

## FREQUENTLY ASKED QUESTIONS

## 802.11a FAQ

The IEEE 802.11a standard was developed primarily to offer higher throughput as well as move away from the 2.4 GHz spectrum, which is becoming more crowded

**What is 802.11a?**

802.11 refers to a family of wireless LAN (WLAN) specifications developed by a working group at the Institute of Electrical and Electronic Engineers (IEEE). 802.11 defines the standard for WLANs, encompassing four disparate technologies: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Infrared (IR), and Orthogonal Frequency Division Multiplexing (OFDM). Currently the most widely deployed technology is DSSS in the 2.4 GHz band. FHSS and IR are rarely used for wireless LANs.

The 802.11a specification employs OFDM modulation and operates in the 5 GHz range. The IEEE ratified the 802.11a standard in July 1999.

**What is OFDM?**

The OFDM modulation scheme offers higher bandwidth than that of 802.11b-supported DSSS technologies. Since the 802.11a MAC (Media Access Control) is the same as that of 802.11b, Wireless Ethernet Compatibility Alliance (WECA) supporters are tending to now push this standard.

The advantages of OFDM include:

- **Ultrahigh spectrum efficiency:**  
More data can travel over a smaller amount of bandwidth than competing technologies

- **High resistance to multipath:**  
Reflected multipath signals are less likely to cancel the main signal, making it much more suitable for indoor wireless networking
- **Relative immunity to interference:**  
If interference happens to block one data pathway, the other carrier waves remain unaffected

The disadvantages of OFDM include:

- **Expense:** Components are typically more expensive to produce due to their added complexity
- **Higher Power Consumption:**  
OFDM-based systems draw more power than 802.11b-based systems. This is a problem for notebook users.

**Why was this new standard developed?**

The IEEE 802.11a standard was developed primarily to offer higher throughput as well as move away from the 2.4 GHz spectrum, which is becoming more crowded with 802.11b WLAN, cordless phones, microwave ovens, and other wireless networking protocols such as Bluetooth and HomeRF. So, the 802.11a standard may initially serve as a remedy to potential interference problems.

With a range around 50 meters, 802.11a customers will need to deploy twice as many access points to ensure the same coverage area as a Wi-Fi network

### What are the advantages of 802.11a?

The advantages of IEEE 802.11a are:

- Operating speeds up to 54 Mbps. This difference is primarily a result of 802.11a's modulation scheme. The larger bandwidth allocation in the 5 GHz range can be exploited for greater data rates.
- Less interference in the 5 GHz frequency range. The crowded 2.4 GHz band is shared by cordless phones, microwave ovens, Bluetooth, and WLANs.
- Greater potential to handle more users, as a result of more radio frequency channels and increased operating bandwidth.

### What are the barriers to wide-scale implementation of 802.11a?

- The total cost of ownership (TCO) for 802.11a must be close to that of 802.11b before wide-scale implementation takes place. Since the range of 802.11a (approximately 50 meters) is roughly half that of 802.11b, this will be difficult.
- Unlike 802.11b, 802.11a is not accepted worldwide. For example, Japan only permits the use of a smaller band containing half the channels. And Europe is still holding onto the promise of High Performance Radio Local Area Network Type 2 (HiperLAN2). In fact, it's illegal to use 802.11a in Europe, as the standard doesn't comply with various EU requirements. Furthermore, vendors are uncertain whether to deploy at 5.2 GHz or 5.8 GHz. Certain military and government installations use portions of the 5 GHz band for ground tracking stations and satellite communications, creating additional barriers to worldwide 802.11a deployment.

