# Wireless Data Access – **Technology**, Range and Convergence

President and CEO of IntelliClear - January 2005

The human race has always been driven by the obsession of convenience. The visions of data access anytime, anywhere, along with real-time system response have been a focal point of convenience for professionals and technologists for decades. Billions of dollars in research and development have been spent by a multitude of companies to turn those visions into reality. Nowhere has this dynamic been more prevalent than with wireless data technology. There are several implementations of wireless data to be aware of and understand, each carrying with it a set of standards and ever increasing expectations. The obsession for unrestricted wireless data access has started fires under a number of technology sectors today, leading to innovation, lamentation, and jubilation.



Background.....2 Four Technologies......2 WPAN (Bluetooth).....5 WLAN (WiFi).....7 WMAN (WiMax) .....11 WWAN .....13 Wireless Data Devices ....15 Final Thoughts.....16

Using a variety of findings from numerous independent sources, augmented by industry experiences, IntelliClear takes a brief look at the wireless data space to help readers understand the technology and the current status of the market. Furthermore, we'll take the opportunity to highlight future possibilities inherent in the technology, and the implications for consumers and professionals alike.



Written By Eric Shuster

### method of wireless data access today, the vision of one integrated methodology looms on the horizon.

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ABSTRACT:

The vision of wireless data

and technologists for over a quarter of a century. While the vision of wireless data access has been clear, the

access from anywhere at anytime has been a passion and pursuit of individuals

journey to making the

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IntelliClear briefly examines the wireless data market to educate the reader and provide understanding for the future.

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#### The Roots of Wireless Data:

Wireless data is often seen as the natural outgrowth of wireless voice communication, which originated when the Detroit Michigan Police Department mounted a radio in a police car in 1921. Fifty years later, in 1974, the FCC made an allocation of the 40 MHz spectrum for mobile telephone service in preparation for "cellular systems." Three years later in April of 1977, Dr Martin Cooper, once an employee at Motorola, made the first call on a wireless phone and is today considered the inventor of the modern cell phone.

The roots of wireless data harkens back to the mid 1980's with the advent of wireless networks such as Ardis and RAM/Mobitex, which provided speeds between 8Kbps and 19.2Kbps. By the early 1990's wireless data solutions became available that connected landline laptop modems to analog cellular phones. Although this solution was clumsy and not reliable enough for commercial use, it created a vision of wireless data. CDPD technology was introduced in 1995 and achieved data rates of 19.2Kbps. CPDP was followed by GSM and CDMA, which ushered in the modern era of wireless wide area networks (WWANs) that include 1xRTT, EDGE, and 3G. In parallel with WWANs there developed more localized paths to wireless data access such as infrared (IRDA), Bluetooth, and wireless local area networks (WLANs).

Regardless of the wireless data methodology being developed or deployed, the goal of each of the implementations has been the same: un-tethering the data access device from wires, while increasing the availability of information to the user.

#### Not One, But Four Key Wireless Data Technologies:

The evolution of wireless data has birthed four different wireless implementations of technology, each with an accompanying standard distinguished by its *range* of accessibility, *throughput* of data, and *frequency* of operation.





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- Wireless Personal Area Network (WPAN) targeted towards operability within a 10 to 30 foot range between devices, making WPAN a "workspace-based" wireless technology.
- Wireless Local Area Network (WLAN) targeted towards operability within a 150 to 300 foot range between a device and a base station, making WLAN a "campus or officebased" wireless technology.
- Wireless Metropolitan Area Network (WMAN) targeted towards operability within one to five miles between a device and a base station, making WMAN a "metropolitanbased" wireless technology.
- Wireless Wide Area Network (WWAN) targeted towards operability within a carrier coverage area (one to five miles from a tower), making WWAN a "national-based," or even "global-based" wireless technology.

