



POSITIONING PAPER

Bluetooth and Wi-Fi

A vertical image on the left side of the page shows several blue, glowing, flower-like structures against a dark background. The flowers have thin, vertical stems and small, rounded heads that emit a soft blue light.

Imagine,
You're Mobile and
Connected—
Without Wires

Want to connect your notebook PC to a mobile phone, handheld PDA, or printer without cables or connectors? How about accessing the LAN and the Internet without being tied to an Ethernet port? Even better, what if these kinds of connections could be made automatically, effortlessly?

Well, thanks to Bluetooth and Wi-Fi (IEEE 802.11b) wireless technologies, this kind of connectivity is becoming a reality.

Bluetooth Wireless Technology

Bluetooth is an open, global standard for radio links that provides affordable wireless connections between PCs, handhelds, mobile phones, printers, and more, as well as giving these products access to network resources. The Bluetooth specification defines a low-power radio link optimized for secure short-range connections, and lays out standard steps for connecting various types of devices. Bluetooth radios, which can be incorporated into most any electronic device, offer a universal wireless communication link that enables reliable interoperability between products from different manufacturers.

How Bluetooth Wireless Technology Works

Bluetooth radios operate in the 2.4 GHz spectrum. Each unit includes a radio, a baseband link controller, and software for link and data-flow management. The Bluetooth specification defines two radio choices: a low-power level with up to a 10-meter range primarily intended for client devices and a high-power level with a 100-meter range for access points. Bluetooth devices can simultaneously connect with up to seven devices. These radios also use a signaling technology called frequency hopping spread spectrum (FHSS) to minimize interference and enhance security with connection speeds of up to 1 Mbps.

Turn on a Bluetooth product, and it automatically searches out and identifies other authorized devices within range. Then, users can decide to connect to one or multiple discovered devices. When they connect, these products begin a master-slave relationship where slave units synchronize with the master. Each master can connect to up to seven slave units simultaneously, creating a personal area network (PAN). In addition, multiple PANs can connect to one another, forming a scatternet.

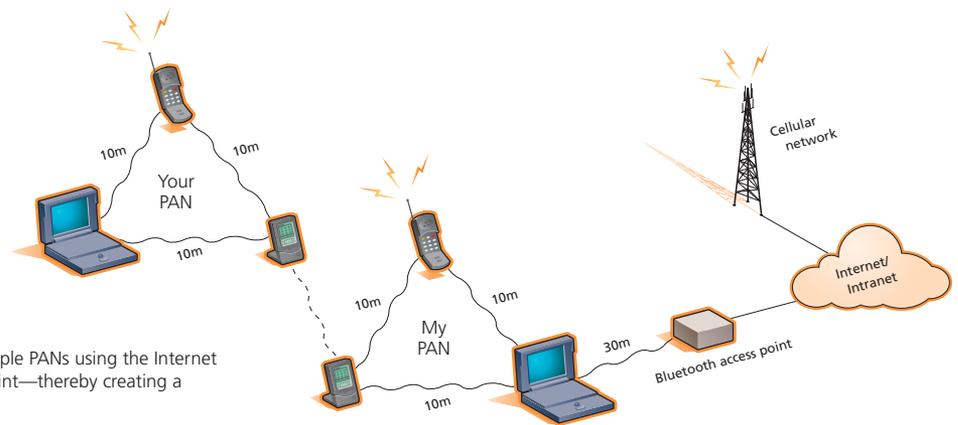


Figure 1. Connect multiple PANs using the Internet or through an access point—thereby creating a scatternet.

Bluetooth wireless technology is going to simplify your life in more ways than you can imagine.



Key Features of Bluetooth Wireless Technology

Speed

2.4 GHz radio provides up to 1 Mbps throughput without line-of-sight requirements.

Low Cost

This cost-effective wireless solution enables broad deployment.

Low Power

Low-power radio links provide access to a wide array of devices, including handhelds and mobile phones.

Personal Area Range

Up to 10 meters client-to-client, up to 100 meters client-to-access point.

Simple Application Development

Bluetooth connects application to application through standard Bluetooth profiles, eliminating dependency on other devices and operating systems.

Interoperability

Bluetooth devices automatically identify other products and applications within range, creating an instant PAN.

Voice and Data Support

Up to seven simultaneous connections for each personal area network.

Security

Most devices come standard with built-in authentication and encryption. Our Bluetooth products feature physical

authentication based on a unique Media Access Control (MAC) address and PIN, 128-bit encryption, and user authentication based on username and password.

Standards-Based

The Bluetooth standard is supported by over 2000 adopter companies.

Bluetooth: Connecting Your World Without Wires

Bluetooth wireless technology is going to simplify your life in more ways than you can imagine. Here are a few examples and benefits that make life easier:

- Automatically synchronize personal contact lists for your mobile phone, notebook, and handheld. Transfer business cards, files, and other information to a coworker's Bluetooth device with simple, spontaneous connections. Or, access any number of wireless peripherals—printers, scanners, fax machines, copiers, and more.
- Imagine a user is sitting in a conference room and needs a colleague's phone number, so she accesses a central server using her Bluetooth handheld. Or she's in the middle of a meeting, and needs the latest sales forecast. No problem, she can download it from the corporate server, using her Bluetooth notebook.

