Roadblocks to Wide Acceptance of Wireless Technologies

by Barbara J. Moore, User Technology Associates

Just like the FAX; Wireless LAN technology has been around much longer than the current surge of interest in it suggests. As usual the economic factors of business and industry can let a technology languish or push it quickly to the forefront. In this era of changing corporate structures, international competition, and tight budgets; companies are forced to configure and reconfigure their information processing infra-structure quickly and at an affordable cost. Wireless LANs are able to meet these challenges as no 'wired' network can.

Wireless technology comes in several forms; infra-red, carrier current, and "radio" transmissions. Some common characteristics of these forms which have recently brought wireless technology into the limelight are flexibility, cost savings during reconfiguration, and mobility. We are seeing wireless emerge from the laboratories and enter the production environment. It is rapidly losing its status as a novelty or icon of the future and becoming a potential staple in the toolkit of network designers. Forrester Research Inc. projects the number of wireless networking users to exceed 2 million by 1997.

How far has wireless technology come? New products and applications are appearing in trade journals of many types and case studies of businesses with wireless implementations are available. Several products are on the market, with many more in the planning phase; nearly a dozen committees are meeting worldwide to discuss wireless technology, flyers appear regularly in mailboxes touting conferences on the subject; and at least one magazine has been devoted to the topic. However, many roadblocks to widespread implementation still exist. What are these roadblocks? The obstacles come in many forms and are broad ranging.

Major obstacles include:

- Limited product base
- Small user base
- Insufficient compatibility
- Lack of defined standards
- Lack of a trained integrator base
- Misperceptions and lack of understanding of the technology by designers, integrators, and end users.
- Insufficient exposure of the technology
- Scarcity of benchmarks to test performance
- Dearth of guidelines on when and how to best use wireless
- Myriad special interest groups with little intergroup coordination.
- Frequency allocations still being determined
- Product documentation deficiencies
- Unsolved problems related to mobile, wireless communications (i.e. mobile addressing)

How can these obstacles be overcome?

The limited product base is a problem that the vendors are overcoming by seeing

the potential of this technology and striving to be competitive in this market. A myriad of types of wireless products have sprung up with more uses on the horizon. Figure 1 lists some of the wireless products which have already hit the market.

Product types	
Ethernet cards	Wireless modems
Antenna (building to building)	Printer sharing
Bridges	Wireless POS
Data entry units	Cellular modems
Pagers	

Figure 1. Wireless Product Types

However, vendors are held back by other factors in a catch-22 cycle at times. There are significant regulatory issues involved especially for radio frequency based equipment. Obtaining FCC approval can be time consuming and costly. Small companies may have innovative ideas but may not have the resources to develop a product which may not get to the market for some time while awaiting FCC approval. Another catch-22 for developers of leading edge technology involves the limited customer base. In general, the customer base for new technology grows over time as the products mature. Ironically growth of the customer base itself fuels further growth of the customer base. For example, users in the marginal markets may gain confidence in a technology by seeing others show confidence in it. This means that while the early developers may get a jump on the market, they have to spend much more time and effort coaxing each early customer into the sale.

Three interoperability issues must be resolved for wireless technology to flourish.

Compatibility with:

- With wired networks
- With other wireless networks
- With other components (hardware and software)

Insufficient product compatibility issues will fall by the wayside as wireless becomes a more cost feasible product line. Most manufacturers are already making their products compatible with those existing elements that they anticipate to be most frequently used in conjunction with their own product niche. For example, the NCR Wavelan®[1] card is compatible with Novell Netware. Many multi-company agreements are currently being formed to provide at least pockets of integration. These include agreements such as between RAM Mobile Data and Lotus to provide a wireless version of cc:Mail, and with Novell to develop a wireless TCP/IP driver. Simware Inc. has announced wireless access to IBM PROFS and Office Vision e-mail. Radio Mail Corporation has teamed with RAM Mobile Data and HP to provide two way wireless messaging over the Mobitex network using palmtop PC's. Currently, there are no third party vendors making niche products to fill the compatibility gaps but this too will come.

Once wireless products are developed that are compatible, cost competitive, and easy to implement; there are problems finding the technical staff to implement them. Marketing by product developers as well as other forms of publicity and education about the technology such as conferences, seminars and articles help spread understanding quickly to technical staff. In most cases, knowledge of a new technology alone will not prompt usage of it. However, this knowledge of the technology's capabilities combined with an understanding of the benefits and economic feasibility will make wireless an option for technical staff when they are faced with potential applications.