The table below outlines the key characteristics of each of the aforementioned wireless technologies, including its commercial name, usage, standard, throughput, range and frequency:

| Commercial<br>Name      | Usage            | Standard  | Through-put   | Range                | Frequency  |  |
|-------------------------|------------------|-----------|---|----------------------|--|--|
| UWB (ultra<br>wideband) | WPAN             | 802.15.3a | 110-480 Mbps Up to 30 feet                                |                      | 7.5GHz   |  |
| Bluetooth               | WPAN             | 802.15.1  | Up to 720Kpbs   | Up to 30 feet        | 2.4GHz   |  |
| Wi-Fi                   | WLAN             | 802.11a   | Up to 54Mbps  | Up to 300 feet       | 5GHz   |  |
| Wi-Fi                   | WLAN             | 802.11b   | Up to 11Mbps  | Up to 300 feet       | 2.4GHz   |  |
| WIMAX                   | WMAN<br>fixed    | 802.16d   | Up to 75Mbps<br>(20MHz BW)                                | Typical 4-6<br>miles | Sub 11GHz  |  |
| WIMAX                   | WMAN<br>Portable | 802.16e   | Up to 30Mbps<br>(10MHz BW)                                | Typical 1-3<br>miles | 2-6 GHz  |  |
| Edge                    | WWAN             | 2.5G      | Up to 384Kbps   | Typical 1-5<br>miles | 1,900 MHz  |  |
| CDMA2000/1x<br>EV-DO    | WWAN             | 3G        | Up to 2.4 Mbps<br>(typical 300-600<br>Kbps)               | Typical 1-5<br>miles | 400, 800, 900,<br>1,700, 1,800,<br>1,900, 2,100<br>MHz |  |
| WCDMA/UMTS              | WWAN             | 3G        | Up to 2Mbps (up<br>to 10Mbps with<br>HSDPA<br>technology) | Typical 1-5<br>miles | 1,800, 1,900,<br>2,100 MHz                             |  |

### **Broadband Wireless Technologies**

Source: Intel, January 2004



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One wireless data world would be ideal and is perhaps within our reach from a theoretical if not a virtual perspective in the next decade. That depends of course on how one defines "one wireless data world." One might ask why so many flavors of wireless data have been developed, and why so many different standards are necessary. IntelliClear often hears the question, "why can't there be one wireless service that covers home, work, and everything in between?" There are human, financial, political, and technological reasons for the multiple implementations of wireless data. At a more broad level, the answer is that from the very beginning of the wireless era, different consortiums and companies have chased after different visions of wireless communications (voice and data). Some of those visions ended up taking root, while others did not.

For instance, the Iridium project was conceptualized in 1987 by a group of Motorola engineers who believed that by putting into orbit 77 satellites (77 is the atomic number of Iridium) they could provide paging and phone service all over the world including the ocean, deserts, and anywhere else that wireless phones would not work. The first Iridium satellite was launched in 1997, leading to the eventual launch of 88 satellites. The Iridium service was expensive because of massive overhead of the project, running up a projected debt that ran into the billions of dollars. Although still alive, Iridium proved to be an ill-fated idea.



While the vision of Iridium was being pursued, others invested in cellular towers using one or more different voice and data standards. The lack of standardization (especially in the US) created parallel investments on the part of different firms, using different strategies and executions. Each had the same goal – providing wireless communication services for voice, and eventually data. All this activity has resulted in long delays, redundant investments, conflicting and non-compatible standards and implementations — and the growth of more localized wireless data implementations such as WiFi, and looming in the future, WiMax.



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#### Bluetooth (WPAN) – Wireless Within an Arm's Reach:

The focus of a WPAN is centered on an individual's workspace (in their office), or existence space (in their car, kitchen, etc.). Introduced by Ericsson in 1994, the name Bluetooth originated from a 10th century Danish king by the name of Herald Blätand, who was known for unifying Norway and Denmark. Blätand translates to Bluetooth in English. Bluetooth from the start was embraced by industry giant Intel, but was slow to reach the mainstream technology market. Reasons for the slow ramp-up include the perceived high expense of Bluetooth devices, the limitation of a 30-foot range, lack of security, and the absence of widespread OEM integration. Despite its slow adoption, Bluetooth today is positioned for mass implementation in both the consumer and commercial sectors in a variety of devices including phones, cars, and household appliances.

