

The logo graphic consists of several overlapping, curved lines in a light blue color, creating a sense of motion or a stylized 'P' shape. The word 'Intermec' is written vertically in a bold, dark blue font, positioned to the right of these lines.

Intermec

White
Paper

**BUYING CONSIDERATIONS FOR
WIRELESS NETWORKING**

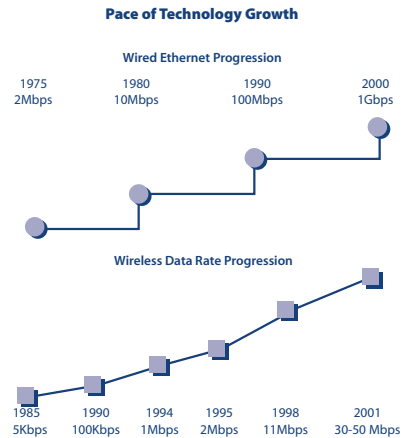
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INTRODUCTION

The recent ratification by the Institute of Electrical and Electronic Engineering (IEEE) of the 802.11b standard protocol for 11 Mbps wireless connectivity and interoperability has opened the door for all wireless devices to become full citizens of the enterprise network. The new standard raises the data transmission rate to 11 Mbps, comparable to a 10baseT wired Ethernet network.

Even more significant is the availability of 11 Mbps radio cards at a street price of less than \$200. These facts have fueled an unprecedented boom in wireless networking, whetting people's appetites for mobile wireless data communication, and broadening a business model that now accommodates the needs of the mobile worker.

The rate of major technological leaps in wireless networking is tremendous compared to wired networking products. A key buying requirement in choosing a wireless provider is a clear forward and backward technology migration strategy that will protect your infrastructure investment and accommodate future leaps in technology to keep pace with changing business needs.



BENEFITS OF WIRELESS NETWORKING

Wireless networking allows for the acquisition and presentation of information at its source with a portable, mobile client device, communicating remotely with a host server. When data is collected where it is generated, the velocity and validity of the information increases. Movements of inventory that are communicated to a Warehouse Management System through a wireless network are available in real time, creating a real advantage. Timely handling of information leads to higher financial returns, decreases the need for buffers (both inventory and manual buffers), and provides more agility in the marketplace. If wireless networks have many important advantages over traditional wired networks, why has their adoption been slow?

Perhaps more than anything, there is one simple reason. Prior to the IEEE 802.11b standard, the fastest wireless data transmission speed that could be achieved was 2 Mbps. For many mission-critical business applications, this was unacceptably low. The new standards have raised data transmission rates to 11 Mbps, opening up a world of possibilities, even the accommodation of voice into the network.

There are four major reasons making the selection of wireless networking a compelling choice. By nature, wireless networks offer the flexibility required in a temporary or ever-expanding location; they can be rapidly deployed; they allow for the support of mobile personnel in or out of the office or warehouse; and finally, they are cost effective.

Flexibility

In the case of historical buildings or outdoor environments, traditional cabling is often not possible or is cost-prohibitive. Consequently wireless networking is the only option. Wired networks require the installation of miles and miles of wire, resulting in permanent portals to the system, limiting the flexibility of the user population. Any reconfiguration of the space, as in the case of company growth or assembly line changes, requires the reconfiguration of network wiring – a costly and time consuming proposition.

As technology improves providing faster data rates, as is the case with 100baseTX Ethernet replacing 10baseT, companies face a costly migration path for their wired networks. However, simply replacing a radio card in a hand-held device or access point is a far less expensive alternative to keep pace with technological change and speed.

Wireless can also be a natural complement to wired networking, if the full migration to a wireless network is not the goal or is not possible.

Rapid Deployment

Wireless technology is developing faster than companies can track. Flexibility and the ability to upgrade to new technologies as they develop are paramount to today's business success. Choosing a wireless provider that protects the original investment and enables migration to updated technology is critical.

