

# WIRELESS LAN Fundamentals Workshop (WL-FDN, 4 days)

## Course Description

You will learn the fundamental WLAN concepts and protocols from an implementation and technical support perspective. The topics cover fundamental WLAN elements, including understanding of radio frequency and modulation issues, transmission protocols, frame formats and security concerns.

This course is fast-paced, with a broad range of exercises designed to provide the participant with real understanding and experience in the implementation and support of Wireless LAN infrastructure



## Who Can Benefit

- Network and Systems Administrators
- LAN Designers and Infrastructure Integrators and Consultants
- Network, Infrastructure and general IT managers

## Prerequisites

**To succeed fully in this course, participants should have:**

- Basic understanding and experience in LAN technologies

## Skills Gained

**Upon completion of this course, participants should understand:**

- Wireless LAN Environment
- Bodies and Organizations defining interoperability standards and regulations
- Radio Transmission elements and modulation concepts
- Robust Security Network architecture
- Wireless Channel control and monitoring
- Wireless LAN analysis and troubleshooting
- Performance analysis and optimization

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### REGISTRATION AND INFORMATION

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## Course Content

### Module 1 WLAN Overview

- Wireless Applications
- The Wireless Link
- Wireless Networking Technologies
- Peer to Peer
- WLANs
- Wireless Broadband
- Wireless Access Methods
- Fixed Access
- Nomadic Access
- Mobile Access
- Wi-Fi Versatility

### Module 2 - Wi-Fi Standards

- WLAN Organizations
- The IEEE
- The Wi-Fi Alliance
- The IEEE 802.11 Standard
- The 802.11 Physical Layer
- The 802.11 MAC Layer
- 802.11 Amendments and Wi-Fi Certifications
- 802.11a
- 802.11b
- 802.11g
- 802.11n
- 802.11 and Wi-Fi

### Module 3 - WLAN Infrastructure

- The Basic Service Set
- Access Points
- Basic AP Operation
- WLAN Controllers
- Wi-Fi Stations
- Wi-Fi Client Software
- Service Set Identifier
- The Extended Service Set

### Module 4 - Radio Frequency Foundations

- Radio Frequency
- Signal Strength
- Reading Signal Strength
- Transmitter Power
- Antenna Operation
- Baseband RF to Radio Waves
- Antenna Types
- Omnidirectional Antennas
- Semidirectional Antennas
- Highly Directional Antennas
- Antenna Coverage Patterns
- Elevation Measurements
- Azimuth Measurements
- Signal Degradation
- Multipath

### Module 5 - Robust Security Networks

- 802.11 Security Amendments
- 802.11i Robust Security Networks
- RSN Authentication Options
- Preshared Key
- Small Networks
- WPA-PSK Vulnerability
- Preshared Key Design
- 802.1X
- Extensible Authentication Protocol
- 802.1X/EAP Design
- 802.1X/EAP Authentication
- WLAN Encryption
- Wired Equivalent Privacy
- RC4 Encryption
- Secure Stream Cipher
- TKIP Operation
- AES-CCMP Operation
- 802.11i Encryption
- Automatic Encryption Selection

### Module 6 - WLAN Operation

- 2.4-GHz Channels
- 2.4-GHz Networks
- Channel Design
- 5-GHz Channels
- 802.11a Networks
- 802.11 Channel Access
- CSMA/CA
- A Clear Channel
- Interframe Spacing
- Random Backoff Time
- The Contention Window
- Winning Arbitration
- Acknowledgments
- After the Acknowledgment
- An Arbitration Example
- Timelines
- IFS Timelines
- Frame Timelines
- ACK Timelines
- Effects of Arbitration

### Module 7 - Mixed Mode Operation

- Mixed Mode Networks
- 802.11b/g Mixed Mode
- Protection Mechanism
- Enabling Protection
- 802.11g/n Mixed Mode
- PLCP Header
- 802.11g/n Mixed Mode AP
- Nearby 802.11g AP
- 802.11n 2.4 GHz Problems
- 802.11n 5 GHz
- Mixed Mode Best Practices