Bluetooth provides a low-power, short-range frequency-hopping radio link between devices. Operating in the unlicensed industrial, scientific, and medical (ISM) band at 2.4 GHz, Bluetooth was meant to improve on the implementation of infrared (IR) devices, which found their way to notebook computers in the early 1990's. The line-of-sight limitation of IR made the technology awkward to use, but its low cost was compelling. The vision of a WPAN is that a user with a Bluetooth- ready notebook (for example) could wirelessly connect to Bluetooth-enabled devices such as a personal digital assistant (PDA), a portable printer, headphones, keyboard, or other devices on a network. The focus of a WPAN is centered on an individual's workspace (in their office), or existence space (in their car, kitchen, etc.).



The Economist Intelligence Unit reported in January of 2004 that one in four global businesses that had deployed mobile computing solutions had also deployed some form of Bluetooth.<sup>1</sup> Security concerns by IT professionals, coupled with application incompatibilities (not taking advantage of Bluetooth technology), have inhibited the widespread growth of Bluetooth (and consequently WPAN) in the mainstream *commercial* market. For those professionals who use Bluetooth everyday, the technology provides outstanding reliability and convenience.



Among everyday consumers, a desire to own "the latest and greatest technology" keeps Bluetooth

on the radar of wish-list features for devices. Strategy Analytics reported in June of 2004 that 22% of US mobile phone users desired Bluetooth technology as a mobile phone feature. <sup>2</sup> Although one in five consumers indicated an appetite for Bluetooth, it was a distant forth behind cordless handsets, push-to-talk capability, and improved personal information management capabilities.
Outside of cell phones and computers, Allied Business Intelligence (ABI) reported that it expects 10% of new vehicles worldwide by 2007 to be factory-fitted with Bluetooth hardware.<sup>3</sup> Such future possibilities suggest that the finest hour for Bluetooth and the WPAN may be yet to come.

Mobile Phone Features Desired by US Mobile Phone Users June 2004 (as a % of respondents) Cordless Handset 54% **Push-to-Talk Capabilities** 50% Improved Personal Information Manager 34% Capabilities 22% Bluetooth Technology **QWERTY Keypad** 13% **Music and Video Applications and Games** 10% 0% 20% 40% 60%

Source: Strategy Analytics, June 2004 n=1,000

#### WiFi (WLAN) – Propelled By Intel and Embraced by Many:

When it comes to wireless data the most common implementation is that of wireless local area networks (WLAN) - commonly known as WiFi. Launched in 1997 through the unlicensed spectrum of up to 5.8GHz via the IEEE 802.11 specification, WLAN implementations have exploded over the last 24 months. Consumers and businesses alike have jumped into the WiFi arena. The 802.11 specification has had three key iterations (802.11a, b, and g), with b and g being the main ratifications of interest. The difference between the b and g implementations of 802.11 is that b operates at 11 Mbps, and g operates at 20+ Mbps, while both operate at a frequency of 2.4 GHz. Both b and g are capable of interoperability with one another.



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It is estimated that the worldwide WLAN hardware market single handedly generated \$1.7 billion in 2003 (140% increase) according to In-Stat/MDR in 2004. The WiFi explosion was facilitated in large part by the introduction of Intel® Centrino<sup>™</sup> mobile technology in January of 2003, which was accompanied by one of the largest advertising campaigns in the history of the high technology industry. Dana Houghton, a senior marketing manager at Intel, put the total Centrino<sup>™</sup> campaign cost at close to \$300 million according to *Technology Marketing Magazine* in September of 2003.<sup>4</sup> Intel plastered the Centrino<sup>™</sup> blue and maroon butterfly-like logo on billboards, hotel lobbies, airports, store windows, buses, magazines, and newspapers for months following its introduction. The campaign by Intel had the effect of moving wireless data into the mainstream of technology consideration, while helping propel the multi-billion-dollar industry of wireless data. In the US, Wireless home networking (WHN) recently achieved a staggering awareness level of 72%, according to Ipsos-Insight in 2004.<sup>5</sup>