- OFDM is inherently less power-efficient than DSSS. This means a 54 Mbps OFDM transceiver operating at a given range will consume much more power than an 11 Mbps DSSS transceiver with the same range. This presents an extra burden on the battery life of notebook PCs.
- Currently, there is no interoperability certification available for 802.11a products. Wi-Fi certification (performed by WECA) ensures multivendor interoperability of 802.11b products.
- 802.11a is not compatible or interoperable with the 802.11b protocol
- The 802.11a standard does not address growing concerns over wireless networking security
- Although there is less interference in the 5 GHz frequency range, signals at 5 GHz have a higher absorption rate, and are therefore blocked more easily by walls and other building structures

The emerging IEEE 802.11a standard for wireless LANs will complement and co-exist rather than compete with the 802.11b standard

802.11a vs. 802.11b?	802.11a	802.11b
Raw data rates	Up to 54 Mbps (54, 48, 36, 24, 18, 12, and 6 Mbps)	Up to 11 Mbps (11, 5.5, 2, and 1 Mbps)
Range	50 meters	100 meters
Bandwidth	UNII and ISM (5 GHz range)	ISM (2.4000—2.4835 GHz range)
Modulation	OFDM technology	DSSS technology

## 802.11a vs. 802.11b

### How does 802.11a differ from 802.11b?

Both IEEE 802.11a and IEEE 802.11b are wireless LAN technology standards. The chart above highlights key differences.

- Like Ethernet and Fast Ethernet, 802.11b and 802.11a use an identical MAC. However, while Fast Ethernet uses the same physical-layer encoding scheme as Ethernet—only faster—802.11a uses an entirely different modulation scheme called orthogonal frequency division multiplexing (OFDM).
- Because 802.11a has a range approximately half that of 802.11b, more access points are required to cover the same area in a building.

### Will 802.11a replace 802.11b?

No. It's believed that the emerging IEEE 802.11a standard for wireless LANs will complement and co-exist rather than compete with the 802.11b standard. The higher data rate will prove beneficial when wireless video and multimedia applications become widespread. If you need to increase bandwidth, you can begin by deploying pockets of 802.11a gear right alongside your 802.11b installation. Wi-Fi's greater range and sustainable 11 Mbps data rate complement 802.11a's shorter range and 54 Mbps data rate. Because the two standards can coexist without interference risk, products could even be deployed that use both standards simultaneously, such as dual-radio access points.

### Are 802.11a products backward compatible with 802.11b products?

No. Short of replacing the radios, there is currently no defined upgrade

path between 2.4 GHz and 5 GHz technologies. This could prove to be a difficult selling point for 802.11a-only vendors.

### What are the likely applications for 802.11a?

It's expected that 802.11a equipment makers will market products to home and SOHO users. This market segment is likely to deploy Wi-Fi for shared Internet access, and a higher bandwidth standard like 802.11a for video streaming and video sharing applications. This is because of the higher data rate and the fact that the shorter range limitations would be less of a factor for these users. Equipment using this standard could network gaming applications, devices like high-definition televisions, and multiple streaming audio and video devices.

The enterprise market segment will likely have deployments of both 802.11a and 802.11b for a number of years. As Wi-Fi is a much further developed standard, the following trends will persist:

- Its popularity will continue to drive down costs
- Wi-Fi certified interoperability will continue to be a catalyst for widespread adoption
- The risk-averse enterprise segment will continue to focus on cost savings and increasing the return on investment in Wi-Fi
- As all public access wireless deployments today are based on 802.11b, mobile professionals will continue to support Wi-Fi, as 802.11a cards won't offer connectivity

Because of the higher cost of the 802.11a chipset, shorter range, and other related issues, early adoption of

3Com is supporting IEEE 802.11a and is targeting the shipment of such products in mid-2002

the 802.11a technology will likely be limited to these types of applications:

- Building-to-building connections
- Video and audio conferencing/streaming video and audio
- Data mining
- Large file transfers, such as engineering CAD drawings
- Faster web access and browsing
- High worker density or high throughput scenarios, such as a trading floor with multiple networks and numerous PCs running graphics-intensive applications

#### **When will 802.11a products be available?**

802.11a is still merely a standard. Currently, there are no volume-shipping products on the market, and the technology will take some time before achieving widespread availability. Atheros Communications, Radiata Communications, and Intersil Corp. have all announced plans for 802.11a chipsets, with the first expected to be available by the end of CY01. Most of the remaining chipset vendors will have products available by the latter half of 2002.