- What about when users are on the road? A user is lost and needs directions, so he accesses the Internet using his Bluetooth handheld connecting through his mobile phone. Or while traveling in his car, he retrieves the latest price sheet from the home-office computer, and then faxes a price quote to his customer.

Wi-Fi (IEEE 802.11b) Wireless Technology

The 802.11b standard, wireless fidelity (Wi-Fi), is an IEEE specification for wireless LANs. Wi-Fi uses Ethernet-like protocols to provide 11 Mbps throughput, with fallback rates of 5.5, 2, and 1 Mbps, to all wireless-enabled desktop and notebook PCs on your LAN. All Wi-Fi certified products are interoperable, regardless of manufacturer. These products deliver a full-service wireless LAN, so you can extend your wired LAN, or deploy a wireless network from the ground up, without worrying about wires or sacrificing performance.

How Wi-Fi Works

Like Bluetooth devices, wireless networks also use radio signals in the unlicensed 2.4 GHz frequency to

connect devices throughout businesses and homes. Unlike Bluetooth wireless technology, Wi-Fi networks can be instituted as a fully functional LAN, but without the cables. Plus, you don't even have to establish a connection. The network structure also varies from Bluetooth. Rather than master/slave relationships, Wi-Fi certified PC Cards and PCI cards connect to access points across the campus. Using spread spectrum technology, wireless networks ensure that all network devices are tuned to the same signal frequency.

Like Ethernet and Fast Ethernet, Wi-Fi uses an identical MAC. The current speed and range for Wi-Fi networks is adequate for you to run all but the most bandwidth-intensive applications—just like you're on a wired LAN. Developments are underway to create 802.11a products that can transmit at speeds up to 54 Mbps over the 5 GHz spectrum. These products will coexist with Wi-Fi products, but require more power and transit over shorter distances. Therefore, Wi-Fi wireless LAN products are expected to remain the standard for most wireless mobility applications in business environments.

All Wi-Fi certified products are interoperable, regardless of manufacturer.

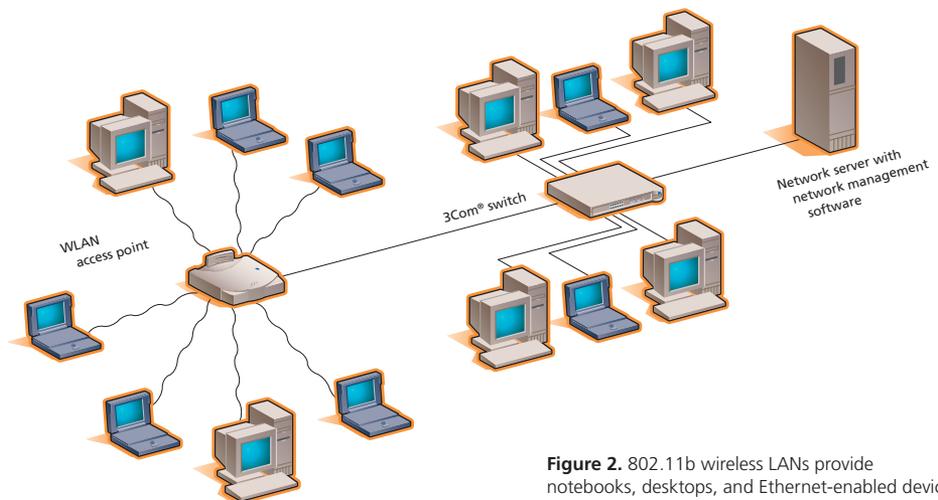


Figure 2. 802.11b wireless LANs provide notebooks, desktops, and Ethernet-enabled devices with Ethernet-speed wireless network services over the entire campus.

The 802.11b standard and Wi-Fi certification make the corporate lifestyle so much easier.

Key Features of Wi-Fi Technology

Speed

2.4 GHz direct sequence spread spectrum radio provides an 11 Mbps maximum data rate without line-of-sight requirements.

Dynamic Rate Shifting

Rates fallback to 5.5 Mbps, 2 Mbps, and 1 Mbps when RF conditions deteriorate.

Local Area Range

Wi-Fi technology has a range of up to 100 meters (328 feet) in office environments.

Robustness

An Ethernet-like link-layer protocol combined with packet recognition provides reliable data delivery and efficient use of network bandwidth.

Interoperability

Unlike previous standards, 802.11b allows for only one standard signaling technique, so all Wi-Fi certified products are interoperable.

Power Management

Wi-Fi PC Cards can go to sleep, and access points will buffer messages to these clients—contributing to longer notebook battery life.

Roaming Support

Enables seamless roaming between access points as a user moves across a building or campus.

Load Balancing

Wi-Fi PC Cards and PCI adapters change access points if the signal degrades or the current access point becomes congested.

Scalability

Up to three access points can be co-located in a given coverage area to support hundreds of users.