As stated by the Dell'Oro Group in February of 2004, the year-over-year revenues contributed to WLAN of Linksys, D-Link, and NETGEAR grew 29%, 28%, and 35% respectively, as each cashed in on the mad rush to wireless networking.<sup>6</sup> Worldwide WLAN hardware revenues in 2003 alone grew 52% in North America, 25% in EMEA, and 19% in Asia-Pacific according to Infonetics Research.<sup>7</sup>

It is estimated that the worldwide WLAN hardware market single handedly generated \$1.7 billion in 2003 (140% increase) according to In-Stat/MDR in January of 2004.<sup>8</sup> Hardware manufacturers were not the only ones to benefit from the WLAN boon; tens of thousands of local service providers and independent consultants have made millions of dollars installing wireless networks in homes and businesses across the globe.



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With Intel helping propel the WiFi market forward, hype alone has not sustained its growth. Consumers are embracing the freedom and convenience that wireless networking provides them within their home, while IT managers are cautiously ramping up implementations in commercial businesses in hopes of improving employee productivity.

A key inhibitor of WLAN for the commercial space has been its lack of security. The genesis of these concerns is the weak layers of security inherent with WLAN. Full control over security is difficult with WiFi, due to its status as an unlicensed spectrum. The first generation of WiFi protected access (WPA) as a security measure was easily broken, making many businesses leery of wireless LANs. "The advent of the more robust WPA-2 security standard and other ways of securing WiFi networks, has cleared the way for corporate deployments that won't be cracked in minutes, hours or days" according to Kevin Walsh, director of product management for Funk Software.<sup>9</sup>

Such easing of security concerns have helped fuel WiFi roll-outs among commercial businesses in the US and abroad. US IT executives reported WLAN-enabled laptop computers and PDAs were among the most common wireless devices being supported in their organization, according to a study conducted by CIO magazine in February of 2004.<sup>10</sup> WLAN deployment objectives center on improved employee productivity, enhanced customer satisfaction, and efforts to lessen the IT managers own load in making changes due to moves and additions according to a Sage Research study in January of 2004.<sup>11</sup>



Potential Benefits from the Deployment of Wireless LANs cited by IT Professionals in the US (as a % of respondents)

43%

50%

60%

66%

70%

Improved employee productivity As stated by Improved customer Gartner, there are satisfaction an estimated 30 Less IT staff time for 35% move/additions/changes million global Improved employee 32% satisfaction hotspot users.<sup>12</sup> 0% 10% 20% 30% 40% across an estimated Source: Sage Research, January 2004; n=117 132,000 hotspot WiFi Away from the Home or Office - Hotspots: locations worldwide.

Devices on a WiFi network must be within a certain distance of the router or access point (generally 150 feet or so), thus restricting WLAN users to the office or home in which the router or access point resides. To provide WLAN access while away from the office or home, public entities have installed WLAN hotspots. A hotspot is a location where a WLAN connection can be obtained, usually a publicly accessible area such as an airport or eating/drinking establishment. Access to the hotspot may be obtained on a subscription basis (per month), for a one-time-only fee, or increasingly, free, for patrons of the sponsoring hotspot owner (restaurant, hotel, bar, etc.). A whopping 70% of on-line consumers were aware of WiFi access in public spaces, according to a study conducted by JupiterResearch.<sup>13</sup>