A wireless networking environment gives a company the agility to change almost instantly. The substitution of a PC card and possibly the installation of a new access point could be accomplished in less than an hour. In a wireless environment, new devices can be connected at any time or place without the cost and delay of installing new cabling and conduit. Not so in a wired network where the complexity of the task could range from days to weeks, resulting in a loss of productivity.

Mobility

Most companies have made a substantial investment in mobile client devices, such as laptop computers, cellular phones and personal digital assistants (PDAs). Within the confines of a wired network, mobile devices cannot take full advantage of real time data on the network unless the device is tethered to the system in some way.

Furthermore, mobile devices have changed how we do business. Wireless networks let businesses capture data at the source, increasing the business's ability to react to it efficiently and enhancing its service to customers. For example, a car rental agency could inspect returned vehicles and take payment over the wireless LAN, leaving customers free to get on the airport shuttle and make their flight. Customers no longer have to wait in an office or in line to pay their bill. The ability to provide increased levels of customer service through the provision of real-time, accurate information and customized service levels has emerged as a real competitive advantage to companies that have deployed wireless networks.

Several Intermecc wireless customers have issued mandates to have their offices go totally wireless in the next few years. This will increase the flexibility of their staff to form small workgroups quickly and rearrange those groups in reaction to new initiatives. The ability to cost-effectively outfit users with wireless laptops gives a strategic advantage to companies in all competitive markets.

Cost Effectiveness

When considering the advantages highlighted above, it is easy to see how wireless networks are remarkably cost-effective. If change is the only constant in today's business environment, then agility and flexibility are demanded of a network system. A clear migration path to future technology, without incurring a huge expense, is a must to remain competitive. The interoperability afforded by the 802.11b standard, coupled with the increased data speed of 11 Mbps, makes wireless networking an obvious choice.

KEY CONSIDERATIONS FOR ANY WIRELESS PURCHASE

Interoperability

Interoperability assures you of backward compatibility with the existing equipment you already own, as well as a future migration path to the new technology you are bound to purchase. Despite the wide acceptance of 802.11b, not all vendors are interoperable. Although stated compliance with the 802.11 standard assures interoperability, any attempt at combining systems or devices that operate with proprietary technology with those that do not will result in the sacrifice of data transmission speed. This will become even more of an issue when 802.11a products are rolled out in the summer of 2001.



A good starting point in determining interoperability is membership in the Wireless Ethernet Compatibility Alliance (WECA), a non-profit organization formed in 1999 to certify the interoperability of 802.11b High Rate products. However, membership in WECA alone is no determination of passing interoperability testing. Only after products have successfully completed all phases of interoperability testing are vendors permitted to use the Wi-Fi Interoperability certification and logo for a specific product. Intermec was among the first to earn this certification for its 2101 Access Point.

The Wi-Fi logo is a clear indicator that a wireless product will work with any other certified product, without modification. In other words, they offer true interoperability. All Wi-Fi certified products, such as the Intermec 2100, 2101 and 2102 Access Points, support a data transmission rate of 11 Mbps. By combining Wi-Fi certified devices with non-certified devices that use Direct Sequence radio technology, your wireless system can still deliver data transmission rates of 11 Mbps. Additional information about Wi-Fi certification can be found at <http://www.wi-fi.com>.

The Importance of the Wireless Backbone

Most vendors will emphasize a particular aspect of a wireless solution as the most critical component to consider, such as the hand-held data collection terminal, or the technology of the radio cards. The most important thing to consider is that as network topology changes, the wireless system and devices you purchase today should support new networking requirements of the future without incurring huge expenses to manage the transition.

A wireless system is only as good as its backbone. In other words, achieving optimal transmission rates and coverage depend more on the quality and installation of the backbone than any other component. A good wireless backbone should be reliable, easy to install and administer, and scalable. It is the crucial component to not only future migration, but also good radio coverage and optimal data throughput.

The backbone is made up of the local area network (LAN), or the wired component of the system, and the access point(s). Ideally, a wireless network should be invisible (or transparent) from an IT management perspective. In other words, your wireless system should be seamless to the existing wired system and should not require any additional expertise to manage.

