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Enterprise users are demanding mobile broadband, but the complexity has many IT managers confused. Here's how to evaluate rapidly improving 3G technologies

BY PETER RYSAVY

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CELLULAR PROVIDERS ARE IN A HIGH-STAKES RACE WITH WiMAX and Wi-Fi proponents, each seeking to dominate the transition from today's 3G services to next decade's 4G technologies. This jockeying is nothing new—over the past decade, a heady cycle of reinvention and evolution has propelled about one new wide-area wireless technology down the pike every year. Ardis, Mobitex, CDPD, Ricochet, GPRS, 1xRTT, EDGE, 1xEV-DO, UMTS, HSDPA ... all tried to capture the fancy of mobile users—and the dollars of enterprise IT groups tasked with keeping those mobile users productive.

This time, IT should be in the driver's seat. Rather than taking what your service providers are offering, consider your requirements. We've got the information you need to plan for the next wave of wide-area wireless.

To start with, architecting a comprehensive wireless access strategy goes beyond choosing an operator. You must consider what types of devices to use, whether to employ mobile/wireless middleware, how to manage mobile computers and their configurations in the field, and how to implement security. We help with the device decision in our comparative review of 3G-enabled notebooks (see *nwcreports.com*). Justification involves a careful examination of the job function being performed and how it might change with mobile access to enterprise data. In addition, supporting mobile systems in the field requires expertise that many organizations are only beginning to acquire.

The good news: Wide-area wireless networks are really starting to hum, delivering excellent speeds with good resulting application performance and, by the end of this year, high-speed 3G networks will be available in most U.S. metro areas.

The bad news: The number of wireless technologies you need to assess keeps increasing, with new 3G offerings and alternate technologies, such as WiMAX and metropolitan Wi-Fi, being evaluated or tested by operators for large-scale deployments. If that's not confusing enough, entirely new standards, including IEEE 802.20 mobile broadband, are on the fast track for completion.

A carefully developed and implemented mobile and wireless computing plan will benefit most companies, but creating such a plan is a complex undertaking, which explains the slow adoption rates we've seen so far. We discuss adoption and more in our original in-depth research and analysis report on the mobile broadband market at *nwc.com/nwcanalytics*, but, for example, only 11 percent of readers polled for this article cited widespread adoption of wide-area wireless data in their organizations.

Still, billions of dollars will be spent this decade on

IMPACT ASSESSMENT: MOBILE BROADBAND DATA

	BENEFIT	RISK
IT Organization	The ability to have real-time access to enterprise systems from anywhere greatly extends the reach of IT managers to efficiently perform their job functions.	Monthly service plans cost $50 to $60, although cheaper plans are available for smartphones. Specialized support may be required.
Business Organization	Businesses can improve many of their internal communications through the use of wireless technologies.	Real-time communications can just as often be a distraction as a productivity enhancer. Businesses must decide which workers to target with mobile data systems.
Business Competitiveness	Businesses can improve overall efficiency in many job functions if mobile workers have real-time access to enterprise data, which can result in reduced downtime and improved customer responsiveness.	To be effective, businesses must verify that applications work well over wireless connections, and may need to implement mobile middleware and adjust their remote-access security architectures.

BOTTOM LINE Mobile broadband data offers many benefits, such as performing job functions more efficiently and helping employees deliver superior customer service. However, a successful deployment is not trivial—it requires careful research and planning, and rigorous trials to test applications.

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these new networks as operators vie for supremacy. We'll look ahead three years to sort out promise from reality by examining various networks, their capabilities, their availability and their costs. Choosing a network based on coverage or speed is straightforward. It's the other items, such as figuring out return on investment and how to manage devices in the field, that can flatten you if you're not paying attention.

HOW WE GOT HERE

A decade ago, wide-area wireless networks had throughput rates of only about 10 Kbps and were dedicated to data. CDPD, Mobitex, Ardis and Metricom's Ricochet were the big fish, but they ruled a small pond: None netted subscriber numbers greater than the hundreds of thousands.