#### **When will 3Com ship 802.11a products?**

With 3Com's networking and mobility expertise, we understand the needs for new technology deployments and are committed to addressing those needs. 3Com is supporting IEEE 802.11a and is targeting the shipment of such products in mid-2002.

#### **What about other vendors that have announced 5 GHz products?**

Those announcements are primarily upgradable access points with removable, dual-radio PC Cards. Vendors are looking to get around the "incompatibility" sticking point by developing dual-band radios and access points that support both 802.11a and 802.11b.

#### **Should I deploy an 802.11b solution now, or wait to evaluate 802.11a?**

Companies using 11 Mbps WLANs are achieving significant advantages in worker productivity and collaboration, and more easily accommodating organizational change. 3Com's 11 Mbps wireless LANs have evolved through several generations, and are proven to deliver the real-world security, reliability, and ease of deployment and use required for business-critical networking.

If your business can benefit from greater mobility and continuous access to information, or has a hard-to-wire location, you should consider implementing an 802.11b-based solution today. In its April 2001 market analysis titled: *Will Wireless LANs Migrate to 5 GHz?*, Gartner Dataquest concluded "802.11a and 802.11b technologies will coexist to provide the best of both worlds, given that both can coexist with no interference risks."

#### **Why is the standard defined as 802.11a following 802.11b?**

Each new project/standard in IEEE is started by a PAR (Project Authorization Request). 802.11a was requested first, and both the 802.11a and the 802.11b standards were approved around the same time in 1999. However, because of technical challenges, the implementation of 802.11a is taking much longer.

#### **Wi-Fi certification assures broad compatibility for 802.11b components. Will 802.11a products receive similar testing?**

Yes, WECA is planning to produce a test specification for 802.11a in the near future. This spec will require products to be tested using at least two different silicon implementations.

802.11a uses the same MAC as 802.11b, which gives developers only one task to complete—designing a 5 GHz IEEE 802.11a-compliant radio

## Other 802.11 Standards

### What is the difference between 802.11a and HiperLAN2?

HiperLAN2 is a wireless LAN technology operating in the license-free 5 GHz (5.4 to 5.7 GHz) U-NII band. Under development by the European Telecommunications Standardization Institute (ETSI) Broadband Radio Access Networks (BRAN) project, HiperLAN2 is designed to carry ATM cells, IP packets, firewire packets, and digital voice from cellular phones. Where 802.11a is a form of wireless Ethernet, HiperLAN2 is commonly regarded as wireless ATM. An extension of the 802.11 standard, 802.11a is a connectionless Ethernet-like standard, meaning there isn't a persistent connection between client and server. On the other hand, HiperLAN2 is based on connection-oriented links, though it can accept Ethernet frames. 802.11a is optimized for data communications, as are all standards based on 802.11. HiperLAN2 is best-suited to wireless multimedia because of its integrated Quality of Service (QoS) support.

802.11a shares the same physical layer as HiperLAN2, as both use OFDM technology. However, they each use a different MAC layer. The HiperLAN2 MAC design has proven to be problematic and controversial. As such, the HiperLAN2 standard is far from completion. In contrast, 802.11a uses the same MAC as 802.11b, which gives developers only one task to complete—designing a 5 GHz IEEE 802.11a-compliant radio.

Each protocol supports slightly different data rates. Both support rates ranging from 6 Mbps through 54 Mbps. However, HiperLAN2 supports a 27 Mbps data rate not supported by 802.11a, while 802.11a supports 24 Mbps and 48 Mbps data rates not supported by HiperLAN2.

Finally, HiperLAN2 is completely incompatible with 802.11a.

### How is QoS addressed in 802.11a, as this seems to be a clear advantage for HiperLAN2?

QoS is being addressed by the IEEE 802.11 Task Group E. The changes to the standard proposed by this group will mainly affect the MAC layer and are therefore applicable to both 802.11b and 802.11a. Most of the work for basic QoS has been completed, and it's currently in the adoption process.

