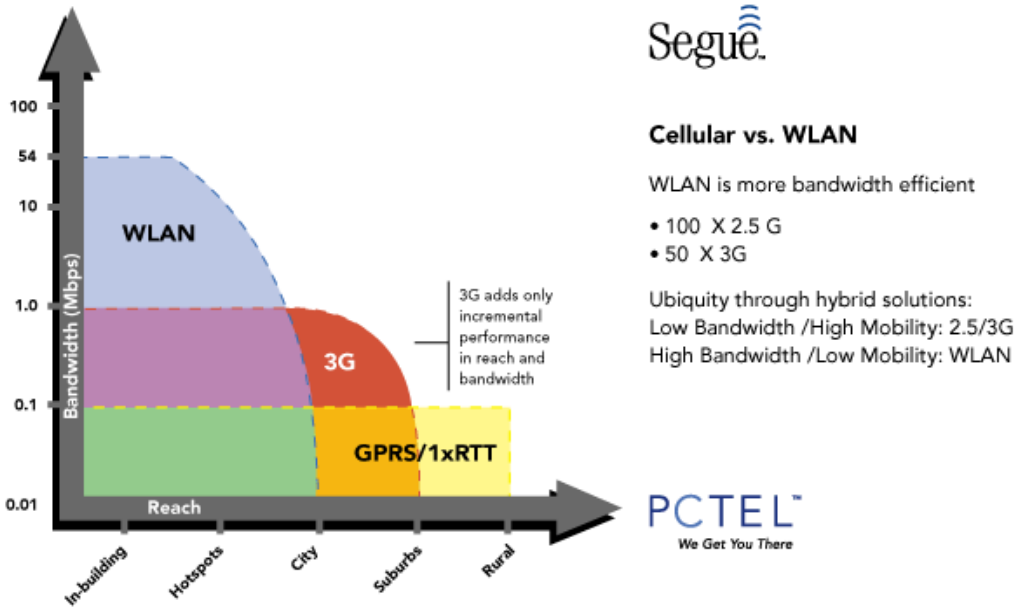
Lecture 13: Wi-Fi Systems

Why Wi-Fi?
Wireless data doesn't always mean cellular data. The IEEE 802.11 standard has emerged as a surprising new alternative (or complement to cellular), upstaging even 3G.
Once hailed as a pervasive wireless data solution (at least on the drawing board), 3G technology has been delayed to a point that stretches its credibility. Testing the patience of wireless operators and consumers alike, the 3G promise has also betrayed investors world wide. The GNP-sized investments in 3G spectrum licenses and required infrastructure is enough to seal shut even the deepest pockets in the business.



The beauty of the 802.11 wireless LAN (WLAN a.k.a. Wi-Fi®) solution is that it doesn't even touch the cellular network. It simply channels the data from the unlicensed 802.11 spectrum at the Hot Spot access location into a gateway and on to the wired Internet. And it is inherently scaleable and easy to deploy. The technology is based on the concept of "Hot Spots," micro-network coverage areas between 20 and 100 meters in radius around a low-powered, high frequency (2.4 GHz - 5 GHz) access point. The access point, in turn, is connected to a gateway to the wired Internet. Users with the proper modem card and software can enjoy high-speed wireless Internet access while inside the Hot Spot coverage area. Today's 802.11 technology delivers data between 11 and 54 Mbps. The higher the speed the shorter the range.

Competitive opportunities suddenly surface for ISPs, software companies (MSN, etc.) and others well positioned for mass deployment because almost anyone can enter this market. IDC forecasts 20 million public wireless LAN subscribers accounting for some 60,000 Hot Spots in 2006.

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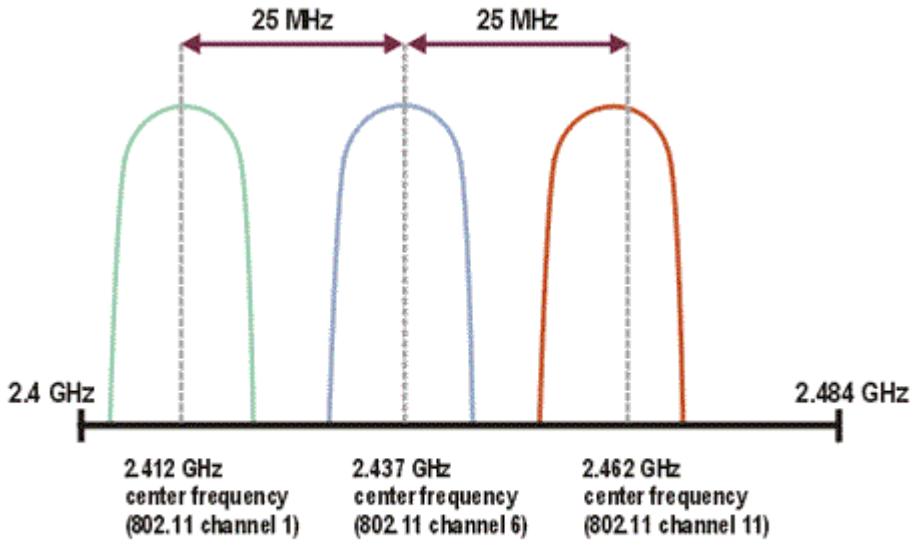
So far, 3 existing protocols exist for 802.11 networks: a/b/g:

