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In·Stat MDR

Wireless WAN Solutions for US Business Users

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Methodology

In-Stat/MDR conducted research of the WWAN market using the following sources of data:

- Interviews with key representatives from laptop manufacturers including IBM, Dell, and HP.

- Interviews with US wireless operators such as AT&T Wireless, Cingular Wireless, Sprint, and Verizon Wireless (T-Mobile chose not to participate in this study).

- Interviews with established contacts at wireless PC modem manufacturers Sierra Wireless and Novatel Wireless.

- Analysis of primary research, already completed by In-Stat/MDR, related to end-user demand for and usage of WWAN data services

Definitions

- CDMA: Code Division Multiple Access. An airlink standard for digital wireless communications. Most prevalent in the Americas and Asia. Currently there are more than 200 million wireless subscribers using mobile phones based on the CDMA standard.

- CDMA IS-95b: A second generation digital airlink standard, used primarily for voice, but supporting data sessions with speeds of up to 14.4 kbps. This standard has largely been replaced by the newer CDMA 2000 technology, which includes 1xRTT and 1xEV-DO.

- CDMA 1xRTT: An airlink standard that triples voice capacity and that typically provides data speeds of up to 70 kbps.

- CDMA 1xEV-DO: Evolution Data Optimized. An enhanced version of the CDMA wireless standard that delivers peak data speeds of up to 2.4 Mbps.

- CPC card: Cellular Personal Computer. Refers to cellular modems based on the PCMCIA card standard.

- EDGE: Enhanced Data for Global Evolution. A GSM based airlink standard that provides data rates of 384 Kbps or more over wide area wireless networks.

- Embedded refers to wireless modems embedded into a laptop. In-Stat/MDR does not believe that this will become an important part of the market until late 2004 early 2005, when EDGE and 1xEV-DO and DV networks begin to be deployed.

- GSM: Global System for Mobile Communications. An airlink standard for digital wireless communications. There are currently more than a billion wireless subscribers using mobile phones based on the GSM standard.

- PCMCIA cards: Removable wireless modems that are inserted into a laptop computer's PCMCIA slot. Also referred to as PCMCIA standard PC cards, PC cards, or more simply, CPCs. Most typical PC cards used in laptops as modems are Type II cards, which are 5.5 mm thick.

- WAN: Wide Area Network and refers to carrier cellular networks. This report and forecasts do not refer to 802.11 a, b, or g wireless local area networking (WLAN) technologies.

Introduction

The expansion of cellular wireless data networks over the last two years in the United States, and particularly the introduction of high-speed wireless data networks such as AT&T Wireless' EDGE network and Verizon Wireless' CDMA 1xEV-DO network have made using a cellular-based wireless laptop connectivity solution a realistic option for laptop users. Manufacturers have seen significant increases in the number of Cellular Personal Computer (CPC) modem sales over the last six to 12 months, both through wireless operator channels and through resellers, including laptop manufacturers.

The purpose of this whitepaper is to examine the ability of laptop manufacturers to support customer need for wireless Wide Area Network (WAN) connectivity solutions. The solution sets offered by four major laptop manufacturers (Dell, Hewlett-Packard, IBM, and Toshiba) are reviewed, as are their relationships with major US wireless operators, and with leading CPC modem manufacturers such as Sierra Wireless, Novatel Wireless, and Sony Ericsson.

Market Overview

The US wireless industry has long offered wireless data options for laptop users needing to access the Internet remotely using WANs. Until recently, users had to be satisfied with data rates ranging from 8 to 14.4 Kbps over older cellular data networks using CDPD, CDMA IS-95b, or GSM airlink standards. Over the course of the last two years faster cellular data networks using GPRS or CDMA 1xRTT have offered data rates ranging from 30 to 70 Kbps, which makes them relatively equivalent to landline dial-up speeds. Nevertheless, in comparison to T1, DSL, and cable Internet speeds, these slower data rates have led many potential laptop users to forego the convenience of anytime/anywhere access due to the low data speeds. Most users of these earlier generation cellular data services worked in specific verticals where applications were not dependent on high data rates.