Site Surveys and Signal Strength

If you've ever experienced bad reception on a car radio when you pass by a building or through a deep valley, you can appreciate the importance of setting up antennas to provide all users with a strong signal. Wireless data transmissions are no exception. Unlike a wired network, a successful wireless network depends greatly on the accuracy of the site survey and the expertise and experience of the company doing the installation. If the access points are not appropriately placed and the correct antennas accurately positioned relative to environmental obstructions or competing radio signals, then bad coverage and inadequate data throughput can occur. The best insurance against transmission problems is to seek a vendor who can provide references to a substantial number of site surveys and installations within your industry.

Antenna Technology

The antenna should not be disregarded as a minor component in an overall wireless network purchase. Extensive understanding of antenna technology on the part of the wireless vendor can make a difference in not only the overall performance of the wireless system, but also the cost. It can mean the difference between meeting your specific needs in the most cost effective manner possible or incurring added costs from installing more access points than are truly necessary.

The appropriate antenna should be selected based upon several important aspects including regulatory requirements, size and shape of the area requiring coverage, antenna mounting options and aesthetics.

Dual Radio Technology

Most 802.11b radio cards come in a PC card form factor, so they can be easily swapped out of client devices or access points. This can be a selling point if you are planning to upgrade your wireless system in the future to higher speeds such as the 802.11a standard. However, upgrading an access point with a single data radio requires you to upgrade ALL clients on the wireless system at the same time. Not only does this mean huge capital investment, it also requires a potentially lengthy shut down period.

Intermec is the only LAN manufacturer with a patent for dual radio access points. This innovative design lets you operate different radio technologies simultaneously, allowing a phased approach to upgrades and built-in support for legacy devices. This allows you to upgrade your access points to the latest technology while continuing to leverage your existing investment and to upgrade on your timetable.

Dual radio access points provide another important advantage: the ability to segment voice and data traffic. It is important to note that the 802.11 standard requires a radio to operate at the speed of the lowest device on the wireless system. This means, for example, that if you have a phone operating at 2 Mbps on your 11 Mbps wireless LAN that you have in effect throttled both your wireless voice and data traffic to 2 Mbps. With Intermec's dual radio solution, you can dedicate one radio to voice traffic and one to data thereby allowing each to operate at optimum speeds.

Voice Over IP

In a business world filled with multi-media information, real-time data means voice and images, not just numbers and letters. Furthermore, most business information is becoming digital. Voice, images and data are all converging onto a single network operating on IP (Internet Protocol). To offer a complete communications solution, networking companies need to provide technology that can seamlessly merge voice over a single system. This technology is known as Voice over Internet Protocol (VoIP). Just like data packets sent over a network, voice packets are taking similar routes over the same network, utilizing the common protocol used for the Internet.

Since a wireless network is merely an extension of the wired network, mobile users, too, are demanding the same connectivity for real-time voice as data collection for increased efficiency and productivity.

PAN/LAN/WAN

The emergence of Personal Area Network (PAN) technologies has begun to blur the once distinct lines between local area and wide area networks (WAN). PANs not only connect LANs and WANs, they also enable devices not necessarily tied to a specific network.

Bluetooth—the device and software manufacturers' consortium for short-range wireless communications, has prompted a flurry of activity in the personal communications market. Initially, Bluetooth technology was thought of as mostly a cable replacement for notebook computers, cell phones and PDAs. As more big-name technology manufacturers got involved in the consortium, the applications for Bluetooth-enabled products exploded. See <http://www.bluetooth.org> for additional information.

PAN relationship to LAN

Personal area network devices, or PANs, operate in the LAN space as pure cable replacements. For example, in the case of a rental car worker processing returned vehicles, the worker's portable printer will be connected to their personal digital assistant (PDA) via a wireless link as opposed to a cable, thus creating a PAN. The PDA, however, communicates with the main network using an 802.11 radio within a LAN. In this case, the PAN devices, such as the printer, must not interfere with the operation of the PDA's communications with the LAN. Since Bluetooth's primary benefit to the device manufacturer is low cost we will see a great many Bluetooth enabled devices being sold worldwide. Therefore, we will see a lot of these products operating in the confines of a LAN.

