

# WLAN: Trends And Analysis

Aaron Vance

**WLANs are one of the few technology bright spots. They're selling well, stimulating improved products and new applications**

There hasn't been much that's been positive during the past two years in the networking industry, but one notable exception is the 802.11 Wireless Local Area Network (WLAN) or Wi-Fi market. Our research shows that the overall WLAN market grew more than 200 percent from 2000 to 2002, and will continue to grow at a compound annual growth rate of 23 percent over the next five years.

Although most of this growth will continue in the small office/home office (SOHO) and home market, the enterprise WLAN market is poised for substantial growth (Figures 1 and 2). Our optimism stems in part from the promise of new 802.11 technologies, notably the 802.11g standards due to be finalized midyear, but also from improved price/performance of WLAN systems and the growing availability of wireless LAN

solutions that consolidate voice, data and mobility functions.

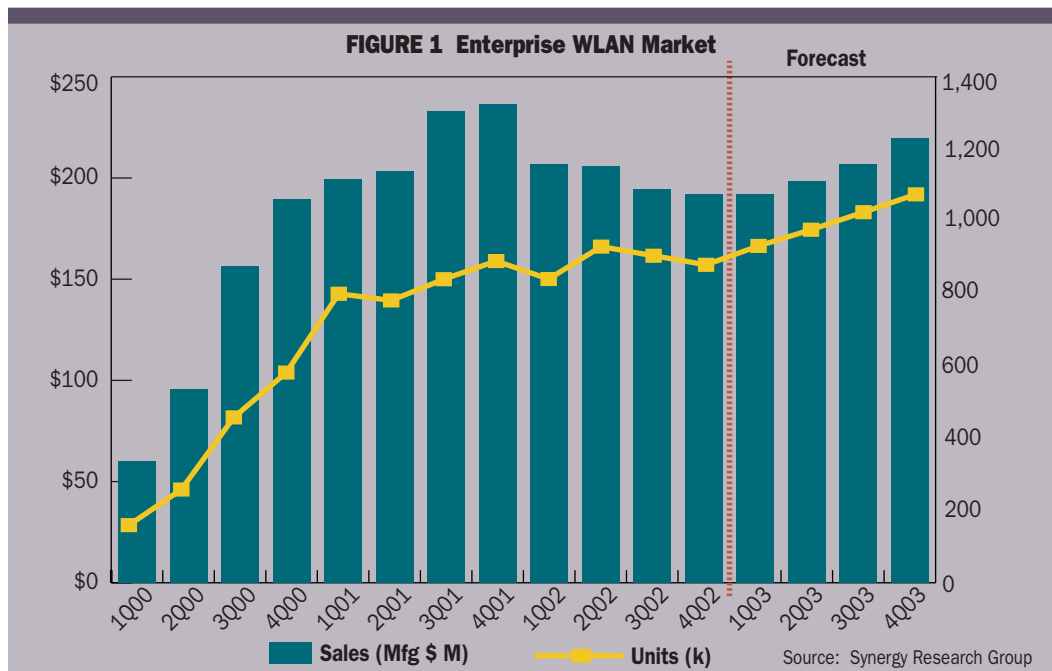
Another positive WLAN bellwether is Intel's recent announcement of the Centrino Mobile Platform, which should stimulate the WLAN industry, especially the enterprise market. This platform includes built-in Wi-Fi technology and extra-long battery life support. As users of Centrino laptops, PDAs, Pocket PCs, phones and other mobile devices come to regard wireless access and mobility as ordinary functions, they will want these benefits at work and at home.

Other roadblocks to widespread enterprise adoption of WLANs are also coming down as security issues are resolved, product lines are fleshed out and individuals get more familiar with the technology—especially at home. Even Cisco has bought into the booming SOHO/home wireless market (see "Cisco + Linksys = WLAN King?" p. 45).

