

# Enterprise Wi-Fi Analysis & Troubleshooting – CWAP

## Course Contents

### **Principles of WLAN Communication**

- 802.11 Working Group
- OSI reference model and the 802.11 PHY and MAC
- Communication sublayers and data units
- WLAN architecture components
- Organization of station forwarding
- Addressing and internetworking operation
- Modern WLAN product architectures

### **Physical (PHY) and MAC Layer Formats and Technologies**

- Physical layer functions
- Preamble function and format
- Header purpose and structure
- Analysis of PHY problems
- Physical PPDU formats
- 802.11b
- 802.11a
- 802.11g
- 802.11n
- MAC frame components
- MAC encapsulation
- Fields and subfields of the MAC header
- Frame Control
- Frame types and subtypes and their uses
- Addressing
- Frame body

- Data frame format
- Control frame format
- Management frame format
- Information elements and fields

### **Protocol Operation**

- Beacons and synchronization
- Scanning
- Client state machine
- 802.11 contention
- QoS
- Admission control
- Band steering and airtime fairness mechanisms
- Fragmentation
- Acknowledgments and Block acknowledgments
- Protection mechanisms and backward compatibility
- Power management
- Dynamic Frequency Selection (DFS) and Transmit Power Control (TPC)
- Security components, methods, and exchanges
- Roaming procedures exchanges
- Future protocol enhancements

### **802.11n**

- Transmit beamforming
- Spatial multiplexing
- Maximal Ratio Combining (MRC)
- Space-Time Block Coding
- 40 MHz channels
- Frame aggregation
- HT-OFDM format
- Modulation and Coding Schemes (MCS)

- HT frame formatting
- And More

### **Protocol Analysis Tools and Methodology**

- Troubleshooting methodology
- Protocol analyzer types
- Analysis NIC/adaptor selection and constraints
- Interpreting results based on location
- Analyzer settings and features
- Filtering and channel scanning
- Interpreting decodes
- Using advanced analysis features
- Assessing WLAN health and behavior factors
- Evaluating network statistics
- Troubleshooting common problems
- Wired analysis to support wireless network issues

### **Spectrum Analysis Tools and Methodology**

- Radio frequency behavior review
- Visualizing RF domains using spectrum measurement tools
- Spectrum analyzer types and operation
- Analyzer specifications and characteristics
- Understanding spectrum data presentation
- Interpreting plots and charts
- Common WLAN spectrum analyzer features
- Identifying transmit patterns
- Device classification and network impact
- Recognizing transmit signatures

## ***Hands-on Lab Exercises***

### **Protocol Analyzer Setup, Use, and In-Depth Analysis**

- Basic installation and familiarity with capabilities, configuration, and data display
- Opening, collecting, saving, and modifying capture files
- Exploring common features like device naming and prioritization, filtering traffic, and using coloring rules as analysis aides
- Configuration of the tool to perform live captures based on a set of desired collection criteria
- Identifying significant network behaviors, metrics, and statistics used to identify and isolate network problems
- Using expert features of the analyzer, such as conversation analysis
- Remote packet capture with an AP

### **Understanding Frame Components**

- Understanding the MAC header
- Comparing the three major frame types and their subtypes
- Analyzing frame formats of individual frame types
- Analyzing 802.11n frame components
- Identifying what additional information is reported by protocol analyzers
- Understanding what information is not visible in protocol analyzers

### **Frame Exchanges**

- Connectivity exchanges and sequences
- Legacy and modern security exchanges
- ERP and HT protection mechanisms
- Power save behavior
- Acknowledgments, block acknowledgments, and supporting action frames
- Dynamic rate switching
- Band steering
- And more

### **Troubleshooting Common Problems**

- Troubleshooting connectivity exchanges

- Troubleshooting 802.1X and EAP exchanges
- Troubleshooting roaming

### **Spectrum Analyzer Setup, Use, and In-Depth Analysis**

- Installing the analyzer and becoming familiar with display and navigation
- Understanding the “RF perspective” provided by each plot and chart
- Using built-in features like markers and traces as well as automated device identification
- Characterizing the behaviors of an interference source
- Assessing the impact of an interference source
- Determining the impact of transmitter proximity on interference and spectrum displays
- Identifying signatures of common transmitters
- Remote spectrum analysis with an AP