In the late 1990s, wireless data systems became integrated into cellular networks, which had been deployed first for analog, then digital, voice service. Initial data speeds were relatively slow, still around 10 Kbps, and were based on a circuit-switched (dial-up) model where data essentially consumed a voice channel.

However, speeds quickly increased, and the model switched to packet-based IP. GPRS (General Packet Radio Service) for GSM networks, operated by Cingular Wireless and T-Mobile, had average throughput rates of 30 Kbps to 40 Kbps; throughput improved to around 100 Kbps with EDGE (Enhanced Data Rates for GSM Evolution), and CDMA networks, operated by Sprint Nextel and Verizon, had average rates of around 70 Kbps. Network latency was quite high in early networks, but started to decrease for round-trip times to below 500 milliseconds (msec).

Today, most cellular operators are deploying what are called 3G technologies (1G is analog; 2G, digital). Average downlink throughput rates for 3G networks are quoted by operators as 400 Kbps to 700 Kbps—50 times faster than earlier networks. Moreover, network latency has improved significantly, approaching 100-msec round-trip times in the latest systems. Pricing has also improved: A year ago, unlimited data plans cost $80 per month; these plans are now trending toward $50 per month.

But though the industry has made tremendous progress, relatively high service costs, connections that aren't as stable as wireline links and complicated security mean wireless data remains challenging for many organizations. Evidence of this: Wireless operators have worked hard to get data revenues to reach 10 percent of their total revenues. However, adoption is growing rapidly, and is likely to double within three years, according to Yankee Group. Voice continues to dominate as the killer app.

CELLULAR WIRELESS DOMINATION

You can't argue with more than 2 billion subscribers worldwide—clearly, cellular operators are providing extremely broad coverage of wireless services. The United States alone has more than 100,000 cell sites, providing service in virtually all areas where people work and live, as well as all major and many minor highways. And now that cellular networks provide both voice and data services,

CELLULAR CARRIERS RULE THE MARKET

No Wi-Fi or WiMAX deployment can match cellular carriers for coverage. Here are the major networks:

Technology	Peak rate downlink	Peak rate uplink	Average downlink	Average uplink	Typical latency to Internet site	Major U.S. operators	Deployment
CDMA2000 1xRTT	153 Kbps	153 Kbps	50-70 Kbps	50-70 Kbps	500 msec	Alltel, Sprint/ Nextel, Verizon	Available nationwide
CDMA2000 EV-DO Rev 0	2.4 Mbps downlink	153 Kbps	400-700 Kbps	50-70 Kbps	250 msec	Alltel, Sprint Nextel, Verizon	Top 100 metro areas by year end; currently available in more areas than HSDPA
CDMA2000 EV-DO Rev A	3.1 Mbps downlink	1.8 Mbps	450-800 Kbps	300-400 Kbps	Improved over EV-DO Rev 0	Sprint and Verizon have announced intentions to deploy	Expected 2007
EDGE	200 Kbps	200 Kbps	70-135 Kbps	70-135 Kbps	450 msec	Cingular, T-Mobile	Available nationwide
HSDPA (UMTS Release 5)	1.8, 3.6, 7.2 Mbps[1]	128 Kbps or 384 Kbps[1]	400-700 Kbps	110 Kbps or 300 Kbps	150 msec	Cingular; T-Mobile also plans deployment	Top 100 metro areas by year end
HSDPA with HSUPA (UMTS Release 6)	1.8, 3.6, 7.2 Mbps[1]	1.46, 2.0, 5.76 Mbps[2]	400-700 Kbps	Likely 300 to 400 Kbps	Improved over UMTS Release 5	Cingular; T-Mobile likely	Expected 2007

[1] Depends on market; most markets are being upgraded to 384 Kbps. [2] Depends on device capabilities.

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data is available in more locales than ever before. Although hotspots and metro Wi-Fi are available in an increasing number of areas, their total coverage constitutes a fraction compared with cellular coverage. For any truly mobile application, it's hard to beat cellular-based services.