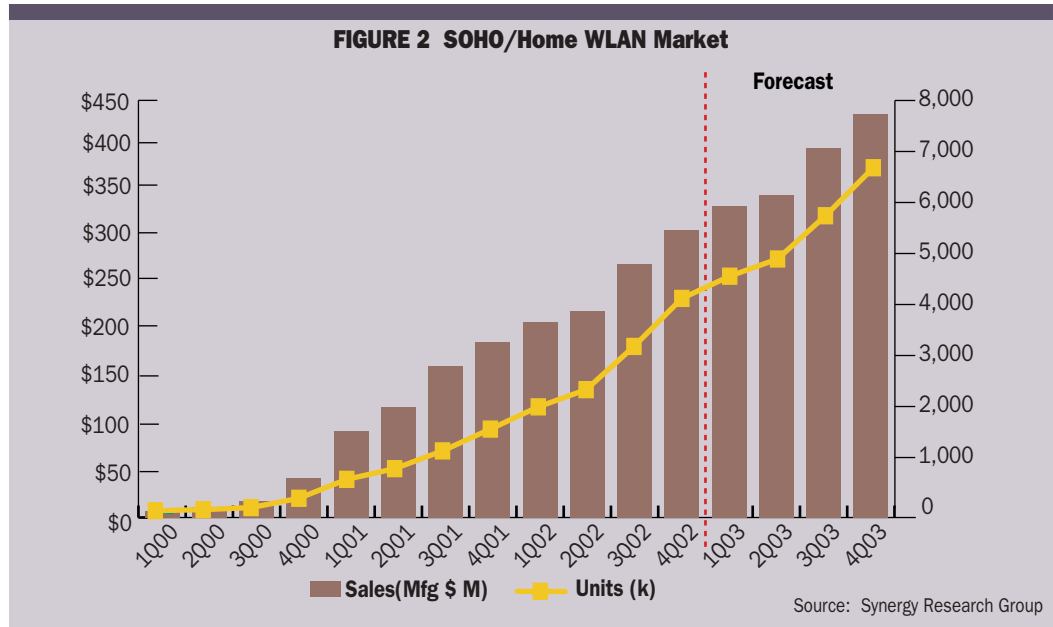
## Bigger Hit At Home Than At Work

Enterprise customers may be taking their time evaluating WLANs as office replacements for wired LANs, but consumers have been bringing home millions of Wi-Fi access points and laptop cards to share access to high-speed Internet connections, files, printers and other peripherals. It

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**Security's improving, but management is still tough**



helps that prices are low (around \$150), and that the technology is easy to implement.

In contrast, most enterprise CIOs and IT managers are just beginning to consider wireless, and they still have concerns. Until recently, security was at the top of this list. However, recent advances in standards, such as 802.1x and Wi-Fi Protected Access (WPA), coupled with new WLAN architectures that perform a variety of Layer 1–3 security schemes, have helped to alleviate many of these concerns (also see *BCR*, March, 2003, pp. 48–52.).

Beyond security, IT managers will face another challenge—*management*. Few network and IT specialists have much experience with Radio Frequency (RF) technology. They may have no problem setting up their own home Wi-Fi installations, but designing an access point coverage plan for an entire floor or building is much more complex.

For all their convenience, WLANs aren't easy to deploy or manage (see *BCR*, August, 2002, pp. 30–34). Nonetheless, the vendors shown in Figure 3 are developing new technologies, devices and architectures that alleviate the pains of deployment and day-to-day management by centralizing intelligence and control of the wireless network rather than pushing it out to the edge.

### 802.11 Gee-Whiz

In terms of new technology, Wi-Fi choices will expand in June or July with IEEE ratification of the 802.11g standard, the long-awaited, heavily-debated WLAN technology that extends WLAN data rates for 2.4-GHz systems to a theoretical maximum of 54 Mbps. Pre-standard 802.11g products are already available from some SOHO/home vendors (Figure 4), including Linksys (now Cisco), Buffalo, D-Link and Netgear, although all of these will require some

firmware or software upgrade to interoperate with the 802.11g standard products.

Backwards compatibility of 802.11g with 802.11b is assured, because 802.11g will use the same 2.4 GHz frequency and will include the complementary code keying (CCK) used in 802.11b as one of its two mandatory packet formats. This will allow new 802.11g access points (APs) and clients to “speak” the 802.11b format to older Wi-Fi APs and clients. In fact, in a mixed 802.11b and 802.11g environment, “g” clients are limited to the slower “b” speeds. When 802.11g APs and clients talk to each other, and no “b” clients are on the air, they can go faster (20–54 Mbps) by using the other mandatory format, orthogonal frequency division multiplexing (OFDM).

Two optional packet formats, shown in Figure 5, are included in the 802.11g specifications, but many industry experts doubt they will be widely implemented. One of these, however, CCK/OFDM, seems like an excellent idea. By using CCK for the preamble/header, legacy Wi-Fi devices are alerted that a transmission is beginning and how long that transmission will be; then the payload is transmitted at the higher rate with OFDM. This solves the “hidden node” problem—i.e., 802.11b devices can't detect OFDM packets.

The other optional packet format, CCK/PCBB, uses Texas Instruments' packet binary convolutional coding (PBCC), a more complex and slower mechanism, with a maximum data transfer rate of 33 Mbps.