PAN relationship to WAN

PANs can also adopt more of a local area network role when the LAN is very small and mobile. For example, a truck driver may carry a PDA, a scanner, and a printer that all need to communicate with one another. This is accomplished through a PAN. Communications to the host computer from the PDA travel via a wide area network (WAN) and require that the PDA device be placed in a docking station. However, the same PAN used by the scanner and the printer to communicate with each other can also be used to communicate to the docking station. In this case not only is the PAN serving as a cable replacement for the printer and the scanner, but it is also acting as a LAN communicating with the on-board docking station in the truck. The docking station still operates within the WAN to communicate with the host.



Security

Neither the walls of your company, nor the firewalls of your network can prevent the theft or sabotage of data on the wireless network. Wireless networks have become another point of entry into a wired network and require protection.

Wired Equivalent Privacy or WEP 128, part of the 802.11b standard, is a 128-bit encryption code and a necessary part of any IT manager's wireless security arsenal. WEP offers data encryption on the wireless network. The user must have an authorized security key to have access to data on the network. This gives a necessary level of security on the wireless network that is comparable to a wired network.

The Intermec MobileVoice™ Wireless Telephone System (WTS) allows telecommunications and IT managers to simplify their wireless infrastructure by combining voice and data traffic over the same network, as well as leveraging their existing investments in 802.11b WLAN and digital PBX technology.

MobileVoice is an IEEE 802.11b standards-based wireless LAN telephone system consisting of three components: wireless access points, wireless telephones and telephony PBX gateways. MobileVoice wireless telephones operate as clients on the wireless LAN along with other mobile 802.11b devices. Access points within the WLAN receive IP voice packets from the telephones and forward them to the MobileVoice Telephony Gateway over the Ethernet LAN. The Telephony Gateway connects to the host telephone switch (PBX) using digital or analog line interfaces. This connection allows the wireless telephones to enjoy the full features of PBX wired counterparts, such as voicemail, caller identification and multiple lines.

Routers and Switches

One of the most important features of a wireless network is the ability for mobile devices to roam the confines of the LAN without interrupted connections to the network. Successful roaming depends on the wireless network's ability to integrate with the routers and switches located on the wired network.

The main function of a router is to keep network traffic at a manageable level, ideally five percent of network capacity. By dividing the network into subnets, routers segment data thus controlling the flow. Routers can act as filters to the data as well.

The capabilities of a router are configurable so their function can be customized to the network's demands. Switches are responsible for segmenting data to various ports, acting as subnets within the network. Because switches are most directly affected when mobile devices roam the network, they are the "trouble spot" with regard to maintaining a consistent connection. A mobile user can be "dropped" from the network if the switch cannot "keep up" with the roaming of the mobile user.

Intermec solves this problem through the use of IP Tunneling technology, which creates tunnels of communication between access points. The software architecture of the Intermec Access Points enables mobile clients to roam transparently to the switch. Network connections are maintained and optimal service levels are achieved.

IP Tunneling vs. Mobile IP

A key demand of mobile workers is to maintain their network connection as they roam from building to building (or floor to floor). In order to accomplish this, enterprise wireless networks need backbones that can track mobile users throughout an enterprise.

One method to support wireless is simply to create a separate sub-network within the existing LAN, where all wireless access points are wired back to a single hub. This simplifies administration, but requires extra cabling costs. Rather than creating a physical subnet for wireless devices, suppliers offer systems that create virtual subnets to track users. The two most popular solutions to this need are Mobile IP and IP Tunneling.