In 2003 US wireless operators began to roll out new wireless data networks using EDGE technology over the GSM networks, and for Verizon Wireless, CDMA EV-DO. By the end of last year, EDGE networks were deployed across all US major markets, and by the end of 2005, EV-DO will also be available in the top 50 US markets.

The introduction of high-speed wireless data networks has changed the dynamic of the CPC modem market. Prior to 2002 the number of CPC modems being shipped each year was measured in the tens of thousands by all but the largest CPC modem manufacturer, and the total number of CPC modems shipped was less than half a million worldwide, with the US making up the bulk of that market. In 2002 the number shipped exceeded three quarters of a million, with two thirds of those units being sold in the United States. In 2004 In-Stat/MDR expects the number of units shipped will double, with the majority of those cards being shipped in the US.

Laptop Manufacturer Relationships with Wireless Operators

To date, most laptop manufacturer/wireless operator relationships are limited. Of the four major laptop manufacturers profiled in this study, only Hewlett-Packard is able to provision CPC modems that it ships with its products to customers. Other laptop manufacturers must refer their customers to wireless operators to provision CPC modems that are shipped with their products or direct those customers to the operators to purchase the modems separately.

The laptop computer industry and the wireless industry are in some ways very similar. Both industries are fiercely competitive, highly commoditized, and are undergoing rapid technological innovation. As demand for cellular-based wireless solutions for laptop users grows, the relationship between laptop manufacturers and wireless operators has begun to change. In previous years laptop manufacturers and wireless operators had weak relationships with each other because they saw little overlap between their respective industries. As more robust wireless data networks are now being rolled out, members of both industries have begun to take steps to find ways to strengthen their relationships. As of yet, those steps have been tentative, with both operators and manufacturers fully aware of the benefits of cooperation but also wary of the prospect of entering into relationships that could weaken ties with their customers.

Laptop manufacturers have a significant amount of experience in dealing directly with business customers and selling large numbers of their products to corporations. Several wireless operators also have expertise in selling their services to business customers, but (with some exceptions) their greatest strengths are selling wireless services to individual customers, not to corporations. However, this is changing as businesses are starting to learn the value of wireless data services. For wireless operators, there is a significant opportunity to take advantage of this demand by forming relationships with laptop manufacturers.

Typical Laptop Manufacturer/Operator Relationship

Currently these relationships typically mean that a laptop manufacturer sells its products and bundles a CPC modem with a laptop, and then directs the customer to a wireless operator's representative to provision the modem. The laptop manufacturer may receive a fee from the operator for directing the customer to the operator, but in most cases that is the extent of the relationship. Since in this situation the laptop manufacturer is not acting as a reseller, they are losing the chance to receive larger fees from the wireless operator, and are missing the opportunity to receive residuals from the operator, as other resellers do. For the wireless operator, there is a missed opportunity here because potential customers are not immediately provisioned and therefore the operator is not immediately receiving revenue from the customer. Furthermore, since the customer is not immediately provisioned and activated on purchase of the laptop and CPC modem, there is the possibility that the customer may not activate their modem, or may activate it with a different operator (in the case of GSM/GPRS/EDGE modems).

Laptop Manufacturer/Operator Reseller Model

A different model exists, though, one that allows wireless operators and laptop manufacturers to receive the benefits of closer cooperation. In this model, operators and laptop manufacturers work more closely together. Laptop manufacturers are able to directly provision their customers onto the wireless network of their customer's choice. That means that when a customer receives their laptop, they are immediately able to turn it on and connect to the wireless network that they have chosen. The benefits of such a model, to operator and manufacturer alike, are obvious – and the key benefit is that the customer is immediately satisfied because they receive an immediate and complete wireless computing and connectivity solution. While, as noted above, only one of the laptop manufacturers profiled in this paper is currently able to provision modems, In-Stat/MDR expects that this model will become more prevalent during the next 12 to 24 months.

WWAN Products Currently Available to Corporate Buyers

Choosing a CPC modem for a laptop is a relatively straightforward process for users. From a laptop standpoint, users need only determine if their laptops are equipped with a Type II PCMCIA slot – which are standard on nearly all laptops. The next step in the process for users is to determine which wireless operator they want to purchase service from. Operator choice generally comes down to network coverage and speed. In the United States customers can choose from two types of networks, based on coverage and speed: GSM and CDMA.