Neither 802.11b nor 802.11g are compatible with the other Wi-Fi technology, 802.11a, which uses the much cleaner 5GHz spectrum. This allows 802.11a to support more channels, more capacity and with less likelihood of interference from other wireless devices than in the much-utilized 2.4GHz spectrum used by 802.11b and 802.11g. Adding to

the confusion is the fact that both 802.11a and 802.11g promise a maximum 54-Mbps throughput.

Until the 802.11g standard is ratified this summer, and the Wi-Fi Alliance completes its interoperability testing later this year, customers will have to tread cautiously. Pre-standard 802.11g devices may not interoperate with one another and experts have already voiced concerns that 802.11g

and 802.11b devices won't work together properly. They say the "hidden node" problem could cause 802.11g clients to be prioritized ahead of 802.11b clients and may even prevent 802.11b clients from accessing the wireless network in a crowded environment.

Given the installed base of about 25 million 802.11b devices, these are legitimate concerns that could stunt the adoption of next gen Wi-Fi



**callout**

## Cisco + Linksys = WLAN King?

In March, Cisco announced it had agreed to acquire Linksys, the market leader for consumer networking equipment, for \$500 million in common stock. This acquisition vaults Cisco into the top spot in both the low and high ends of the market (for more of the Cisco-Linksys deal, see this issue, pp. 8–9).

Linksys will operate as a division of Cisco, and its products will continue to be sold under the Linksys brand through its existing retail, distributor and ecommerce channels. This is a much different, albeit a wise, strategy for Cisco in that they will be catering to a market with which they have no experience or success. Linksys, on the other hand, has been extremely successful at the low end with consumer channel relationships and the business savvy to succeed in such a price-sensitive environment. Linksys also has one of the most extensive product lines in home networking.

Cisco's acquisition of Linksys was strategic from a number of different perspectives. First, the U.S. consumer broadband market is nearing a point of inflection. Access equipment is readily available, prices are dropping and subscriber levels are growing. What's more, the ability to share high-speed Internet access is

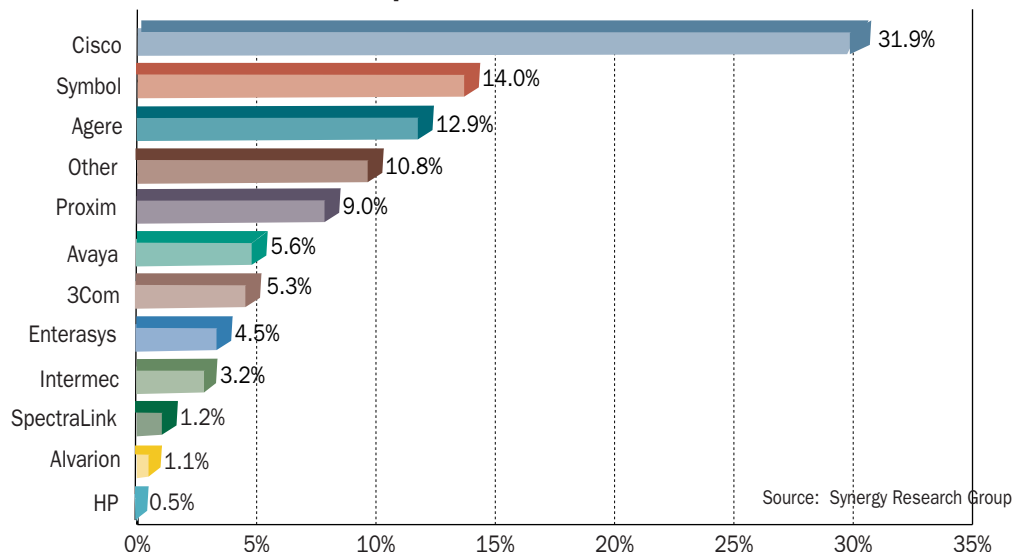
the number-one home networking application. By buying the leading home networking vendor, Cisco ideally positions itself to capitalize on these trends.

Second, nearly all (98 percent) of Linksys' business is domestic; they have been able to dominate the low end of the market with almost no international sales channels. Cisco will use its international relationships to grow the Linksys business globally.