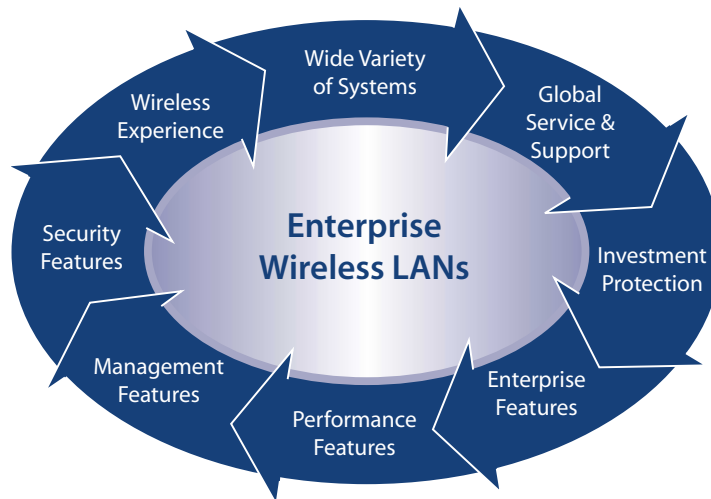
While Mobile IP is widely used, there are some important drawbacks to consider. First, Mobile IP relies on dedicated servers to maintain tables of remote and mobile clients. The "anticipated" location of each mobile client must be manually entered into the system by an administrator. This is a tedious process. Mobile IP requires

software to be loaded on all the end-devices that support IP within the wireless network, which means that licenses must be purchased for each end device. Further, if a client roams outside its pre-assigned "territory" of defined subnets, the Mobile IP server will drop the network connection, forcing the client to re-boot to reestablish a link.

Finally, Mobile IP servers represent a single point of failure in a network. If the Mobile IP server fails, NO mobile client will be able to roam. Intermec has "smart" wireless access points that automatically track mobile clients without the administrative burden or the single point of failure associated with Mobile IP. Intermec's IP Tunneling support provides robust, seamless connections for all mobile devices. Most important: these solutions will work with any IP-based client and do not require any client-side modifications. Essentially, any client that attaches to an Intermec Access Point will have the capability of roaming across subnets.

SUMMARY

The Intermec Wireless LAN Solution



When selecting a vendor for wireless networking, look for a partner with extensive experience in wireless networking, strong global services and support capabilities, and a product strategy that is technology leading and customer focused.

Intermec is a full system and solution provider for wireless networking technology. Intermec's products are based on more than 30 years of industry leadership in managing supply chain information and wireless technologies. The company developed the first wireless data collection network and has more than 250,000 wireless and 500,000 wired terminals installed to date. Among these is the ultimate "mission-critical" network, and world's largest wireless LAN, NASA's Kennedy Space Center, covering 47 square miles.

Intermec leads the way in the establishment of 802.11 standards and was among the first companies to receive Wi-Fi certification for wireless LAN interoperability. The company now has the largest and most diverse product family of Access Points and end devices that are Wi-Fi certified on the market today. Other Intermec achievements include the first spread spectrum RF data collection technology approved for sale by the FCC, the first 2.4 GHz data collection technology, and the first and only patented multi-radio access point. Intermec equipment is certified and approved by more enterprise resource planning (ERP) and warehouse management system (WMS) providers than the products of any other data collection vendor.

Intermec has the proven expertise of applying the technology of wireless networks to supply chain applications. For more information on Wireless Networks visit the Intermec web site at: <http://www.intermec.com>, the WiFi web site at: <http://www.wi-fi.org>, and the Bluetooth web site at <http://www.bluetooth.org>.

When selecting a vendor for wireless networking, look for a partner with extensive experience in wireless networking, strong global services and support capabilities, and a product strategy that is technology leading and customer focused.

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BUYING CONSIDERATIONS CHECKLIST

- **Interoperability**
 - Backward compatible
 - 802.11 compliant
 - Wi-Fi certified
- **Wireless Backbone**
 - Reliable
 - Easily manageable
 - Scalable
 - Offers ubiquitous coverage
 - Provides optimal data throughput
 - Allows for roaming across subnets
 - Accommodates VoIP
 - Provides secured networking
- **Antenna Technology**
 - Meets regulatory requirements
 - Accommodates size and shape of coverage area
 - Provides mounting options to suit needs
- **Radio Technology**
 - Offers dual radio technology
 - Segments voice and data traffic



**The Standard for
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