Source: JupiterResearch, December 2003; n=2,835

As stated by Gartner, there are an estimated 30 million global hotspot users,<sup>14</sup> across an estimated 132,000 hotspot locations worldwide.<sup>15</sup> Asia-Pacific is fertile ground for hotspots, which often exist in Internet cafes. Economic limitations inhibiting home PCs and/or broadband connections often drive users to public areas to pay for such ad hoc Internet access. IDC projects a healthy hotspot environment in Asia-Pacific, with revenues generated from Asia-Pacific hotspot activity projected to reach \$800 million by 2007,<sup>16</sup> and 1 billion Euro dollars in Europe by 2006.<sup>17</sup>



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|                      |             | 2002  | 2003   | 2004   | 2005   | 2006   | 2007   |
|----------------------|-------------|-------|--------|--------|--------|--------|--------|
| IntelliClear         | Australia   | 56    | 520    | 750    | 1,020  | 1,180  | 1,298  |
|                      | China       | 850   | 1,600  | 2,313  | 2,658  | 2,759  | 2,841  |
| projects the home    | Hong Kong   | 115   | 505    | 801    | 1,060  | 1,598  | 1,998  |
| and commercial       | Malaysia    | 23    | 101    | 180    | 260    | 320    | 384    |
| WLAN market will     | Philippines | 16    | 55     | 106    | 122    | 126    | 128    |
|                      | Singapore   | 193   | 480    | 753    | 1,051  | 1,540  | 1,925  |
| experience a         | Sough Korea | 8,520 | 20,000 | 28,918 | 33,225 | 34,482 | 35,171 |
| significant increase | Taiwan      | 774   | 3,161  | 4,650  | 5,620  | 6,250  | 6,875  |
|                      | Thailand    | 0     | 18     | 43     | 73     | 101    | 127    |
| in 2005, as barriers |             |       |        |        |        |        |        |

#### Number of Hotspots in the Asia Pacific Region

Source: International Data Corporation (IDC), June 2003; Innovation Magazine, March 2004

Hotels are taking notice that broadband users are increasingly wireless and don't want to be without their wireless connections while on vacation or a business trip. As such, hotels are flocking to augment their wired broadband in-room connections with wireless options.

This surge in hotspot usage is leading to the generation of WLAN revenues associated with hotspot usage fees, hotspot installations, and revenue for establishments as a result of incremental purchases made by patrons (food, merchandise, etc.) using hotspots.

#### A Bright Future for WiFi, but Questions Loom on the Horizon:

Looking ahead, the future is bright for WiFi as a wireless data technology. Projected WLAN usage is strong, with 60% of North American companies planning to increase their deployment of wireless LANs in the next 12 months, according to Forrester Research.<sup>18</sup> This direction is confirmed in a Morgan Stanley report that estimated wireless LAN as being the third leading network spending priority among US CIOs behind security and storage area networks (SAN).<sup>19</sup>

Although commercial businesses are expected to generate the largest share of the revenue in the WLAN space, home WLAN installations will contribute a sizeable revenue steam. In-Stat/MDR believes that 15% of WLAN shipments in Europe in 2003 were home bound.<sup>20</sup> Home installations in the US are on an even stronger track for growth, accelerated by more favorable impressions of WiFi, according to Ipsos-Insight, who reported that 71% of adults in the US believe, "WiFi is easy to install at home."<sup>21</sup> IntelliClear projects the home and commercial WLAN market will experience a significant increase in 2005, as barriers to installation are significantly lowered. Easier installation procedures, enhanced security, increased awareness and education, and a strong dose of enthusiasm for wireless networking will all contribute to its sustained growth.



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Technologies that North American Companies Plan to Increase Their Deployment of In the Next 12 Months, 2004 (as a % of respondents)

Source: Forrester Research, April 2004; n=878 IT Decision Makers at North American Companies

Although the future for WiFi appears bright, new and improved wireless technologies could begin to supplant WiFi implementations over the long run. WiMax and WWAN, both discussed in the proceeding sections of this paper, have the potential to replace WiFi in certain instances where conditions permit. The possibility of a single wireless data network for a user in the home, at the office, and in between, will place WiFi at risk due to its reach limitations. The future is uncertain as to how and when this may come about. For now, WiFi is enjoying immense popularity across the globe among consumers and businesses.