But just how useful are these services for data apps? We summarize the capabilities of today's networks, using speeds derived from operator-stated performance and prior NWC tests in "Cellular Carriers Rule the Market," below left. As you can see, speeds are quite good, and these services are suitable for a wide range of applications. Two important technical issues to consider: the hybrid nature of today's 2G-3G networks and variabilities in network performance.

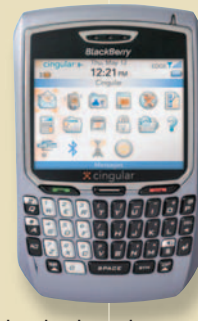
Operators are deploying EV-DO (Evolution-Data Optimized) and HSDPA (High-Speed Downlink Packet Access) as high-speed overlays to substrate 1xRTT (one carrier, radio transmission technology) and EDGE networks. By year's end, Cingular, Sprint and Verizon plan to have coverage in the Top 100 metropolitan areas, but elsewhere, devices will fall back to slower service. Fortunately, connectivity is relatively seamless, and the networks support handover from one service to the other, even in midsession, albeit with delays that may approach tens of seconds. This means if your users are going to work across large geographic areas, you must ensure that your applications work well with both the current faster and the older, slower data services.

The other consideration is variables in network performance. Wireless networks use extremely sophisticated methods to reliably deliver bits in widely varying RF conditions, to widely varying loads of voice and data users across an extremely finite spectrum resource. However, because radio technologies dynamically adjust to radio conditions, throughput and latency can vary, especially in poor signal situations, and you'll need to manage end user expectations. It's not unusual to see the 1-Mbps downlink throughput that 3G services deliver in good

SMARTER THAN YOUR AVERAGE PHONE

SMARTPHONES CONTINUE TO MAKE HEADWAY as a productivity tool for many workers. We use *smartphone* to refer to intelligent devices in both a phone form, like the Cingular 2125 or T-Mobile SDA, and those that are more like PDAs, such as the Motorola Q, Nokia 9300, RIM BlackBerry 8700 and Treo 700.

What differentiates a smartphone is the use of a general-purpose OS that lets a variety of applications run on the device. The leading platforms are Microsoft Windows Mobile, Palm OS, RIM BlackBerry and Symbian. The latest trend in smartphones is support for 3G services; the Treo 700p and Treo 700w, BlackBerry 8700 and the new Motorola Q all support EV-DO. Your users may not need such speed for background e-mail downloads, but it makes Web browsing and other intensive data downloads much more bearable. Some models, like the UTStarcom 6700, also support Wi-Fi, which increasingly will be supported by both smartphones and other mobile telephones.



Other market developments since our review of smartphones late last year (see "Strong Capabilities, Difficult Decisions," at *nwc.com/showitem.jhtml?docid=1622f2*) include the availability of devices using Windows Mobile 5, and Microsoft's Messaging and Security Feature Pack (MSFP) for Windows Mobile 5 that, in combination with Service Pack 2 for Exchange Server 2003, delivers push e-mail without the need for third-party infrastructure. However, third-party systems provide more comprehensive features, such as management tools.

Although Symbian devices represent the majority of smartphones sold globally and continue to do well in Europe, the OS still has little recognition in the United States. Palm OS has sold well through the Treo line, but the current version is reaching the end of its life. PalmSource (now owned by the Japanese company Access) says it intends to evolve the platform to a Linux base.

RIM's powerful BlackBerry 8700 keeps BlackBerry solidly atop the smartphone game. So far, we see no indication that any of these four primary smartphone platforms is going to go away, which complicates the lives of IT managers who must support multiple platforms. Linux will also be a contender in the near future.

Managers must decide whether to have separate remote-access architectures for smartphones and laptops. Conventional IPsec VPNs do not support smartphone platforms, but mobile VPNs, from NetMotion and others, and SSL VPNs, from companies like Aventail, have increasing support for mobile platforms, which makes a unified remote-access architecture feasible. Your circumstances will dictate which approach makes the most sense.