Currently CDMA operator Verizon Wireless offers the most widespread coverage, though that coverage is mostly CDMA 1xRTT, with typical data speeds of around 70 kbps. For faster data speeds, though with a trade off of somewhat less coverage, customers can choose from AT&T Wireless or Cingular, both of which have upgraded their wireless data networks to EDGE, which provides typical data rates of about 130 kbps. Customers that choose either of these carriers will benefit from their planned merger at the end of 2004/beginning of 2005 that will result in an integrated EDGE network with even greater coverage and no roaming charges. A further advantage for users of EDGE-based networks is that when they travel overseas, they can often roam onto GPRS networks in other countries.

Over the course of the next 12 to 24 months customers will have even more choices as Verizon completes the rollout of its CDMA 1xEV-DO network (offering data speeds of 300-500 kbps), Sprint chooses to deploy either CDMA 1xEV-DO or CDMA 1xEV-DV, and Nextel decides whether to expand its Flarion wireless technology trial (which offers users data speeds of up to 1.5 Mbps, but is currently only available in Raleigh, North Carolina). Obviously buyers need to be aware not only of their current needs, but of those that will exist in a year or two.

Once users have chosen the operator whose network best fits their needs, they can choose the CPC modem that fits their needs. Since there is little substantial difference between modems other than airlink, choice is most often limited to what modem an operator makes available to its customers. In most cases, operators only make one or two CPC modems available, though Sprint gives its customers three different modems to choose from. Differences cited by manufacturers between theirs and competitors' modems are typically based on power consumption, and network reception. However, given the rigorous testing CPC modems face before being certified by a wireless operator for access to their network, it is highly unlikely that any manufacturer has a significant advantage in this area over competitors.

One potentially significant area of difference between modems is the software interface that ships with the modem. From initial installation and setup of wireless modems through day-to-day use, the software interface is an important feature of a CPC modem. For instance, problems can result when a modem is incompatible with the OS of the

laptop it is intended to run on. This is most commonly an issue for users that purchase a modem from an operator for use on an older laptop, and not an issue for laptop manufacturers whose laptops are running an up-to-date OS.

US Wireless Carrier Data Network Rollout Strategy

Wireless operators are not currently reporting actual numbers of CPC modem units shipped. Nevertheless, based on manufacturer data, company reports filed with SEC, and conversations with operators, In-Stat/MDR believes it is possible to estimate operator shipments in aggregate with a fair degree of accuracy.

CDMA

In the United States, CDMA is the dominant airlink for wireless data, and going forward it will continue to dominate, even as it evolves. CDMA airlink evolution will move from CDMA2000 1xRTT, currently deployed by both Verizon Wireless and Sprint PCS, to 1xEV-DO (Evolution Data Optimized) and 1xEV-DV (Evolution Data Voice). EV-DO is currently deployed by Verizon in San Diego and Washington DC/Baltimore, and will be deployed across 30% of Verizon Wireless's network by the end of 2004, going nationwide in large markets by the end of 2005. Sprint has stated publicly that it will wait for the commercial availability of EV-DV, though some within the wireless industry speculate that the carrier will alter course and announce an EV-DO deployment within the next several months.

GSM/GPRS/EDGE

The market for GSM/GPRS/EDGE PCMCIA cards has gotten off to a slow start. This is due to the fact that US GSM carriers have been slower to deploy higher speed wireless data networks than their CDMA counterparts. AT&T Wireless (AWE) has been rolling out its GSM/GPRS network over its existing TDMA network for the last two years. Currently its network is deployed nationwide, but has some significant gaps. AWE is the first carrier to deploy EDGE in the United States, and will enjoy a temporary position as the carrier with the fastest wireless data network in the US (until Verizon completes its EV-DO rollout). EDGE will continue to have a significant advantage in the US through 2006 as AT&T Wireless and Cingular merge their networks (the merger is expected to be completed by the end of 4Q04 or 1Q05). Cingular currently has deployed EDGE throughout nearly 90% of its markets and the combined AT&T Wireless/Cingular EDGE network will cover more of the US population than will Verizon's EV-DO network in 2005.