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## Module 8 - Troubleshooting Station Connections

- Common Station Problems
- Radio On/Off Switches
- Wi-Fi Client Utilities
- Automatic SSID Configuration
- Manual SSID Configuration
- Security Configuration
- Reading Signal Strength
- Power Management Protocols
- 802.11 Power Management
- Automatic Power Save Delivery
- Power Management Settings

## Module 9 - WLAN Analysis

- Packet Capture
- Passive Monitoring
- Monitor Mode
- Protocol Analysis Software
- The Wi-Fi Connection
- Beyond Basic Troubleshooting
- Connection Fundamentals
- Scanning Analysis
- Authentication and Association
- Roaming
- Roaming Problems
- Secure Connections
- WEP Connections
- WPA-PSK Connections
- 802.1X/EAP Connections
- Connection Loss

## Module 10 - WLAN Channel Analysis

- Analyzing the Channel
- Channel Efficiency
- Data Rate Fundamentals
- Wi-Fi Overhead
- Wi-Fi Collisions
- 802.11 Acknowledgments
- Performance Degradation
- Interference Types
- Using Protocol Analyzers

## Module 11 - Optimization

- Station Configuration
- Additional Station Settings
- Roaming Aggressiveness
- Disable Upon Wired Connect
- Pre-Login Connections
- Station Optimization Best Practices
- Basic AP Configuration
- Enterprise WLAN Needs
- Optional AP Settings
- Wireless Network Management Systems
- WNMS Deployment
- Wireless VLANs
- Wireless VLAN Security
- Picocells
- Power Output Settings
- Channel Reuse
- Redundancy
- Intra-BSS Blocking
- RTS/CTS
- AP Optimization Best Practices

## Module 12 - QoS Configuration

- Legacy WLANs
- QoS Needs
- QBSS Load
- Enhanced Distributed Channel Access
- AIFSN Lengths
- The Contention Window (QoS)
- TXOP
- TXOP and CFB
- Admission Control
- TSPECs
- Priority Settings
- Power Management Options
- 802.11 Power Management
- Unscheduled APSD
- Power Management Configuration
- QoS Configuration Best Practices

## Module 13 - Site Surveys

- Radio Frequency Problems
- Site Surveys
- Survey Preparation
- Kit Preparation
- WLAN Simulation Software
- Predictive Coverage Modeling
- High Cost, High Benefit
- Spot Checks
- Performing Spot Checks
- Live Survey Software
- Coverage Mapping
- Survey Reporting
- Site Survey Best Practices

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## Module 14 - Channel Optimization

- Section Topics
- Section Objectives
- RF Difficulties
- Handling RF Problems
- Roaming
- Cell Overlap
- Roaming Behavior
- Common WLAN Types
- Basic Coverage WLANs
- High Density WLANs
- Application-Based WLANs
- Channel Optimization Best Practices

## Module 15 - Security Design Considerations

- RSN Concerns
- General Security Approach
- Wireless Data Security
- Eavesdropping
- Encryption Options
- Network Security
- RF Denial of Service
- Client Testing Software
- DoS: Connection Loss
- DoS: Flooding
- DoS Response
- Rogue APs
- MAC Address Spoofing
- VPNs
- Endpoint Security
- NAC
- ESS
- Wireless vs. Mobile End Users
- Controller-Based Segmentation
- Enterprise WIDS
- Enterprise WIDS Summary
- Security Design Best Practices

## Module 16 - 802.11n and Beyond

- Next Generation Improvements
- 802.11n
- 802.16
- MIMO WLANs
- MIMO Operation
- Secure Roaming
- Fast Transition Basics
- Fast Transition Options
- Fast Transition Guidelines
- Mesh Networks
- Mesh Networking Technology
- Equipment Variations
- Outdoor Access
- Wi-Fi Broadband Access
- Home Media Streaming
- Direct Link Setup
- Fixed Mobile Convergence
- FMC Architectures

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