This increasing usage in designs will lead to larger pools of end users who have a general understanding of the technology. Word of mouth spread by satisfied users will further increase demand. This elevated exposure causes further expansion of the viability of the technology and spurs additional product development to restart the cycle.

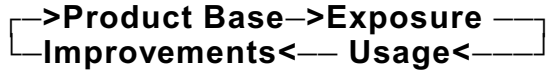

Figure 2. Emerging Technology Cycle

Problems within this cycle include a scarcity of good guidelines regarding when and where to use wireless technology. Figure 3 identifies some of the prime applications of wireless technology.

This, along with misperceptions and lack of understanding of the technology by designers, integrators, and end users also slows acceptance of wireless.

There is also a scarcity of benchmarks available to test performance. In this era of Total Quality Management, benchmarks and other measurements of performance play a role in acceptance of technology as never before.

In addition to the standard measurements such as throughput some additional measurements and benchmarks should be identified.

- Are there performance bottlenecks in wireless to wired transition points
- How does weather affect outdoor implementations
- What ranges of noise etc. cause interference
- Are there restrictions such as distance in multiple wireless LANs in a limited area
- Frequency overlaps
- Spectrum overlaps
- In carrier current implementations what are the effects / restrictions of Transformers in Carrier Current Circuits

There are still many technical issues which must be resolved before wireless is accepted widely. The key issue is the lack of standards for the technology. Some integrators feel this is less of a problem since so many of the major wireless product developers are filling key roles on the standards and other special interest committees.

These integrators believe the products will mature along with the standards so an early investment in the technology will be upgradeable. Figure 4. identifies a few of the groups working on or influencing wireless standards.

Prime Uses for Wireless LAN Technology	
●	Temporary sites Temporary offices Conferences Meetings Short term projects
●	Frequently changing configurations
●	Local mobile computers Computer on a cart for presentations Factory floor automation Hand held inventory modules Stock market floors
●	Hard to wire buildings Sites with asbestos problems Sites with marble etc walls, historic sites Sites with no dropped ceiling or raised floor for cable runs Rented/leased sites that can not be altered
●	Inter-building connections Especially where no conduit or underground cabling is available Wireless can go over roads etc without rewiring Useful for connecting branch offices within a city
●	When flexibility is needed
●	Mobile Computing Transportation industry ● Trains ● Trucks ● Delivery services ● Cabs Field service technicians Sales representatives People traveling on business
●	Combined pager / telephone / data services

Figure 3. Primary Applications of Wireless Technology

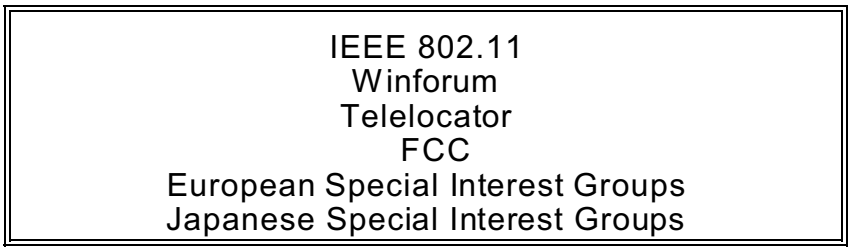

Figure 4. Organization Influencing Wireless Standards

Others fear the myriad special interest groups involved in developing standards have too little intergroup coordination and may come up with vastly different real and de-facto standards which could cause total obsolescence of early designs and purchases of equipment.

This may be especially true in the case of frequency allocation for radio based wireless equipment. The Frequency allocations are still being determined - sometimes in fierce conflicts between special interest groups and the FCC.

Licensing of allocated frequencies is another area being handled differently by different vendors. Currently Motorola obtains a license from the FCC for users of its product and maintains the license, however if the customer decides to move its product to another city, the license must be changed by Motorola to accommodate it. Other manufacturers have chosen unlicensed bandwidths to avoid this problem. They may, however, run into frequency competition due to the number of users of wireless and other technologies within these same frequencies. Competition and possible interference is dramatically reduced in frequencies where licensing is used to control the number and proximity of users of the same frequency.

A more mundane issue is deficiencies in product documentation. An omitted step in one manual caused engineers to have to make dozens of attempts to find the correct switch settings in one prototype network installation. In a production environment, many designers would have given up on the product and replaced it with a more common or better documented unit. Deficient documentation can be the downfall of an otherwise excellent product. Good documentation is even more important in an emerging technology where few people can reply upon their experience.