Laptop Manufacturer WWAN Product Offerings

Each of the four laptop manufacturers reviewed for this study has a somewhat differentiated WWAN solutions strategy. In the table below is a summary of each laptop manufacturer's WWAN connectivity solutions.

Table 1.   Laptop Manufacturer WWAN Product Offerings Summary

	Has US Wireless Operator Reseller Relationship [Y/N]	Number of US Wireless Partners	Sells Wireless Operator CPC Modems [Y/N]	Provisions CPC Modems [Y/N]	Bundles CPC Modems [Y/N]	Offers Rugged Laptop with CPC Modem [Y/N]
Dell	No	0	No	No	Yes	No
HP	Yes	4	Yes	Yes	Yes	Yes
IBM	No	2	Yes	No	Yes	No
Toshiba	No	0	No	No	No	No

The first column shows whether each laptop manufacturer has a relationship with a US wireless operator that allows it to resell that operator's wireless data service to its customers. Currently, only HP has such a relationship, through an outsourcing strategy that subcontracts this service to resellers. The second column shows the number of wireless operators that the manufacturers have relationships with, either to provision their CPC modems and resell their service or to bundle their modems with the manufacturers' products. The third column shows whether the manufacturers can sell operators' CPC modems (Dell sells its own branded CPC modems, which do operate on GPRS carrier networks). The fourth column shows whether the manufacturer can provision the modems, and the fifth column, whether they are able to bundle CPC modems (operator modems or laptop manufacturer-branded modems) with their products. The last column shows whether the laptop manufacturers offer a rugged laptop that can be used with a CPC modem. Though rugged laptops are not directly relevant to whether a laptop manufacturer has a WWAN access strategy, users of rugged laptops are in many cases early adopters of WWAN access technology because their fieldwork often takes them into areas where other access technology is not available.

Below is a review of each laptop manufacturer actual WWAN connectivity solutions.

Dell

Dell is, avowedly, wireless operator neutral, meaning that while it does sell Dell-branded CPC modems, it does not have preferred wireless operators that it attempts to guide customers to. The reason for this is that Dell believes that customers have varying needs and it wants to be as responsive as possible to those needs.

Currently Dell sells a Dell-branded, Sony Ericsson-built GSM/GPRS modem that has been certified by AT&T Wireless and T-Mobile in the US, and by Vodafone and O^2 in the UK. Dell is able to ship the modem, with a Subscriber Identification Module (SIM), to a customer. The customer then calls the wireless operator of their choice, directly, to have the SIM and modem activated.

Dell does, however, recognize that other laptop manufacturers have close relations with operators that allow them to provision CPC modems before they are shipped, which is an important advantage. In light of this, Dell is currently talking with major operators in the regions where it is most active in order to play a more active role in how it serves its customers WWAN needs. Dell expects that as this market evolves, and as operators roll out more robust wireless data networks, that it will develop stronger ties with the operators to provide a more complete WWAN solution.

Hewlett-Packard (HP)

Hewlett-Packard (HP) has the most developed WWAN solution of any of the laptop manufacturers reviewed. HP has developed relationships with US wireless operators AT&T Wireless, Sprint, T-Mobile, and Verizon Wireless. These relationships allow HP to supply activated CPC modems with computing products that it sells, or to support customers who wish to deal directly with wireless operators. HP's strategy is not to compete with operators for WWAN solution sales, but to be able to provide a wireless solution that will fit any customer's needs.

HP is able to offer its customers the ability to buy a laptop or other computing product, to choose a wireless data service plan from among four different US wireless operators, to purchase a modem that will operate on that wireless operator's network, and to provision the service. HP is able to do this by outsourcing provisioning and activation of CPCs to resellers with whom it has a subcontractor relationship. This relationship is transparent to customers, who call a single number to choose a wireless operator and data plan to fit their needs. This level of integration is significant since it means that HP customers can choose a WWAN solution that fits their computing needs and have the solution work as soon as the product is shipped to them. Another customer benefit is the fact that this provides a compatible product to the customer and the ease of one-stop shopping. It simplifies the purchase process and the need for the customer to navigate what could be a confusing buying process. None of the other manufacturers surveyed for this report can offer this level of integration and support.

