlackBerrys, Palms, and smart phones without ever knowing they are using the Mobitex, Motient, or CDPD (cellular digital packet data) networks. And many field service workers use Mobitex, such as Country Companies Insurance Group's 100-plus appraisers, who use the network to pull up vehicle information to assess damage while in the field and so speed claims processing. These stable wide area packet networks have long been the workhorses of enterprise wireless data. The 9.6Kbps Mobitex and Motient networks have excellent coverage of major North American cities. Motient owns the ARDIS network, originally developed by Motorola to address IBM field service communications. Mobitex was developed by Ericsson for data only and is widely deployed in Europe; it is operated by Cingular Wireless in North America.

Another stable, widely available public packet data network is CDPD. It incorporates both authentication and encryption in all packets over the airlink and uses channel hopping for additional security. While rated capacity is 19.2Kbps, forward error correction reduces throughput to about 15Kbps. As a full duplex network, it is ideal for real-time applications such as point-of-sale and financial transactions. Because it supports IP multicast, it is also efficient for public safety and field sales applications. The city of Calgary, Alberta, Canada, equips its ambulances and paramedic units to receive real-time GPS (global positioning system) inputs over CDPD to shave vital minutes off emergency response. There are also solutions in financial trading, traffic signal control, dispatch, credit card verification, ATMs, and hundreds of other mission-critical uses. CDPD was developed by a consortium of cellular carriers beginning in 1992 and operates over the analog (AMPS) network.

Voice Control Channel Networks

Aeris.net and Cellemetry LLC deliver cost-effective wireless monitoring over the voice control channel of the AMPS network. This 32-bit two-way channel is excellent for telemetry applications where transmissions are short and "bursty." AMPS was the first generation of cellular technology and was originally designed to provide service in rural areas, so there is nearly 100% coverage of the North American population, making AMPS ideal for deploying asset tracking, monitoring, and control applications across the continent. For example, Notifact provides wireless power monitoring and control to 250 Albertson's supermarkets throughout California via the Aeris Microburst network. In addition to curtailment of energy consumption, telemetry applications include equipment control, vending machine replenishment, pipeline monitoring, and a host of other vital tasks to protect enterprise fixed assets.

Specialized Mobile Radio (SMR)

Over 3,000 independent companies are licensed to operate SMR and E-SMR networks in the 800 and 900 MHz bands. A decade ago, Craig McCaw bought up enough licensees to create a national packet network, and Nextel Communications was born. Starting with the building and construction industry, Nextel defined itself as the carrier for business. As an SMR operator, Nextel is often at odds with the cellular industry on matters of spectrum management. It runs on a proprietary Motorola protocol (iDEN) with throughput at 19.2Kbps. Nextel has been aggressive in launching enterprise services such as instant messaging. It was the first carrier to pilot Flarion Technologies' RadioRouter to test LAN/WAN connectivity. Led by Nextel, the Private Wireless Coalition, the Industrial Telecommunications Association, the Association of Public Safety Communications Officials International, and the International Association of Chiefs of Police (among others) reached a compromise with 80% of the licensees in the 800 MHz spectrum band to reduce interference among them. Cellular and noncellular bands would be separated. The parties have presented this unified solution to the FCC. Nextel is contributing $500 million to finance relocations and will gain 10MHz of spectrum for new enterprise uses.

MANs

If your operations are confined to a metropolitan area, consider the use of a broadband MAN. Best known in this category is the Richochet network, a 128Kbps MAN operating in the unlicensed 900 MHz and 2.4 GHz spectrum. It provided rescue workers at the World Trade Center with communications when the wired and cellular infrastructure was destroyed. Richochet's original owner, Metricom, invested $1.3 billion in 21 major cities before declaring bankruptcy. Aerie Networks, Inc. purchased the intellectual property and nonspectrum assets for $8.25 million in November 2001 and is actively looking for partners to revive the networks in Atlanta, Baltimore, Boston, Chicago, Dallas/Ft. Worth, Detroit, Houston, Kansas City, Los Angeles, Miami, Minneapolis/St. Paul, and New York/New Jersey. Based in Denver, Aerie has revived the network there with assistance from a group of Denver public safety providers. Another example is Skypipeline, serving 40 cities, including Los Angeles, Santa Barbara, and the Ventura County areas of California. Additional wireless MANs are scattered around the country,

with new ones being announced weekly.

LANs

The IEEE 802.11 family of specifications covers both one infrared and two RF-based LANs. Infrared is a good choice for plant floors and other high-RF-interference environments like hospitals and telephone switch rooms, but most firms will choose between 802.11b (2.4GHz) and 802.11a (5GHz). Both must currently utilize external security because the WEP (wired equivalent privacy) security protocol included in the standard is seriously flawed — it has been broken in real time in15 minutes. The IEEE is addressing this 802.11 security flaw, but the nearly half-mile range of 802.11b is a major drawback, since the signal often extends well beyond the corporate perimeter. Popularly known as Wi-Fi and widely deployed in public gathering places like hotels, airports, and coffee shops (known as "hot spots"), these insecure public-space 802.11b LANs are unsuitable for unencrypted corporate data.