- The most popular and widely used at the moment is 802.11b, which operates in the 2.4GHz spectrum up to 11 Mbps along with cordless phones, microwave ovens, and another wireless technology known as Bluetooth.
- In addition, 802.11a, known as Wi-Fi5 because it operates in the 5GHz spectrum up to 54 Mbps.
- Also 802.11g has been developed to be more secure or to travel on more channels in the 2.4-GHz frequency band beyond 11 Mbps.

Both 802.11a and 802.11g must maintain backward compatibility and interoperability with existing IEEE 802.11b products.

Within the 2.4-GHz frequency band, the 802.11 standard defines 14 "center frequency channels." Figure 4 shows a channel arrangement using channel 1 (2.412 GHz), channel 6 (2.437 GHz), and Channel 11 (2.462 GHz). Channels 1, 6, and 11 are commonly used to minimize the complexity of configuring and managing channels. These three channels, when laid out correctly, can accommodate large installations with many APs and clients.



Source: *The IEEE 802.11 Handbook: A Designer's Companion*

Lecture 13: Wi-Fi Systems (cont.)

WiMax- poised to reshape the way service providers offer broadband Internet access. It is also known as the wireless networking standard 802.16a that offers greater range and bandwidth than the Wi-Fi family of standards, which includes 802.11a, 802.11b and 802.11g. Whereas Wi-Fi is intended to provide coverage over relatively small areas such as in offices or "hot spots," WiMax can transfer about 70Mbit/sec. over a distance of 30 miles to thousands of users from a single base station. By comparison, the most commonly used flavor of Wi-Fi, 802.11b, can transfer data at speeds up to 11Mbit/sec. at a range of up to 1,000 feet in open areas.

The greater range and higher bandwidth of WiMax gives service providers the ability to offer broadband Internet access directly to homes without having to worry about the problems that can arise when laying down a physical connection over the so-called last mile, thereby making WiMax a very effective replacement for the last mile for broadband because broadband capabilities can be broadcast from just a few access points, whereas with Wi-Fi you need very many such access points. The standards for WiMax were just approved in January, 2003, with commercial products scheduled to come on-line by 2005.

Examples of Wi-Fi enabled embedded systems

-Embedded software developer Wind River Systems has WLAN technology in its VxWorks real-time operating system (RTOS) and its Tornado. Implemented on Intersil's PRISM II 802.11b WLAN chip set, one has the basis for smart device architectures. The company's WindNet 802.11b Device Driver Kit provides source code support for 802.11b hardware. Potential uses for the Wind River solution include consumer networking gear, industrial automation products, and medical monitoring products incorporated into OEM-designed embedded devices. It can also be applied for the development of wireless access point and other WLAN equipment for the home/office.

-AbsoluteValue Systems has a software-based solution that allows for new changes in WLAN technology to acquire higher performance from the hardware at lower costs. Their wireless platform allows software-enabled implementation for WLAN products such as Access Points, Residential Gateways, Ethernet Bridges, and Point-to-Point systems, based on their embedded Linux system. Support for IEEE 802.11a/g is provided using the PRISM Duette(TM) chipset. Host CPU independence is provided with multiple embedded target board options. The base system includes a single-board computer using a MIPS CPU with two miniPCI slots for WLAN adapters or other peripherals. Another optional embedded target board is a single board computer with a CPU based on the 486 architecture and includes Cardbus and miniPCI interfaces. While primarily targeted at embedded systems, the software package can also be run on a PC or laptop, including PowerPC systems such as those manufactured by Apple Computer.

-D-Link has a DCS-2100 security camera which connects directly to Wi-Fi networks anywhere the network's signal can reach, taking pictures that are easily viewable from a Web browser anywhere. The camera shoots MPEG-4 video at a rate of 30 frames per second and includes an integrated Web server software package, an integrated microphone and a motion detection sensor. Video can be saved and archived directly to a hard drive, so you can watch what happens over time in your home or office. It also has an e-mail alert feature designed to send a snapshot of what the camera is seeing as an attachment to any e-mail address.