International Business Machines (IBM)

IBM has wireless operator relationships that allow it to offer its US wireless customers a CDMA solution and a GSM/GPRS/EDGE solution. IBM has partnered with Sprint and with AT&T Wireless. Customers can purchase their computing products from IBM, and also buy CPC modems for either Sprint or AT&T Wireless from IBM. After purchase, however, the customer must contact the wireless operator directly to provision and activate their CPC modem.

IBM's strategy is based on perceived customer need. Like Dell, IBM has not seen strong customer demand for WWAN solutions. IBM does, however, believe that in the future demand for these solutions will grow, and it will look to developing closer relationships with its current wireless operator partners and with other operators to meet those demands.

Toshiba

Toshiba declined to participate in this study. A review of their modem product offerings shows that while they do offer LAN, WLAN, and other connectivity solutions, they do not have any WWAN solutions. No wireless operator that In-Stat/MDR has spoken to regarding WWAN laptop connectivity solutions, for this study or for any other research on related subjects, has mentioned Toshiba or indicated that Toshiba has a WWAN solution. Based on Toshiba's decision not to participate in this study, their apparent lack of a WWAN modem product, and operator feedback, In-Stat/MDR believes that Toshiba has no WWAN solution for its customers at this time.

Online Information Sources for Laptop Manufacturer WWAN Solutions

Additional information regarding laptop manufacturer solutions can be found at the following locations:

Dell

This site details Dell's laptop product offerings:

http://www1.us.dell.com/content/products/category.aspx/notebooks

Hewlett-Packard

This site details HP's WWAN product offerings:

http://www.hp.com/go/wan

This site details HP's rugged laptop product:

http://h18000.www1.hp.com/products/notebooks/rugged/specs.html

International Business Machines

This site details IBM's laptop product line and services:

http://www.ibm.com/think

Future Directions for the WWAN Connectivity Market

As indicated in the CPC modem forecasts in the next section, demand for WWAN solutions are expected to grow rapidly over the next five years. This growth will be driven by several factors. These factors include rapid expansion of wide-area wireless data networks by operators worldwide, increased demand from customers for laptop-based wireless data solutions, stronger marketing efforts by wireless operators of CPC modem solutions, and stronger relationships between wireless operators and laptop manufacturers.

Global Wireless Data Network Expansion

As previously mentioned, wireless operators in the US are rapidly expanding their wireless data networks. Worldwide, operators are following a similar path. Wireless networks in Asia, particularly in Japan and South Korea, are most developed, with hundreds of millions of potential customers having access to wireless networks operating at near-broadband and broadband speeds, and with tens of millions of actual customers. Wireless operators in Western and Eastern Europe are also upgrading their networks to offer high-speed wireless access using Universal Mobile Telephone System (UMTS) a third generation network technology that is one variant of Wideband CDMA (W-CDMA). Subscribers in Latin America will also soon have access to advanced wireless data networks. The advent of these high-speed wireless services will be the main driver of WWAN computing, as users are able to access data networks at high speeds anytime, anywhere.

As customers have access to advanced data networks, their demand for WWAN laptop connectivity solutions are set to expand. Customer demand for these solutions will be limited by high-speed data network coverage and by operator pricing for services. In many regions, high-speed data network coverage will never be as large as overall wireless network coverage, as operators choose to build out these networks only in those areas where demand for the services will be great enough to justify the cost of network build out. Pricing will also play a role. For instance, in the United States, operators have been quick to introduce flat-rate pricing plans for CPC modem users. In Europe, operators continue to price data services based on kilobytes of data transfer. For CPC modem users, who can use substantial amounts of data, this type of pricing acts as a limiter on their use of these services. Unless operators change their pricing plans for CPC modem customers, adoption will continue to lag behind that of the US.

Customer Demand for CPC Modem-Based Solutions

Customers who never before thought about a CPC modem-based solution are now actively considering them. This is due in no small part to the "Centrino Effect." This refers to Intel's development of the Centrino chip, which provides embedded Wi-Fi capability into laptops. As customers become used to using their laptops to access Wi-Fi networks, they are becoming aware of both the freedom of using their computers in an untethered fashion, and of the limitations of hot spots, which do not provide the same level of ubiquitous coverage as cellular-data-based networks. Customers wanting to step up to the next level of wireless access are becoming aware of and buying access to these wide-area wireless data networks.