There are other compelling reasons to select 802.11a rather than 802.11b for corporate deployment (see Table 1). The shorter-range 802.11a utilizes OFDM (orthogonal frequency division multiplexing), a modulation technique that permits 12 channels yielding 54 MB of rated capacity. While 802.11b Ethernet is data only, its OFDM cousin allows multimodal operation: data, video, and voice, which means support for video-conferencing, VoIP (voice over IP), remote white-boarding, and even CAD/CAM. Also, 802.11a operates in uncluttered 5GHz unlicensed spectrum, while the 802.11b standard operates in 2.4GHz, along with microwave ovens, cordless phones, baby monitors, and … Bluetooth.

Bluetooth is a global short-range RF standard originally developed by Ericcson as a cable replacement with a 30-foot range. Any Bluetooth-equipped device senses and communicates with any other Bluetooth device within range. Unfortunately, the standard comes without a security protocol included, so most corporations have banned Bluetooth-equipped laptops and PDAs as corporate security risks. However, Bluetooth remains a useful global solution for cable replacement. If used in a confined and secure internal environment, Bluetooth has the potential to enable highly productive applications in linking industrial controls, biomedical devices, automotive components, and, of course, office equipment. To preserve the option of using Bluetooth internally, enterprises will choose 802.11a. A final benefit of 802.11a is that the European Union's ETSI-defined HiperLAN also operates in the 5GHz range, a boon for trans-Atlantic travelers.

LAN/WAN CONNECTIVITY

A recent development in LAN/WAN connectivity is the emergence of mobile VPNs (virtual private networks). These are in trial and offered by new ventures like Mergic and Ecutel. VPNs require a corporate server and link a software-equipped mobile device through standard PPTP (point-to-point tunneling protocol) to the corporate network. For additional security, a separate or firewall-partitioned VPN server may be used. These still-unproven mobile VPN solutions appear to offer future promise for secure remote access to LANs. Another form of LAN/WAN connectivity is offered by a new venture called RadioFrame. It has developed an in-building system that supports both an 802.11b LAN and a packet data "cell site." It permits in-building WAN coverage where none would otherwise be possible and is IP-compliant.

ANALOG NETWORKS

A new development in the regulatory environment is worthy of mention. The FCC has just ruled that in five years, the long-standing requirement that cellular carriers must equip handsets to operate on both digital and analog networks

Table 1 — Wireless LAN Options

	Speed (MBps)	Media Type	Spectrum, Clutter	Range (ft.)	Cost/ 100K	Channel #
B	11	data	2.4 GHz, Hi	3,000+	$70.00	3
A	54	data video voice	5 GHz, Lo	750+	$35.00	12

will be phased out. Will the carriers support their analog networks with this requirement removed? This author believes a phaseout of analog networks is highly unlikely for three reasons. First, cellular networks have not been profitable until the last five years, and with long operating lives assumed for fixed capital equipment (often 25 years), most analog networks are not fully depreciated. Second, vital enterprise wireless data services move over the analog networks: all existing installed and operating CDPD customers, Aeris Microburst customers, and Cellemetry customers are dependent on them. Third, the current requirement for redundant communications networks for homeland security will likely delay any near-term phaseout of the stable and ubiquitous analog networks.

The mass-market, voice-centric cellular carriers must overcome a sad track record of disdain and neglect toward enterprise wireless data applications.

THE CELLULAR CARRIERS MUST LISTEN TO BUSINESS

Apart from reassuring business that analog networks will continue to be supported, the mass-market, voice-centric cellular carriers must overcome a sad track record of disdain and neglect toward enterprise wireless data applications and demonstrate their commitment to such solutions.

In 1995, carriers failed to build out the CDPD network. In 1999, the cellular carriers decided to merge the Wireless Data Forum (WDF) into the Cellular Telephone & Internet Association (CTIA). In the process, wireless data became equated with mobile Internet and consumer applications. Case studies of high-return enterprise wireless data solutions were lost in the hype of wireless Web access to cartoons and global interactive games. Formal networking functions for WDF members and their customers (mainly focused on enterprise applications) were eliminated at CTIA shows, and enterprise customer presentations (typically 1 of 40 per show) were relegated to last place in CTIA "educational" programs. Belatedly, in March 2002, the CTIA formed an Enterprise Action Committee to create education and awareness programs targeted at enterprise customers. This is a small, positive first step, but more substantive and sustained initiatives will be needed in the future.

