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

- Beaconing 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/adapter 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