Wireless Operator Marketing of CPC Modem-Based Solutions

Wireless operators are transitioning from a handset-based services solution model to one that also incorporates CPC modems. For operators, this represents a change in how they market their services, since usage patterns, services, and pricing for CPC –modem-based wireless is very different from handset-based wireless. As operators become more adept at raising customer awareness of CPC modem-based solutions, demand for and usage of the services will rise. This rise will not be even across operators, markets, and regions, as some operators do a better job of marketing the services, and because some regions (for instance those where laptop penetration is higher) are more appropriate for the services than others. Laptop manufacturers need to be aware of this and position themselves accordingly to take advantage of rising demand.

Building Stronger Wireless Operator/Laptop Manufacturer Relations

Reviewing the CPC modem-based solutions market reveals that most operators are not positioned to meet demand for laptop-based WWAN connectivity solutions. Going forward, laptop manufacturers and operators will need to build ever-stronger relationships, including integrated ordering and provisioning capabilities. Those operators and laptop manufacturers that do not form strong relationships to support the provisioning of WWAN services will not be able to meet their customers' needs and will lose market share to the operators and laptop manufacturers that have formed strong relationships. As with other wireless services, there is a first mover advantage in which those companies that move quickly to provide solutions to their customers are able to win sizable market share and are difficult to dislodge by other companies that enter the market later.

CPC Modem Worldwide Forecasts

Below are In-Stat/MDR's forecasts of the CPC modem market. The numbers in this forecast represent units shipped, through 2009.

For most of the forecast period, the United States represents the largest market for CPC & embedded modems, through 2008. By 2009, though, modem shipments overseas will represent the largest part of the modem market.

US hegemony through much of the forecast period is driven by the widespread access to high-speed wireless data networks, by a high laptop computer penetration, and by flat rate pricing plans that encourage laptop wireless data access.

Table 2. **US CPC & Embedded Modems Shipped Forecast 2004 – 2009 (Units in Thousands)**

United States	2003	2004 Fcst.	2005 Fcst.	2006 Fcst.	2007 Fcst.	2008 Fcst.	2009 Fcst.	CAGR 03 - 07
CPC & Embedded WAN	550	1,417	2,300	4,803	8,658	13,707	22,532	44%
CPC Modems	550	1,389	2,185	4,371	6,926	9,183	10,590	38%
% of total units shipped	100%	98%	90%	91%	80%	67%	47%	
Embedded Modems	-	28	115	432	1,732	4,523	11,942	128%
% of total units shipped	0%	2%	10%	9%	20%	33%	53%	

Source: In-Stat/MDR, 06/2004

Outside the United States, Europe will be the strongest driver of laptop-based wireless data access. Access to a uniform wireless data standard network (GPRS+UMTS) will drive the trend toward embedding wireless modems in laptops, though this will not represent a substantial market before 2007.

Table 3. **Worldwide (Excluding US) CPC & Embedded Modems Shipped Forecast 2004 – 2009 (Units in Thousands)**

Worldwide (excluding US)	2003	2004 Fcst.	2005 Fcst.	2006 Fcst.	2007 Fcst.	2008 Fcst.	2009 Fcst.	CAGR 03 - 07
CPC & Embedded WAN	385	1,091	2,093	4,035	7,446	12,884	23,884	47%
CPC Modems	385	1,080	1,884	3,228	4,989	6,957	8,837	36%
% of total units shipped	100%	99%	90%	80%	67%	54%	37%	
Embedded Modems		11	209	807	2,457	5,927	15,047	195%
% of total units shipped	0%	1%	10%	20%	33%	46%	63%	

Source: In-Stat/MDR, 06/2004

Embedded modem use is currently limited by operator and regulator certification process cycles that are typically longer than laptop manufacturers' development cycles, and by pricing structures that make use of PCMCIA-based CPC modems cheaper than embedded modems. Both of these problems will be resolved over the next 24 to 36 months, making embedding modems in laptops a viable prospect.