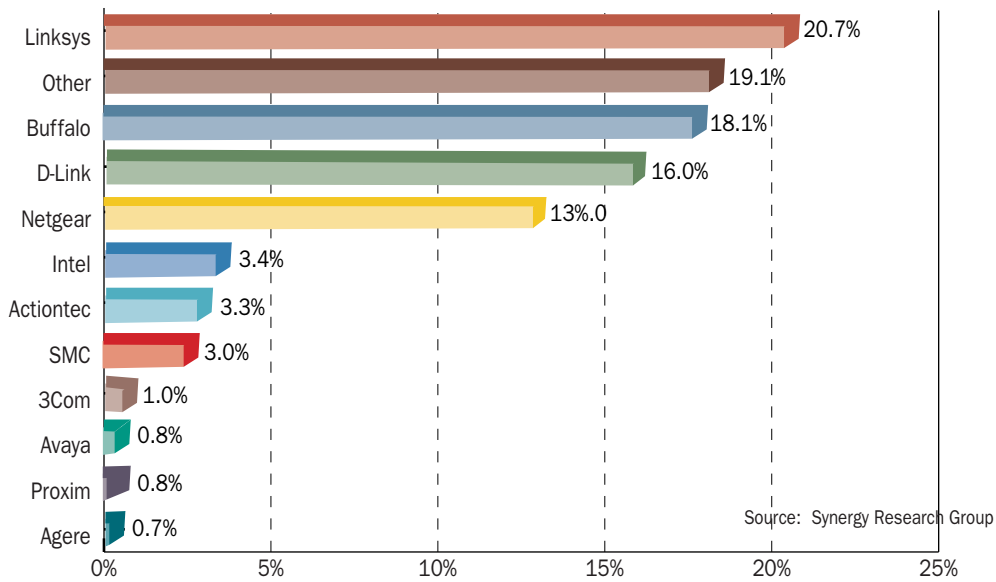
Finally, it will be interesting to see if Cisco can manage a company with such an extremely different business model. Cisco's average sales margin on its business-class networking equipment is upwards of 65 percent; Linksys has an average margin in the 30-percent range. The financial and investment communities are somewhat skeptical that Cisco will be able to successfully integrate a company with a significantly dissimilar style of business, but we believe this acquisition will be successful if Cisco can:

- Allow Linksys to operate internally with a high level of independence.
- Continue to grow the business domestically.
- Successfully develop international retail & service provider sales channels □

**FIGURE 3 2002 enterprise WLAN Vendor Revenue Market Share**



**FIGURE 4 2002 SOHO/Home Vendor Revenue Market Share**



products. However, the IEEE 802.11g task group and the Wi-Fi Alliance are confident these hurdles can be overcome quickly, and our research suggests that the flexibility, speed and backward compatibility of 802.11g with 802.11b will attract additional enterprise Wi-Fi customers. New dual-band (2.4 Ghz & 5 Ghz) and multimode (802.11a, 802.11, & 802.11g) devices are also on the horizon, which will make it easier for customers to combine the three Wi-Fi technologies.

**Freedom Of Speech**

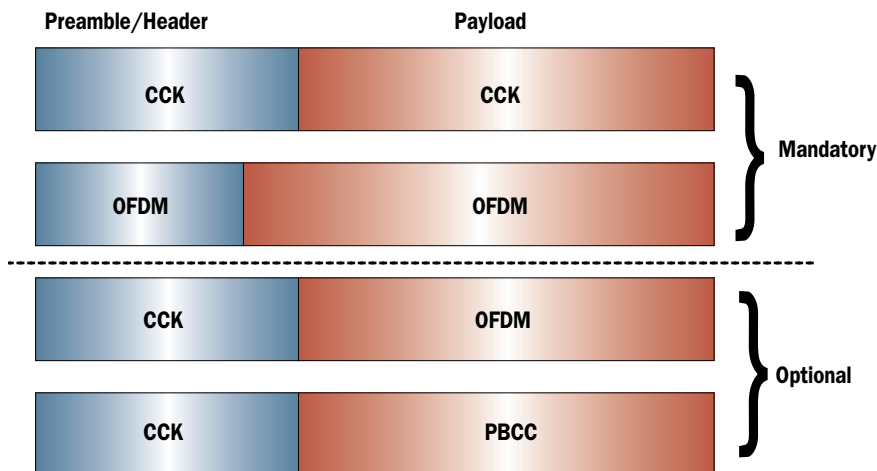
While many new applications for Wi-Fi have been touted, including public access, location based services, vehicular integration and multimedia streaming, IP telephony or using Wi-Fi phones for voice over WLAN (VoWLAN) seems the nearest in terms of being a practical reality (Figure 6).

Many enterprises are already considering converging their separate voice and data networks into one common IP network, and throwing Wi-Fi into the mix would bring another dimension to convergence: mobility.