Finally, IT managers may encounter workers who want to use their personal phones for business. Given that phones are highly personal items, accommodating user preferences is an additional complexity. Despite all these challenges, according to ABI Research, smartphone sales will exceed 120 million units this year, and will constitute a 15 percent share of the mobile phone market.

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conditions fall to several 100 Kbps in poor conditions. Loading from other data or voice users can also affect network performance. For any large-scale deployment, make sure your app can tolerate the full range of speeds users will experience. Today's 3G networks have uplink speeds that are generally slower than downlink speeds, but that will change in next versions of the systems, expected in 2007, where links will be closer to symmetric.

If users are on the move, they may lose the signal entirely. Moreover, when the link picks up again, the new connection could come with a new IP address. This may adversely affect some software, such as VPNs. The bottom line, though, is that you can use off-the-shelf IP-based networking applications over today's wireless networks. There is a "but," however: If apps are going to be used on a continual basis by workers for productivity applications, you must perform rigorous pilots to make sure they work as dependably as you need. Fortunately, nearly all large application vendors, including IBM, Microsoft, Oracle and Sybase, are rewriting their applications so they work well over wireless links. There are also mobile/wireless middleware providers whose mobile VPNs mitigate against connection loss, provide seamless connectivity over different types of networks (such as cellular and Wi-Fi), and offer end-to-end security.

FAST AND CHEAP

While speeds have gone up, prices for services have dropped significantly. As we mentioned, a year ago major operators were charging $80 per month for unlimited data usage. Now, plans are generally $50 to $60 per month when combined with voice service. T-Mobile has the most aggressive pricing, with data plans at $30 per month. Unlimited-use plans will readily support business applications, but if you're thinking of hosting a Web server or want to start downloading movies, you may get a cease-and-desist letter from your operator.

Smartphone plans are less expensive, typically $40 per month for unlimited use. Still, in our reader poll for this article, slightly more than half of respondents said pricing

NWC REPORTS: LAPTOPS WITH INTEGRATED 3G ADAPTERS

IT professionals who've paid attention to the WLAN adapter evolution cycle may notice that the progression of WWAN adapters is following a condensed, yet nearly identical, time line. Just like first-generation WLAN adapters, the first form factor of WWAN adapters arrived as add-on PC Cards designed to work on a variety of platforms. Now, WWAN adapters are beginning their integration into mobile laptop and tablet systems, giving users yet another option to feed their "anywhere, anytime" connectivity desires. But should enterprises in the market for new PCs to outfit mobile workers make the move to an integrated model?

PARTICIPATING VENDORS

For those considering integrated systems, we present a roundup of four 3G notebooks from Dell, Hewlett-Packard and Lenovo, all sporting 3G modules supporting Verizon's BroadbandAccess CDMA2000 1xEV-DO service or Cingular's Broadband Connect GSM/UMTS HSDPA service.

TESTING SCENARIO

We tested the notebooks in Washington, D.C., and Syracuse, N.Y., tabulating upload and download speeds as well as latency at five locations per city. We also examined the vendors' connection management capabilities, which help users choose among available wired, WLAN and WWAN networks. Finally, we tested the configuration utilities, available on the Dell and Lenovo systems, that can automatically select the best connection and seamlessly roam when a better choice becomes available.

RESULTS

The integrated adapters have a slight performance edge over PC Cards, attributable to advanced antenna designs and module placement tuned to make the most of sometimes spotty 3G coverage. However, external PC Cards hold an advantage in flexibility and the cost savings that may be realized by sharing a single card among multiple users.

Although we did not award an Editor's Choice because we weren't comparing apples to apples, we liked Dell's D620; whether we were testing on the Verizon or Cingular network, we found the D620 experience closest to the wired broadband gold standard.

FIND OUR COMPLETE COMPARATIVE PRODUCT REVIEW AT NWCREPORTS.COM. Go to *nwc.com/nwcanalytics* for our original in-depth research and analysis on the mobile broadband market.

