

Course ID

WiFi3

Course Duration

3 days

Aimed At

Course Title

Wi-Fi Technology: Principles and Operation

Those who are developing or deploying 802.11a/b/g/n systems will benefit from the emphasis on propagation and methods for determining maximum useful range. Each system's method of modulating data and real-world throughput figures will provide insight into its respective capabilities. Detailed application analysis of 802.11a/b/g/n will be especially useful to the developers of low-cost short-range wireless networks. Security and coexistence issues will be of great interest to designers, deployment engineers, and users alike.

Group Size

5-25

Course

In a Nutshell

This three-day course offers in-depth coverage of the principles and operation of IEEE 802.11 ("WiFi") short-range wireless communications.

We will begin by looking at the indoor propagation characteristics and how to estimate range limits. You will review the government regulations and learn the techniques used by 802.11 to meet those regulations. You will then examine and compare the modulation schemes employed by the various forms of 802.11. Next, you will study in depth the operation of 802.11a, 802.11b, and 802.11g along with the IEEE 802.11n proposals to enhance throughput. We will undertake a detailed analysis of how security is implemented, followed by a look at countermeasures to various attack strategies. We will conclude the course by discussing the coexistence of 802.11 and other wireless networks such as Bluetooth and a study of the interference solutions.

Customize It!

We can customize this course to the requirements of particular audience groups to make the course more or less technical or to focus on the issues of interest to the audience in question. We perform most tailoring at little to no added charge.

Learn How To

- Calculate signal range using large scale path loss models for the 2.4 and 5 GHz bands
- Describe solutions to the impairments caused by multipath
- Show how 802.11 signaling meets various government regulations
- Compare the 802.11 a, b, g, and proposed 802.11n modulation processes
- Describe the channel-access methods used by 802.11
- Demonstrate the strengths and weakness of 802.11 security
- Show how coexistence can be improved between 802.11 and other wireless systems

**Course
Outline**

Day One

- Introduction to WiFi and Short-Range Systems
 - Wired vs wireless communications
 - Categories of information transmission
 - Overview of 802.11
 - The Wi-Fi Alliance and IEEE 802.11 task groups
 - Other short-range wireless systems
- Propagation and Range Limit
 - Review of decibels
 - Link budget equation and path loss model
 - Calculating maximum range
 - Partition attenuation and primary ray tracing
 - Eavesdropping and jamming vulnerabilities
 - Multipath characteristics and mitigation
- Data Communications
 - Advanced modulation methods for faster data rates
 - Direct sequence spread spectrum
 - Complementary coded keying (CCK)
 - Orthogonal Frequency Division Multiplexing (OFDM)
 - Error control coding
 - Frequency regulation and administration

Day Two

- 802.11 Physical Layer (PHY) Operations
 - 802.11b channel sets and modulation
 - The 802.11b radio and its performance
 - 802.11b PHY packet structure and data rates
 - 802.11g channel sets and modulation
 - 802.11g PHY packet structure and data rates
 - 802.11a channel sets and comparison to 802.11g
- 802.11 Medium Access Control (MAC) Operations
 - Carrier-sense multiple-access operation and throughput
 - Distributed coordination function (DCF) operation
 - Point coordination function (PCF) operation
 - MAC frame construction and examples
 - Throughput and frame transmission times
 - 802.11 management operations

Day Three

- 802.11 Upgrades and Enhancements
 - Types of security threats
 - Operation of 802.11 Wired Equivalent Privacy (WEP)
 - 802.11 WEP weaknesses
 - Temporal Key Integrity Protocol (TKIP)
 - Advanced Encryption Standard (AES)
 - 802.1X port-based network access control
 - IEEE 802.11e quality-of-service (QoS)
 - IEEE 802.11n higher data rates
- Coexistence
 - Consequences of interference
 - Wi-Fi deployment for interference-free operations
 - Coexisting with other wireless networks
 - Collocated Wi-Fi and Bluetooth nodes
 - Microwave ovens
 - Operation aboard commercial aircraft
- Wrap-Up: Course Recap, Q/A, and Evaluations

How You Will Learn

- An experienced engineer/instructor who is well-versed in a variety of short-range wireless technologies including WiFi will teach this course.
- The course will be taught as a hands-on tutorial with discussion, exercises, and other activities interspersed throughout the class.
- The instructor will use real-life examples, applications, and exercises to make the class more practical.
- You will receive a participant handbook designed to provide a record of the instructor presentation as well as your own notes and insights for later recall, reference, and application.

Revised

April 20, 2008f