CELLULAR CARRIERS NEED TO WORK ON INTEROPERABILITY

The CTIA could create an independent (carrier-neutral) network test bed where intercarrier enterprise solutions could be tested *before* launch. There is an industry precedent for such a neutral "for profit" structure. Carriers have long resorted to neutral third-party organizations to operate clearinghouses to capture calls across their competitors' networks (Cibernet, EDS, et al.). Incompatible carrier provisioning, customer care, and billing often defeat national wireless data services plans. Operations support systems are the "dirty back end" of telecommunications and must be seamless in a data network to ensure reliable installation, transmission, maintenance, troubleshooting, and billing. Existing incompatible air interfaces in the cellular network mean that provisioning, mediation (capturing data), and escalation procedures (whom to call when there is trouble) are all different. Fortunately, private-sector alternatives like Metrowerks have begun to emerge for carrier-neutral, internetwork testing.

THE FCC SHOULD REQUIRE A COMMON E-911 LOCATION STANDARD

The United States is a wireless Tower of Babel because the FCC chose standards-based rather than service-based competition. As a result, European cellular carriers with their common GSM (Global System for Mobile communication) standard generate 50% of service revenues from business users, who represent only 20% of total subscribers [2]. Enterprise cellular location-based services like wireless asset tracking and concierge services for travelers have not been fully realized, because the FCC failed to mandate a common emergency (E-911) standard. The FCC should mandate that industry thrash out a common standard on which all emergency wireless location-based services will interoperate, irrespective of airlink.

Again, there is an industry precedent. In 1992, the CDPD Forum

united AT&T, GTE, and all the former Bells (except Bellsouth) to define and create a public packet network whose security has never been broken and that today supports hundreds of secure wireless enterprise applications. Put the best and brightest wireless engineers to solving the problem for the safety of citizens in North America, and the solution will provide a North American footprint for both wireless enterprise asset management and better homeland security.

INDUSTRY MUST UPGRADE WIRELESS DATA ENTERPRISE SYSTEMS INTEGRATION SKILLS

Not only are RF engineers rare in enterprise IT groups, but there is also a severe shortage in the cellular industry of RF engineers and technical support personnel. Even data communications skills are hard to come by. In the1984 AT&T divestiture, the large corporate data networks went to what is now AT&T Broadband, and the Baby Bells, which are now cellular carriers, got the voice networks. Only two wireless carriers have inhouse systems integration capabilities: Alltel and Nextel. Alltel has long derived significant revenues from systems integration activities focused on the demanding financial services sector, but it remains to be seen whether a non-Alltel enterprise customer could tap the company's considerable wireless integration experience. Nextel, as cited above, focuses on the enterprise and has gained considerable integration expertise.

There are also very few third-party systems integrators with experience in deploying enterprise wireless data. A short list might include Cap Gemini, EDS, IBM Global Solutions, SAIC/Telcordia, and Stellcom. Yet in the study cited previously [1], respondents named systems integrators as their first choice for handling some or all of their wireless IT requirements.

This gap between reality and expectations needs to be swiftly closed by beefing up cellular carrier training. Further, wireless enterprise solutions providers need to design platform-independent applications that can be utilized with legacy systems. Business opportunities abound: the cellular carriers are unlikely to metamorphose into systems integrators, so some smaller, well-established firms may seize this near-term market opportunity to expand their services to meet the wireless integration needs of the corporate IT community. They will also be preparing for the future, when the migration to cellular packet-switched networks will be complete and their skills will be needed to deploy a whole new generation of mobile broadband enterprise services.

REFERENCES

1. Bucher, John. *Wireless Data in the Enterprise*. Gerard Klauer Mattison, November 2001.

2. Kendall, Philip. *Western European Cellular User Forecast (2002-2007)*. Strategy Analytics, May 2002.

3. Wiggins, Roberta. Slide presentation, Yankee Group, 26 August 2002.

Brenda Lewis is principal of Transactions Marketing, Inc. Beginning with her 15-year corporate marketing career in international energy, bulk shipping, and metals with Exxon, Marine Management Systems, and Pechiney Ugine Kuhlmann, Ms. Lewis has been continuously active in the design and development of pioneering electronic data communications services, including the first interactive, real-time, wireless global vessel communications and control system in 1974. She formed Transactions Marketing, Inc. in 1982 to manage new ventures in real-time, online, business-to-business services for digital commerce, most in wireless data communications. Among the pioneering applications she has managed are the 1984 launch of PDQ for Telerate, the first wireless quotation service in the money markets, the first (1996) professional financial services trial on AT&T's Pocketnet (CDPD), the first (1998) live wireless Internet conference to due diligence standards, and, in 2001, the first privately funded wireless logistics service in China.

A cum laude graduate of Smith College in economics, Ms. Lewis holds an M.B.A. from the University of Connecticut, graduated from Harvard Business School's Program for Management Development (PMD), and earned a certificate in telecommunications management from New York University. She is adjunct professor at the University of Connecticut's Graduate School of Business Administration and an active big boat racing sailor.

Ms. Lewis can be reached at Transactions Marketing, Inc., 2 Sound View Drive, Suite 100, Greenwich, CT 06830, USA. Tel: +1 203 622 3933; E-mail: blewis@transactionsmarketing.com; Web site: www.transactionsmarketing.com.