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for cellular-data services is still too high, and 85 percent said they prefer flat-rate plans over usage-based offerings.

Looking into the future, networks will just keep getting faster. The next major upgrade to cellular networks for both EV-DO and UMTS (Universal Mobile Telecommunications Systems)—due in 2007—will provide faster uplink speeds, with expected averages of around 400 Kbps. We expect that, by the end of the decade, average throughput rates will be nearly 10 times higher than what we see on today's networks.

THE WI-FI DISRUPTION FACTOR

A completely different approach for mobile broadband is metro or municipal Wi-Fi. Here, a new breed of operator is deploying APs throughout city areas, using a mesh architecture, where APs can act as repeaters and only a subset of APs need wireline connections to a core network.

The attraction is obvious, especially for laptop users who have Wi-Fi cards in their computers. Wi-Fi offers better network application performance, thanks to its higher throughput rates and lower latency. Wi-Fi also can deliver higher data throughput densities than 3G networks because the spectrum serves a small number of users in cells much smaller than those of cellular networks. Typical deployment densities are 20 to 40 APs per square mile, with theoretical aggregate throughputs of 20 Mbps to 100 Mbps in that area—more than 10 times higher than what can be achieved with a 3G base station.

Another benefit is the availability of 4.9-GHz licensed spectrum for public safety applications. Motorola and other vendors have multimode APs that can simultaneously support the 4.9-GHz band for government applications, and 2.4 GHz for residential and business users. Operators can provide tiered service, charging for one level of throughput while offering free or discounted service at throttled-down speeds. There's even an IEEE standard in development, IEEE 802.11s, that will standardize mesh architectures and protocols.

That's the good news about metro Wi-Fi. Unfortunately, there are some serious concerns. One is that at affordable deployment densities, the signal can be quite weak by the time it reaches some buildings. In many cases, this will mandate repeaters to relay the outside signal indoors. This problem is being reported in many

DECISION POINTS: CHOOSING A WIRELESS NETWORK

Throughput, coverage and cost are the Big 3 considerations, but here are some other factors to consider:

Consideration	Options	Comments
Platform type	• Smartphones/PDAs • Laptops	Smartphones are well-suited for e-mail and to access select data. Platforms include Linux, Palm OS, RIM, Symbian and Windows Mobile. For more information, see "Smarter Than Your Average Phone," page 47.
Laptop computer approaches	• Tethered (such as Bluetooth) • PC Card modem • Embedded (built-in)	The tethered approach works well for occasional connections and allows the same data plan for both smartphone and laptop use. PC Card modems provide the greatest flexibility in laptops for heavier data usage. Embedded solutions lock you into a specific technology and operator, but offer simpler setup and more dependable operation.
Application type	• Applications optimized for wireless networks • Standard IP-based networking applications	With Wi-Fi, most applications work acceptably. With 3G, you can make light use of most applications, but serious productivity apps may need optimization, or to be combined with wireless middleware. Large application vendors are now "mobilizing" their applications or working with middleware vendors to extend capabilities to mobile devices.
Security	Many e-mail solutions provide their own security architectures	In our e-poll, security was rated as a major obstacle to deployment. Your security architecture may have to support both handhelds and laptops.
VPN	• Standard • Mobile VPNs	Standard VPNs will work over wireless connections but do not offer some mobility enhancements and performance optimizations available with mobile VPNs.
Device management	Multiple entities are vying for this market: device vendors like Nokia; mobile security software vendors such as Symantec; remote-access system vendors, including Cisco; conventional device-management companies like Novell; mobile middleware vendors such as Sybase; mobile operators; and conventional enterprise-management system vendors, including IBM and Microsoft	You must do your homework on this one. The larger the wireless deployment, the more critical your management system.

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cities, including EarthLink's recent Anaheim, Calif., deployment. Another issue is that at 2.4 GHz, there are only three nonoverlapping RF channels available, making interference between private and public systems inevitable. The IEEE 802.11 protocols accommodate this to some extent, but only if stations can hear one another. The result will be degraded performance for some, as yet unknown, fraction of coverage areas.

