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When deploying a wireless network, one can opt to use products using the 2,4Ghz frequency band or the 5Ghz band. We will take a look into some specifications related to both bands. As the 802.11g standard draft standard was recently approved we give a short overview of the 802.11b,a and g standard as a quick recapitulation.

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✓ 2,4Ghz, 5Ghz Deployment considerations

When deploying a wireless LAN, companies must make a decision on whether to use network interface cards (NICs) and access points designed to operate in the 2.4GHz or 5GHz band (or both). Not too long ago the choice of frequency band was easy, when only 2.4GHz (i.e., 802.11b) products were available. Now, 802.11b and 802.11g products are both available that operate in the 2.4GHz band, while 802.11a use the 5GHz band. This can cause confusion when designing a WLAN, so let's take a look at what you need to consider when making this critical resolution.

Refer to Solid Requirements
When assessing the pros and cons of 2.4GHz and 5GHz systems, be sure to first define requirements. This provides a solid basis for defining all design elements. Without firm requirements, you'll be making the choice on flimsy ground.
The following are requirements that you should consider when deciding on whether to deploy 2.4GH or 5GHz solutions:

Geographical Location. Before getting to far, consider the geographical location of where the WLAN will operate. 2.4GHz WLANs have regulatory acceptance throughout most of the World; however, the use of 5GHz for WLANs is somewhat limited. For example, the U.S. allows operation of 5GHz WLANs, but other countries do not. Your location may require you to use the 2.4GHz band regardless of other requirements. The situation in Europe is very much dispersed, where the 5Ghz band is opened up in some countries the frequency remains closed in many others.

Performance. The 5GHz bands have much greater spectrum available. In this band there are 12 non-overlapping channels, each with 20MHz of bandwidth. This means significantly better performance as compared to the 2.4GHz band. The entire 2.4GHz band is 80MHz wide, which only allows three non-overlapping channels. If high performance is an important requirement, then lean toward the 5GHz band.

Facility Size. As frequency increases, range generally decreases. As a result, 5GHz systems generally have less range than ones operating in the 2.4GHz band. The selection of a 5GHz WLAN could require a greater number of access points, which can result in higher costs. As a result, you may benefit by deploying 2.4GHz systems in larger facilities unless high performance is critical.

Radio Frequency (RF) Interference. 2.4GHz WLANs can experience interference from cordless phones, microwaves, and other WLANs. The interfering signals degrade the performance of an 802.11b WLAN by periodically blocking users and access points from accessing the shared air medium. If it's not possible to reduce potential interference to an acceptable level, then consider deploying a 5GHz system, which is relatively free from interfering sources.

Interoperability. 2.4GHz and 5GHz systems are not directly compatible, and very few users (not to mention access points) today operate in the 5GHz band. Consequently, it may be best to deploy a 2.4GHz solution if you have very little control over the NICs that users have in their PDAs and laptops. This applies mostly to universities and public WLAN hotspots. Your application may require you to definitely implement 2.4GHz to support the more common 802.11b-equipped users.
Vendors, however, have begun offering dual-band radio NICs and access points, which reduces interoperability problems. Someone equipped with a dual-band radio NIC can associate with either a 2.4GHz (802.11b/g) or 5GHz (802.11a) access point. As a greater number of users begin equipping their devices with the dual-band radio NICs over the next couple years, then the interoperability issue will diminish.

Security. Security of the WLAN is of great concern to most companies. By minimising the propagation of radio waves outside the physically controlled area of a facility, a wireless network is more secure because of the reduction of the potential for eavesdropping and denial of service attacks. As a result, 5GHz systems can provide enhanced security over 2.4GHz systems because of less range.

Costs. 5GHz products currently cost 20 to 30 percent more than 2.4GHz counterparts -- even over the brand new 2.4GHz 802.11g products. In addition, the lesser range the 5GHz offers increases the number of access points you'll need for coverage. Think about whether the use of a 5GHz WLAN offers enough additional benefits (e.g., higher performance, less interference, etc.) to be worth the extra expense.

✓ 802.11 b , g , a short overview

802.11b

Intended to retain the error-correction, security, power-management and other advantages of the original, but slower 802.11 standard, 802.11b adds a key ingredient - a technique for increasing bandwidth to 11M bit/sec.
Called Complementary Code Keying (CCK) the technique works only in conjunction with the DSSS technology specified in the original standard. It does not work with frequency-hopping or infrared transmissions.
What CCK does is apply sophisticated mathematical formulas to the DSSS codes, permitting the codes to represent a greater volume of information per clock cycle. The transmitter is now able to send multiple bits of information with each DSSS code, enough to make possible the 11M bit/sec of data rather than the 2M bit/sec in the original standard.

802.11g

The IEEE's 802.11g standard is designed as a higher-bandwidth - 54M bit/sec - successor to the popular 802.11b, or Wi-Fi standard, which tops out at 11M bit/sec. An 802.11g access point will support 802.11b and 802.11g clients. Similarly, a laptop with an 802.11g card will be able to access existing 802.11b access points as well as new 802.11g access points.

However, products based on the finalised 802.11g standard won't be available until at least mid or end-2003. And if you're looking for a higher-speed alternative to 802.11b, 802.11a products are out now and offer top speeds of 54M bit/sec. The main drawback with 802.11a is a lack of interoperability with 802.11b devices.

A vs. B vs. G

Here's how the three wireless LAN standards stack up against each other.

Standard	802.11a	802.11b	802.11g
Number of channels	X		
Interference	X		
Bandwidth	X		X
Power consumption		X	X
Range / penetration		X	X
Upgrade / compatability			X
Price		X	X

X indicates superior technology or feature.

802.11a

Approved in 1999, the IEEE standard lets a wireless LAN achieve data rates as high as 54M bit/sec. Thus, the standard can support many broadband applications, letting wireless users access the most demanding applications.

To dramatically increase throughput, 802.11a proponents had to solve a major challenge of indoor radio frequency: delay spread in the current 2.4-GHz, single-carrier, delay-spread system.

The 802.11a standard cleverly solves this through a modulation technique called Coded Orthogonal Frequency Division Multiplexing (COFDM), which has found earlier application in European digital TV and audio transmission.

COFDM breaks the ceiling of the data bit rate by sending data in a massively parallel fashion and slowing the symbol rate down so each symbol transmission is much longer than the typical delay spread.

A guard interval (sometimes called a cyclic prefix) is inserted at the beginning of the symbol transmission to let all delayed signals "settle" before the baseband processor demodulates the data.

COFDM slows the symbol rate while packing many bits in each symbol transmission, making the symbol rate substantially slower than the data bit rate. It maps the data signal to be transmitted into several lower-speed signals, or subcarriers, which then are modulated individually and transmitted in parallel.

COFDM also uses coding to allow for recovery of errors and to add more interference rejection by spreading information across all carriers. Interferers may jam individual carriers and the data will still get through. The COFDM physical layer allows greater scalability in delivering data over the wireless channel. The larger-spectrum allocation at 5 GHz can, therefore, be exploited for greater data rates.