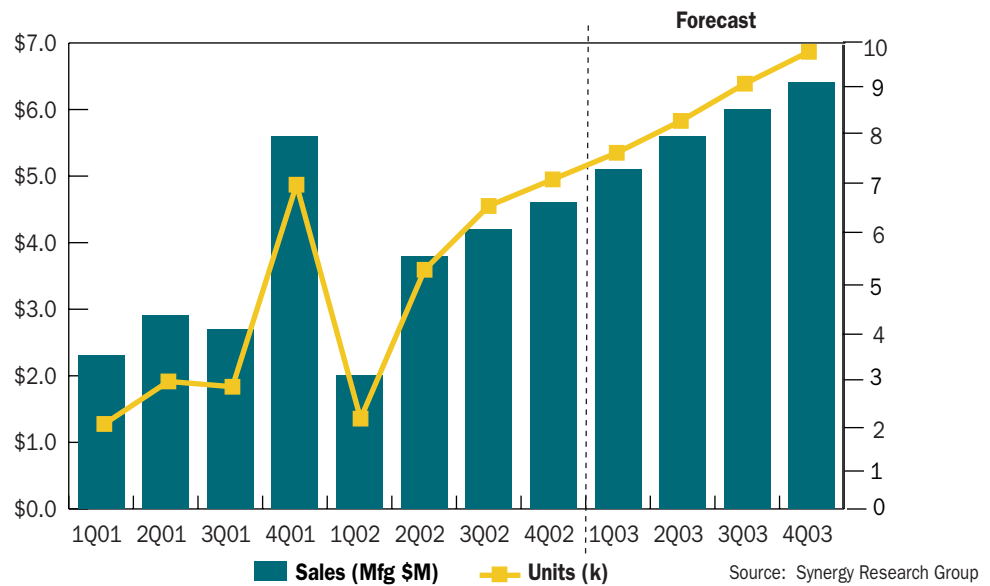
In many large warehouse and manufacturing environments, for example, two-way voice radio and wireless phone systems are already used as separate wireless data devices. Thus it makes sense that a voice-over-WLAN system could supersede these, streamlining the management of the devices and their functions. In corporate office environments, Wi-Fi phones could be issued to new employees then simply carried around, eliminating the need to wire or rewire telephone outlets.

The leading manufacturers of pre-802.11 wireless phones, SpectraLink and Symbol, have APIs

**FIGURE 5 802.11 Packet Format Options**



**FIGURE 6 Voice Over WLAN Phone Market**



to link their devices to popular PBX products, and other vendors are stepping up to compete. 3Com, Cisco and Motorola will sell phone-like devices, while newcomer Vocera offers a Star Trek communicator-like unit with hands-free voice activation and operation.

Microsoft and TeleSym have interesting software “soft phone” solutions, which load onto an 802.11-equipped PDA to convert it into an IP voice device for several hundred dollars. High-end PDAs are beginning to ship with built-in Wi-Fi cards, but older units can be upgraded for under \$100 with a PC card and PCMCIA adapter, or with a compact flash card. These are cost effective solutions, since they leverage the existing PDAs, which many mobile users already have, and cost less than the \$500-and-up handsets that are manufactured by the likes of SpectraLink and Symbol. However, the “soft phones” are not as feature rich.

In principal, packetized IP voice can run over any of the 802.11 packet formats and frequencies, although the IEEE 802.11e is working on QOS enhancements for realtime WLAN traffic. Meanwhile, most vendors, including Cisco and Avaya, are licensing SpectraLink’s proprietary SpectraLink Voice Priority (SVP) technology. Proprietary gateways and APs also are used by Symbol and SpectraLink to handle the special bandwidth control requirements for voice traffic in WLANs. Although these additional devices can be expensive, vendors claim that Wi-Fi phone systems cost several hundred dollars less per station to install and support than wired IP telephony equivalents.

**Conclusion**

There is no doubt that both enterprise and consumer adoption of WLANs will continue. Consumer growth will continue to be closely tied to

broadband adoption rates and falling equipment prices.

Enterprises are beginning to feel more comfortable with wireless networks from the standpoint of security, but business-class WLAN equipment leaves much to be desired in terms of scalability and management complexity. However, vendors are beginning to successfully market more centralized wireless network technologies and architectures, and this will pave the way for next generation wireless applications like voice. Further, the maturation of standards like 802.11a, 802.11g, 802.11i (security) and 802.11e (QOS) should help catalyze WLAN adoption rates in all segments of the market, while companies like Cisco, Intel and Microsoft drive WLANs to the masses in business, in the home and everywhere in between□

**Companies Mentioned In This Article**

- 3Com ([www.3com.com](http://www.3com.com))
- Avaya ([www.avaya.com](http://www.avaya.com))
- Buffalo Technology ([www.buffalo-technology.com](http://www.buffalo-technology.com))
- Cisco ([www.cisco.com](http://www.cisco.com))
- D-Link Systems ([www.dlink.com](http://www.dlink.com))
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