#### WiMax (WMAN) – Addressing the Digital Divide:

The simplicity and growth of WiFi has been impressive — even astonishing — by any measurement. WiFi has catapulted wireless data access into the mainstream, creating the demand for "wireless networking anywhere." Hotspots are ideal for mobile Internet access, but the dead spaces between the home, office, and the next hotspot are too large for most Internet and wireless-data-addicted consumers and professionals. This is commonly known as the "broadband gap," or the "digital divide." 3G, EDGE, and EV-DO wireless technologies are thought to be the ultimate technologies for wireless data, but to date have not offered the availability, bandwidth, or the efficiency of data transport to become mainstream for all users. Wireless Metropolitan Area Networking (WMAN), also known as WiMax, comes to solve the digital divide.



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"WiMAX-certified systems will provide the building blocks to connect the next five billion users to the Internet and truly usher in the broadband wireless
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Based upon the IEEE 802.16 and ETSI HiperMAN wireless MAN specifications, WiMax will work with WLAN by connecting 802.11 hotspots to the Internet, and creating opportunities for continuous wireless connectivity and "last-mile" broadband connectivity to businesses and homes worldwide. As a licensed spectrum (meaning service providers will have to pay the Federal Communications Commission for bandwidth), WiMAX provides metropolitan area network connectivity at speeds of up to 75 Mb per second, transmitting signals as far as 30 miles. With industry titan Intel leading a host of technology start-ups and veterans behind the WiMax initiative, the reality of the deployment is a certainty. However, a firm understanding is required in order to set the appropriate expectations of functionality and availability from a timing perspective. There are two versions of WiMax: 802.16d and 802.16e. They differ in terms of expected benefits and the time frame for deployment.

802.16d is referred to as *fixed WiMax* and is targeted at providing wireless broadband to "large parts of the world that are too expensive to serve with wired technologies," according to Sean Maloney, Executive Vice President and General Manager of the Intel Communications Group. According to Jake Smith, Mobility Marketing Manager at Intel, 802.16d (fixed WiMax) will begin pilot installations in 2005, but will not become a scalable standards based technology until 2006 as the price and cost of 802.16 implementations reaches critical mass. The range of fixed WiMax is expected to be 30 miles, and it can be deployed both indoors and outdoors. Intel is so confident of the technology that Maloney goes on to say "WiMAX-certified systems will provide the building blocks to connect the next five billion users to the Internet and truly usher in the broadband wireless revolution."





802.16/HiperMAN – Broadband Wireless Access in the Last Mile<sup>22</sup>

# Wireless Data Access – Technology, Range and Convergence

WWAN provides wireless data access over the Internet across a coverage area that would generally be measured in hundreds, or even thousands of miles. To the US-based user who desires wireless anytime, anywhere, 802.11d is not going to be a solution of interest. Instead, 802.16e will be the answer to "anywhere" wireless data prayers. While 802.16d is delivering broadband to villages in India and China in 2008, 802.16e will just be starting its own pilot installations. 802.11e is referred to as "*portable WiMax*," and although not sporting the same impressive frequency, range, and throughput as 802.16d, portable WiMax is expected to fill the wireless gaps for die-hard wireless data users who want to be connected everywhere, all of the time. In fact, portable WiMax is expected to compete with WiFi hotspots once widespread implementation takes place.