Finally, the IEEE 802.11s standard is not expected to be completed until 2008, meaning that deployments today are based on proprietary vendor solutions.

And let's not forget yesterday's mobile-connectivity poster child: hotspots. Although media attention has waned, providers keep adding locations. According to JiWire, a company that compiles hotspot locations and statistics, as of May 2006, there were 114,150 hotspots in 126 countries, with 38,588 in the United States. Last time we took a large-scale look at hotspots, in May 2003, there were only 20,000, with Gartner estimating 120,000 worldwide by 2007; looks like that may be on target (see "Wireless Hotspots Heat Up," at *nwc.com/1409/1409f1.html*).

So will Wi-Fi compete with 3G? It certainly will take some customers away, especially laptop users who need only occasional connectivity in places where they know they can obtain Wi-Fi coverage. However, we see the technologies as generally complementary. Wi-Fi, while offer-

JUSTIFY MY WIRELESS DATA

WHAT'S THE ROI FOR WIRELESS DATA? That's a complicated question, and one we struggled with. Our reader poll showed wireless data providing a significant benefit for personal productivity, increased operational efficiency, satisfying general information needs of mobile employees, providing senior executives access to critical information, more positive customer interaction, as well as faster and better decision making.

Clearly, productivity and efficiency are important variables in the ROI equation, and if access to wireless data helps your business deliver a better product or service, that also must factor in. The challenge is to quantify all these items.

We asked a number of carriers to provide their take and received ROI information from both RIM and Cingular Wireless.

RIM sent us a 2004 study by Ipsos Reid of 210 end users and 490 IT managers. Looking at factors such as recovered downtime (being productive at times when work could not otherwise be performed), work efficiency, value of responding more quickly and costs of ownership, the study concludes a payback period as low as one month. Improved personal productivity by itself yielded a seven-month payback period. Our main concern is the distraction factor of people receiving and reacting to nonurgent e-mails when they should be concentrating on other tasks. Still, due to the relatively low cost of equipment and service, it doesn't take much productivity gain and improved business process to justify a smartphone.

For laptops, devices and service are more expensive than for smartphones. Cingular Wireless, in an interview, said it works closely with larger customers to assess ROI. Recognizing the different productivity gains involved in different market segments, Cingular uses segment-specific ROI models. The carrier gave us a sample output of its ROI model, based on a telecom field-service professional engaged in work-order scheduling and processing, and knowledge-base access; the model showed a nine-month breakeven on wireless investment.

If you're performing an ROI calculation for a wireless investment, make sure you factor in the appropriate deployment and ongoing support costs, as well as expenditures for training both support staff and users. There's no question that wireless technology can significantly improve productivity and business efficiency, but if it's a new area for you, there is a learning curve involved.

BENEFITS	COSTS
• Higher worker efficiency	• User equipment (handhelds, PC Card modems, laptops with integrated wireless)
• Faster and better decision making	• Monthly service
• Recovered downtime	• Remote-access architecture that supports wireless
• More positive customer interaction	• Application performance/reliability verification and optimization, including wireless middleware assessment
• Satisfy general information needs of mobile employees	• Training for mobile/wireless support staff
• Greater freedom in how employees do their jobs	• Application deployment pilots
• Reduced office space requirements for employees who work remotely	

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ing good performance, is available in only a tiny fraction—less than 1 percent—of the area covered by cellular networks. Many of your users will want Wi-Fi for better performance when available, but will desire the broader coverage of cellular networks the rest of the time.

Users will have no problem taking advantage of an ever-increasing number of networks, depending on their circumstances and location. Long term, the addition of Wi-Fi capabilities to mobile phones will blend Wi-Fi and 3G network technologies, allowing their use over corporate and home Wi-Fi networks. This is very much a work in progress, however, requiring additional infrastructure in operator networks as well as new types of service plans.