Unsolved problems related to mobile wireless communications (i.e. mobile addressing) are being researched but should not hold back the use of wireless in the more traditional stationary network use.

End user concerns over safety and reliability and misperceptions must be dealt with. Safety concerns impact each of the three major technologies. With the recent scares over the safety of cellular telephones, users fear radiation from radio based systems, eye damage from infrared systems, and the potential of electrical shock from carrier current systems.

The lack of wires was found to disturb users in one test. Users initially perceived an unreliability in wireless networks. As the test progressed, users' confidence in the wireless networks increased to match their confidence in the wired networks. Another manifestation of the mistrust of the lack of wires was users' firm belief that line of sight was required for radio transmissions. Even though omni-directional antennas were in place users tended to stand and aim the antennae at the intended recipient.

User satisfaction varied based upon the user's background. Users who previously had no network connection but previous network experience consistently rated wireless performance fast and perceived it to be as fast as or faster than a wired network, while users with no network connection and no previous experience rated the wireless network as slow to average. Among those users who were switched from a wired network connection to a wireless one, those who were reluctant to be switched rated the wireless system slow; those who were neutral or enthusiastic about switch rated wireless performance as good or better than wired connection.

Summary

Like all emerging technologies, wireless networks are faced with many catch-22 situations. Such as the more products available, the more people are exposed to the technology, the more they use the products which leads to more product development. However, there are always some innovative companies ready to design products for an untried market; technical leaders willing to make the sacrifices of time and energy to work on the committees, conferences, and seminars; and designers and users looking for a better way to handle an application. Wireless technologies will emerge as a standard option for handling various situations. The speed at which it emerges will depend on how the industry is able to overcome the many roadblocks in the path. How these roadblocks are handled will ultimately determine the flavor and viability of wireless networks.

Barbara J. Moore is the Dayton Site Manager for User Technology Associates. She also owns Lida Ray Technologies which provides risk management consulting and handles computerization needs of businesses. She has helped both commercial and government offices improve their information security. Ms. Moore serves as Vice Chair for the Dayton Section IEEE Computer Society, as Program Chair for the IEEE International Conference on Wireless Lan Implementation, and is active in other professional organizations. She contributes articles frequently to technical publications. Ms. Moore is listed in "Who's Who in Science and Industry" and in "Who's Who in the World".

1. Wavelan is a registered trademark of NCR Corporation.

Roadblocks to Wide Acceptance of Wireless Technologies

by Barbara J. Moore, User Technology Associates

Just like the FAX; Wireless LAN technology has been around much longer than the current surge of interest in it suggests. As usual the economic factors of business and industry can let a technology languish or push it quickly to the forefront. In this era of changing corporate structures, international competition, and tight budgets; companies are forced to configure and reconfigure their information processing infra-structure quickly and at an affordable cost. Wireless LANs are able to meet these challenges as no 'wired' network can.

Wireless technology comes in several forms; infra-red, carrier current, and "radio" transmissions. Some common characteristics of these forms which have recently brought wireless technology into the limelight are flexibility, cost savings during reconfiguration, and mobility. We are seeing wireless emerge from the laboratories and enter the production environment. It is rapidly losing its status as a novelty or icon of the future and becoming a potential staple in the toolkit of network designers. Forrester Research Inc. projects the number of wireless networking users to exceed 2 million by 1997.

How far has wireless technology come? New products and applications are appearing in trade journals of many types and case studies of businesses with wireless implementations are available. Several products are on the market, with many more in the planning phase; nearly a dozen committees are meeting worldwide to discuss wireless technology, flyers appear regularly in mailboxes touting conferences on the subject; and at least one magazine has been devoted to the topic. However, many roadblocks to widespread implementation still exist. What are these roadblocks? The obstacles come in many forms and are broad ranging.

Major obstacles include:

- Limited product base
- Small user base
- Insufficient compatibility
- Lack of defined standards
- Lack of a trained integrator base
- Misperceptions and lack of understanding of the technology by designers, integrators, and end users.
- Insufficient exposure of the technology
- Scarcity of benchmarks to test performance
- Dearth of guidelines on when and how to best use wireless
- Myriad special interest groups with little intergroup coordination.
- Frequency allocations still being determined
- Product documentation deficiencies
- Unsolved problems related to mobile, wireless communications (i.e. mobile addressing)

How can these obstacles be overcome?

The limited product base is a problem that the vendors are overcoming by seeing