#### WWAN – The Grand Vision of Wireless Anywhere:

Rounding out the family of wireless data solutions is wireless wide area network (WWAN). A WWAN covers a much broader area than wireless LANs or WiMax, with coverage usually measured on a nationwide, or even global basis. The WWAN network infrastructure (there is more than one network in the US and abroad) is provided by wireless service carriers (Verizon, Sprint, AT&T, T-Mobile, etc.) and is offered to users for a monthly usage fee (much like a cell phone subscription, or even part of a cell phone subscription). By contrast, WLAN allows wireless access that is measured in feet from a base station, while WiMax allows wireless access that is measured in single digit miles from a tower. Because WWAN uses an existing cellular infrastructure with a multitude of towers as coverage (and to a lesser degree satellites), WWAN provides wireless data access over the Internet across a coverage area that would generally be measured in hundreds, or even thousands of miles. This is despite the fact that WWAN range from the tower is similar to that of WiMax from a technology point of view.

Swiftly changing WWAN standards, differing carrier implementations, and international influences all combine to create a confusing set of circumstances to anyone wanting to fully understand the WWAN space. At a high level, WWAN uses cellular networks such as CDMA (Code Division Multiple Access), GSM (Global System for Mobile Telecommunication), GPRS (General Packet Radio Service), and CDPD (Cellular Digital Packet Data) for data transmission. However, it is not enough to know the basic protocols; one must drill down deeper into the three key technologies of the current day for US broadband WWAN data:

- Edge: 2.5G standard, providing up to 384 Kbps throughput, at an average coverage of 1 to 5 miles, with a frequency range of up to 1,900 MHz.
- CDMA2000/1x EV-DO (Evolution Data Optimized): 3G standard, providing up to 2.4 Mbps throughput, at an average coverage of 1 to 5 miles, with a broad range of frequencies from 400 to 2,100 MHz.



A user must either

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WCDMA/UMTS: 3G standard, providing up to 10 Mbps (with HSDPA technology), at an average coverage of 1 to 5 miles, with a broad range of frequencies from 1,800 to 2,100 MHz.

The difference between each of the WWAN technologies has to do with transport speed. Perhaps more importantly however, it has to do with the carrier using the technology. Each of the major WWAN carriers has made a commitment to one of the three WWAN technologies. Therefore a user must either select a carrier and settle for their WWAN technology, or select a WWAN technology and choose the carrier or carriers associated with that particular technology. Verizon, for instance, has deployed EV-DO, which is available in approximately 20 major metropolitan areas and 24 airports at the time of this paper's publication — with more expected in 2005. In places where EV-DO isn't available, Verizon offers the slower 1xRTT network. Sprint has also selected EV-DO as a wireless data transport, with 1xEV technology upgrade options. AT&T Wireless, on the other hand, launched UMTS (Universal Mobile Telecommunications Systems) in six cities in 2004. Although UMTS technology is making headway, CDMA2000-1x EV-DO will be the most widely deployed form of 3G WWAN in the U.S. for 2005.



Besides being used as a data transport, WWAN networks have the advantage of allowing voice traffic over the same network. Both cellular telephones and Wireless WAN PC Cards have the ability to make voice calls as well as pass data traffic on Wireless WAN networks. WWAN networks, with the advent of CDMA2000 1x EV-DO, can now enable voice over the internet (VoIP), thus making phone services a possibility for WWAN data users. Vonage, one such VoIP provider, reportedly has over 250,000 subscriber lines in service. <sup>23</sup> Verizon is seen by most IT professionals as being in the strongest position to deploy VoIP successfully.<sup>24</sup>



select a carrier and settle for their WWAN technology, or select a WWAN technology and choose the carrier or carriers associated with that particular technology.

## Wireless Data Access – Technology, Range and Convergence



A common theme that runs through all four wireless technologies is the primary wireless data access devices that will be utilized across whatever access method or methods the user has selected.