WIMAX AND OTHER LONG-TERM DISRUPTIONS

One potential threat to 3G's hegemony is WiMAX, a broadband wireless technology standardized in IEEE 802.16. Not that carriers are too nervous yet: Any overthrow will take years to happen. The version of WiMAX available now in shipping equipment is Fixed WiMAX (meaning with stationary endpoints), which provides an alternative to DSL, cable modem or T1 services. The most likely deployments are in rural areas or developing countries. The greatest vendor interest, however, is centered on Mobile WiMAX, an enhanced version of WiMAX that allows high-speed movement and hand-offs across base stations. Standards work is complete, but we're still about a year away from certified equipment. Mobile WiMAX could be a high-speed data overlay for future cellular systems, or could exist as a standalone network.

Although Mobile WiMAX promises higher levels of performance than current 3G systems, there are big questions about available spectrum, and which operators are in a position to actually deploy it. In the United States, only Sprint Nextel has spectrum for widescale deployment, using its sizeable holdings in the 2.5-GHz band. On Aug. 8, Sprint Nextel announced its decision to proceed with a Mobile WiMAX deployment, with a network that will reach 100 million people in the U.S. by 2008. The company promises typical throughput rates of 2 Mbps to 4 Mbps, which is a bit optimistic, especially once people start using the network. Nevertheless, this constitutes a strong endorsement for the technology. Meantime, Clearwire, another operator with 2.5-GHz spectrum and broadband wireless coverage that emphasizes secondary markets, recently received $600 million from Intel and $300 million from Motorola to help fund WiMAX deployment.

Beyond Mobile WiMAX and UMTS-TDD, there's also the IEEE 802.20 mobile broadband standard, which has been revitalized with Qualcomm's active participation following its acquisition of Flarion and Flarion's Flash OFDM technology. Work on 802.20 has been suspended due to allegations of improprieties in the standards process, though this is likely a short-term upset. IEEE 802.20 products and infrastructure could be available by 2008, and 802.20 might be a serious contender. There's a proposal within CDMA2000 standards work to harmonize it with a future version of CDMA2000, EV-DO Rev C.

What we're now witnessing is nothing short of a global wireless battle to achieve a dominant position as we move from 3G services to 4G. Never mind that 4G is still completely undefined … this is the opportunity WiMAX proponents are reaching for, but they'll be competing with IEEE 802.20, evolved 3G systems, and the cellular community's own aggressive evolution path to next-generation systems such as 3GPP LTE (Third Generation Partnership Project Long Term Evolution).

In reality, it will be the end of the decade before any entirely new wireless technologies could be widely available, and which one will prevail is hard to predict. For now, what IT managers need to know is that CDMA2000 and GSM/UMTS/HSDPA networks dominate in the wide area. For an evolution time line of the major technologies, see "Mobile Data Evolution," at *nwcreports.com*.

BEYOND SPEED

Throughput, coverage and costs aren't the only considerations when choosing a wireless network to serve mobile employees; there are quite a few other items that you need to consider; we summarize some of them in "Decision Points: Choosing a Wireless Network," page 52.

Given the complexity of developing a strategy, it's no wonder wireless-data adoption has been slow. It's one thing for an individual mobile professional to run an enterprise VPN over a 3G data service to connect from the road. It's another matter to architect a comprehensive mobile computing program that supports both laptops and smartphones, while addressing all the security, reliability, performance and management aspects. Users in the field also need different types of support, such as centrally managed tools that monitor remote device configurations and can update systems accordingly.

This may explain why a limited number of poll respondents indicated widespread cellular-data usage, and a bit higher Wi-Fi usage. Nevertheless, the hardware, software and network options for mobile/wireless are better than ever, so we expect these numbers to grow steadily.

Bottom line, networks are faster and more capable, usage prices are dropping, smartphones are becoming more powerful, more applications run better over wireless, and built-in mobile broadband is now a practical option. We don't quite have ubiquitous, low-cost mobile broadband, but we're closer than ever before. If you work through the issues outlined above, it's highly likely that a sizeable portion of your workers can benefit. ■

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