Voice and Data Support

Wi-Fi certified products support simultaneous voice and data channels.

Security

Most products come with built-in 40-bit Wireless Equivalent Privacy (WEP) encryption and authentication; 3Com® Wi-Fi certified products also support access control list and VPN capabilities. In addition, several 3Com wireless products offer 128-bit encryption with unique session keys.

Wi-Fi: Simple, Reliable Networking Without Wires

The 802.11b standard and Wi-Fi certification make the corporate lifestyle so much easier. Here are a few examples where 11 Mbps wireless LANs make sense:

- Improve productivity by giving employees access to e-mail and company resources anywhere within range of an access point—including conference rooms, colleagues' offices, training rooms, and branch offices. Wireless networking allows people to work anywhere—even in an outdoor courtyard.
- It's easy to add wireless capabilities to your wired LAN. With a Wi-Fi certified wireless LAN, you can expand without worrying about wiring costs or hassles. Wireless expansions install more quickly and cost-effectively, while providing much greater flexibility than a wired network.
- What about those hard-to-wire locations? When you go wireless, it's easy—even in those seemingly impossible-to-wire spots. Now you can give your employees untethered network access, whether they work in asbestos-insulated buildings, clean rooms, plaster-walled structures and older, solid-walled buildings.

Today, more than 2,000 adopter companies embrace the standard and are rapidly developing Bluetooth products.

The Bluetooth SIG and WECA—Ensuring Cross-Vendor Interoperability

The Bluetooth specification was developed by a special interest group (SIG) that's supported by nine promoter companies—3Com, Ericsson, IBM, Intel, Lucent, Microsoft, Motorola, Nokia, and Toshiba. Today, more than 2,000 adopter companies embrace the standard and are rapidly developing Bluetooth products. By 2005, more than 670 million devices will be equipped with Bluetooth wireless technology, providing a basis for wireless connectivity and information exchange (Cahners In-Stat Group, 2001).

Wi-Fi certification for IEEE 802.11b wireless LANs is administered by the Wireless Ethernet Compatibility Alliance (WECA). 3Com and many other leading wireless vendors formed WECA to ensure multivendor interoperability between all components of 802.11b wireless LANs. Only products that pass WECA certification tests may carry the Wi-Fi logo.

Interoperability issues

Can Bluetooth and Wi-Fi co-exist? Yes. Both technologies operate in the 2.4 GHz spectrum, so interference can occur. Although the potential for interference is rather low, there is a possibility that the two technologies may interfere with one another when they're simultaneously transmitting in close proximity. Interference typically appears as an interruption of the Wi-Fi signal with possible data loss, but no physical damage to either system. Since the degree of interference is directly related to the distance between systems and nodes, moving devices further apart usually solves the problem. Throughput can also be reduced when Wi-Fi and Bluetooth networks are simultaneously operating.

As awareness of coexistence issues has grown, regulatory standards bodies have begun to address the problem and look for solutions. Among them are the IEEE 802.15 WPAN Task Group 2 (TG2), Bluetooth SIG WLAN Coexistence Group, and Coexistence Ad Hoc Task Force within WECA, and 3Com is an active participant in these groups.

For example, 3Com along with other members of the Bluetooth SIG recently petitioned the FCC to resolve interference issues by allowing for an adaptive hopping approach. Using this method, modified Bluetooth devices (with firmware upgrades) would operate simultaneously with Wi-Fi devices by dividing the frequency band. Currently, Bluetooth devices don't look for channel use before they start hopping. As a result of this technology, Bluetooth devices would first look for channel use and then hop in the unused channels.

In Europe, the coexistence problem has been addressed, because Bluetooth radios restrict the number of hops in their transmit pattern. This allows the European-only Bluetooth radios to adapt their hopping pattern, so they don't overlap with existing Wi-Fi channels.

Various solutions are being deployed on multiple fronts, such as regulatory and company-level policy, standards bodies' activities, and technology innovations, so there's no reason to hesitate deploying either technology. 3Com is committed to the future of both the Bluetooth and Wi-Fi standards and is actively researching additional techniques to ensure coexistence. As more advanced solutions become available, 3Com will incorporate them into all new products and offer them as upgrades for current products.

Wireless
communication is
the future.

Conclusion

3Com believes Bluetooth and Wi-Fi technologies are pervasive, complementary standards that serve the needs of organizations and individuals in unique and indispensable ways. Bluetooth will inevitably become the recognized standard for personal area networking, while Wi-Fi has already become the pervasive wireless LAN standard for businesses and homes. Given their unique strengths, 3Com plans to continue supporting both standards, and is actively researching techniques for seamless coexistence in their mutual airspace.

Wireless communication is the future. 3Com is using its expertise in wireless networking and mobile computing to provide reliable wireless solutions that are easy to use and manage. As people continue to discover the freedom and productivity benefits that wireless networking provides, connecting without wires will become much more common at work, at home, and in public areas. In other words, the future of wireless communication looks very bright.



3Com Corporation, Corporate Headquarters, 5400 Bayfront Plaza, P.O. Box 58145, Santa Clara, CA 95052-8145.

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