If WWAN sounds like the ultimate answer to the wireless data users dreams, it may well be over the long run. As coverage of 3G networks increases dramatically, and pricing for access services reaches a mainstream adoption-rate, WWAN as a wireless data solution becomes compelling – especially to enterprise users. Another advantage of WWAN over WLAN, and to a lesser degree WiMax, is security. WWAN operates in tightly regulated (and licensed) frequency spectrums, delivering better data security and protection. WWAN networks incorporate military technology and sophisticated encryption and authentication methods. This bodes well for WWAN, as US enterprises name security as the number one factor influencing wireless deployment, followed by cost, coverage and network speed.<sup>25</sup>

#### Wireless Data Access Devices – An Array of Possibilities:

IntelliClear has provided the reader a brief education on the virtues and challenges of WPAN, WLAN (WiFi), WMAN (WiMax), and WWAN as wireless data access options. Each data access method has its place in the spectrum of wireless possibilities for consumer and commercial users alike. A common theme that runs through all four wireless technologies is the primary wireless data access devices that will be utilized across whatever access method or methods the user has selected. Device possibilities primarily center on notebook PCs, cell phones, Blackberry-type handheld devices, PDAs/pocket PCs and smartphones.

NOP World conducted a study in September of 2004 that found the selection of a wireless data access device is somewhat dependent on the size of company the user works for.<sup>26</sup> NOP categorized companies into fewer than 10 employees, 10 to 99 employees, 100 to 999 employees, and 1000 or more employees. The chart on the next page outlines the results of that survey:





Mobile Device that US Companies View As the Primary Device For a Mobile Wireless Data Access Terminal (as a % of respondents)

The results of the study suggest that notebook and ultralite PCs are the wireless access device of choice regardless of company size. However, beyond the PC, smaller firms generally favor traditional phones, while larger companies prefer Blackberry-type email centric devices.

#### Wireless Data Technology - An Evolution That's Here to Stay:

Each of the four wireless data technologies covered in this paper at times sound like technologies that compete with one another. While in some instances they may, the true vision of wireless data access is seamless operation without user intervention. The wireless data technologies described in this paper are by-and-large complimentary and represent different routes to the same endpoint. One or more of the wireless technologies can be roads taken to the final destination - depending on one's point of departure. In all cases the destination is the same. It may be that the user will select his own route, or that the network will make the decision for him, according to access and availability.



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is seamless

OEMs will soon offer devices that come standard with all four wireless connection possibilities, enabling devices to automatically detect the associated wireless network — and to connect according to a predefined set of rules.

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Devices can be equipped today to accommodate a WPAN, WLAN (WiFi), and WWAN connection interchangeably. As WMAN (WiMax) evolves, that road to wireless data will also become available. OEMs will soon offer devices that come standard with all four wireless connection possibilities, enabling devices to automatically detect the associated wireless network — and to connect according to a predefined set of rules. Wireless carriers will have single plans that allow for connectivity across multiple networks, with users not even knowing which one they are connected to. All they will know is that they are connected. Again -- the destination is all that will matter, not the access route.

British novelist Norman Douglas said "*you can tell the ideals of a nation by its advertisements.*" In the US, and in so many other developed countries, advertising abounds that refers to doing more with less, eliminating restrictions, and exercising freedom across a broad range of life experiences. Wireless data is seen as an enabler of these ideals to many who thirst for wireless data access 24x7. However, wireless data access can also be viewed as the polar opposite to those who see it as a way to enslave individuals with the inability to escape cyberspace. No doubt there will continue to be individuals on both sides of the issue.

Wireless data access technology is still in its infancy. It will evolve to ever greater speeds, across larger geographies, with more diverse applications. It's not a trendy fad or an industry that can collapse under the weight of a fragile stock market. Wireless data is here to stay, and it will become whatever users and the industry decide it will be.

#### **About IntelliClear**

IntelliClear is a market research and business consulting firm committed to the delivery of actionable market intelligence to the global IT community. IntelliClear's mission is to bring clarity to IT market intelligence by delivering results-oriented research, responsive industry experience, and effective data synthesis - leading to confident go-to-market plans. IntelliClear leverages the experiences of seasoned IT and market research professionals, while utilizing its global network of industry consultants and research partners to execute projects across a broad spectrum of disciplines and geographies. For more information visit our website at www.intelliclear.com.

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