### Is HiperLAN2 a real threat to 802.11a in Europe, since both run at 54 Mbps?

HiperLAN2 will have a difficult time competing with the momentum of 802.11a for several reasons. 802.11a has a year head start over HiperLAN2, and support for HiperLAN2 is somewhat divided. In addition, the 802.11a group is looking for ways to incorporate the best features of HiperLAN2 within its own standards. It is expected that one merged European standard will emerge and it will most likely be 802.11a incorporating the best features of HiperLAN2. Furthermore, the fact that 802.11a's MAC is the same as that of the popular 802.11b standard, may cause most companies to focus first on getting the 802.11a chipsets and end-products out on the market.

### Currently, 802.11f, 802.11i, and 802.11e task groups are working on roaming, security, and quality of service issues in wireless LANs. How will these efforts impact 802.11a?

Because most work involved in these areas is focused on the MAC and data link layer of 802.11, the results would also benefit future 802.11a implementations.

### How does 802.11a differ from 802.11g?

Various task groups within the IEEE 802.xx standards body develop specifications. The IEEE 802.11 Task Group G was formed to develop a new protocol for the extension of the IEEE 802.11b (2.4 GHz) physical layer—802.11g. This new protocol promises to enhance the performance and



3Com is committed to bringing higher-rate WLAN solutions to market that are standards based

possible application of Wi-Fi networks by increasing the data rate of 802.11b-type devices above 20 Mbps. This will improve access to both fixed wired and wireless LANs as well as create higher-performance ad hoc networks. Currently, there are two proposals under consideration: Intersil has proposed a version of OFDM, and Texas Instruments has proposed its Packet Binary Convolution Coding (PBCC). The benefits of the 802.11g protocol's speed and compatibility with 802.11b are obvious. Unfortunately, it remains mired in a standards battle and approval process.

**Will 802.11b customers choose 802.11g, or will they go directly to 802.11a?**

Customers deploying wireless LANs today are more likely to choose a Wi-Fi solution, especially since there are strong indications of a standards-based approach to higher rate extension at 2.4 GHz. Even though 802.11g is not an official standard yet, its modulation schemes under consideration can accommodate potential data rates of up to 54 Mbps. Once the IEEE endorses an 802.11g proposal, the FCC is also expected to approve this standard.

As 802.11g offers investment protection and backwards compatibility for the 802.11b installed base, customers will proceed with the 802.11b today, and continue to evaluate the progress of both 802.11g and 802.11a as higher-rate WLAN options. The IEEE is expected to finalize the 802.11g standard by mid 2002. 3Com is committed to bringing higher-rate WLAN solutions to market that are standards based.

**802.11e will offer a universal QoS standard for home and business WLAN environments. What are its main features?**

A working group within the IEEE, called Task Group E (TGe) has been developing QoS capabilities to enable reliable voice conversations to join IEEE 802.11b LANs. With the growing deployment of high-speed radio packet networks, there is considerable interest in adding QoS capabilities to current WLAN products. Since WLAN QoS is still evolving, it does not have a standard QoS technology like the wired LAN environment. However, WLAN can use some wired-side QoS technologies to ensure end-to-end QoS solutions. This IEEE QoS specification should be ratified by early 2002.

**What will be the role of 802.11e in the enterprise?**

Once the 802.11e MAC QoS is standardized by the IEEE, some of its enterprise-level capabilities will include packet classification and queuing (802.1q), traffic prioritization (802.1p), and IGMP snooping to eliminate unnecessary network multicast traffic. This would allow vendors such as 3Com to differentiate products in terms of throughput, delay, jitter, and capacity, and provide a reliable platform for future add-on multimedia features such as audio and video over WLANs.



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

To learn more about 3Com solutions, visit [www.3com.com](http://www.3com.com). 3Com is a publicly traded on Nasdaq under the symbol COMS.

Copyright © 2001 3Com Corporation. All rights reserved. 3Com is a registered trademark of 3Com Corporation. The 3Com logo is a trademark of 3Com Corporation. Wi-Fi is a trademark of the Wireless Ethernet Compatibilities Alliance. Other product and brand names may be trademarks or registered trademarks of their respective owners. All specifications are subject to change without notice.

103010-001 11/01