

## **Cisco CCNP 642-845 Optimizing Converged Cisco Networks (ONT)**

- **Course Number:** 642-845
- **Length:** 5 Day(s)

### **Certification Exam**

This course will help you prepare for the following exam:

- **Cisco CCNP Exam 642-845:** Optimizing Converged Cisco Networks (ONT)

### **Course Overview**

The Optimizing Converged Cisco Networks (ONT) course includes topics on implementing a VOIP network, implementing QoS on converged networks, specific IP QoS mechanisms for implementing the DiffServ QoS model, AutoQoS, wireless security and basic wireless management.

### **Prerequisites**

- Cisco CCNA 640-801
- Cisco CCNP 642-901(BSCI)
- Cisco CCNP 642-812(BCMSN)
- Cisco CCNP 642-825(ISCW)

### **Audience**

The ONT course is geared towards IT professionals with an advanced or journeyman knowledge of networks.

### **Course Outline**

- Course Introduction
- Chapter 1 - Network Requirements
- Network Requirements
- IIN and Cisco SONA Framework
- Intelligent Information Network
- Cisco SONA Framework
- Cisco SONA Layers
- Cisco Network Models
- Cisco Enterprise Architecture
- Cisco Hierarchical Network Model
- Example: Enterprise Network
- Traffic Conditions in a Converged Network
- Network Traffic Mix and Requirements
- Example: Integrated Services

- Chapter 1 Review
- Chapter 2 - Describe Cisco VoIP Implementations
- Introducing VoIP Implementations
- Benefits of Packet Telephony Networks
- Packet Telephony Components
- Two Basic Methods for Voice over IP
- Analog Interfaces
- Digital Interfaces
- Stages of a Phone Call
- Distributed vs. Centralized Call Control
- Distributed Call Control
- Centralized Call Control
- Section 1 Review
- Digitizing and Packetizing Voice
- Converting Analog to Digital
- Analog-to-Digital Conversion Steps
- Converting Digital to Analog
- Digital-to-Analog Conversion Steps
- The Nyquist Theorem
- Example: Sampling of Voice
- Quantization
- Quantization Techniques
- Example: Quantization of Voice
- Digital Voice Encoding
- Compression Bandwidth Requirements
- Voice Codec Characteristics
- Mean Opinion Score
- What is a DSP?
- Example: DSP Used for Conferencing
- Example: DSP Used for Transcoding
- Section 2 Review
- Encapsulating Voice Packets for Transport
- Voice Transport in Circuit-Based Networks
- Voice Transport in IP Networks
- Explaining Protocols Used in Voice Encapsulation
- Which Protocols to Use for VoIP?
- Voice Encapsulation Examples
- Reducing Header Overhead
- Voice Encapsulation Overhead
- RTP Header Compression
- When to Use RTP Header Compression
- Section 3 Review
- Calculating Bandwidth Requirements
- Factors Influencing Bandwidth
- Bandwidth Implications of Codecs

- How the Packetization Period Impacts VoIP Packet Size and Rate
- VoIP Packet Size and Packet Rate Examples
- Data Link Overhead
- Data Link Overhead is Different per Link
- Security and Tunneling Overhead
- Extra Headers in Security and Tunneling Protocols
- Example: VoIP over IPsec VPN
- Calculating the Total Bandwidth for a VoIP Call
- Total Bandwidth Required for a VoIP Call
- Total Bandwidth Calculation Procedure
- Quick Bandwidth Calculation
- Effects of VAD on Bandwidth
- VAD Characteristics
- VAD Bandwidth-Reduction Examples
- Section 4 Review
- Implementing Voice Support in Enterprise Networks
- Enterprise Voice Implementations
- Voice Gateway Functions on a Cisco Router
- Cisco Unified CallManager Functions
- Example: Signaling and Call Processing
- Enterprise IP Telephony Deployment Models
- Example: Single Site
- Example: Multisite with Centralized Call Processing
- Example: Clustering over WAN
- Identifying Voice Commands in IOS Configurations
- Identifying Voice Commands in Cisco IOS VoIP Configurations
- What is CAC?
- Example: CAC Deployment
- Demo - Commands to Create a Route Pattern for VoIP Traffic
- Section 5 Review
- Chapter 3 - Introduction to IP QoS
- Introducing QoS
- Converged Networks Quality Issues
- Available Bandwidth
- Lack of Bandwidth
- Bandwidth Availability
- Efficient Use of Available Bandwidth
- End-to-End Delay
- Types of Delay
- The Impact of Delay on Quality
- Ways to Reduce Delay
- Efficient Use of Ways to Reduce Delay
- Packet Loss
- Impact of Packet Loss
- Ways to Prevent Packet Loss
- Packet Loss Solution

- QoS Defined
- Implementing QoS
- The Requirements of Different Traffic Types
- Identify Traffic and Its Requirements
- The Requirements of Different Traffic Types (Cont.)
- QoS Policy
- Section 1 Review
- Identifying Models for Implementing QoS
- QoS Models
- Best Effort Model
- Benefits and Drawbacks of the Best-Effort Model
- IntServ Model
- IntServ Functions
- Benefits and Drawbacks of the IntServ Model
- RSVP and the IntServ QoS Model
- Resource Reservation Protocol
- RSVP Operation
- RSVP in Action
- DiffServ Model
- Benefits and Drawbacks of the DiffServ Model
- Section 2 Review
- Identifying Methods for Implementing QoS
- Methods for Implementing QoS Policy
- Legacy CLI
- Legacy CLI Usage Guidelines
- Legacy CLI Example
- Modular QoS CLI
- Modular QoS CLI Components
- Class Maps
- Configuring Class Maps
- ACLs for Traffic Classification
- Policy Maps
- Configuring Policy Maps
- Service Policy
- Attaching Service Policies to Interfaces
- MQC Example
- Basic Verification Commands
- AutoQoS
- Cisco AutoQoS
- The Features of Cisco AutoQoS
- Cisco AutoQoS Usage Guidelines
- Cisco AutoQoS Example
- SDM QoS Wizard
- QoS Features
- Getting Started with Cisco SDM
- Create QoS Policy

- QoS Wizard
- Interface Selection
- QoS Policy Generation
- QoS Wizard (Cont.)
- Command Delivery Status
- QoS Status
- QoS Implementation Methods Compared
- Demo - Creating Manual Pieces through Modular QoS
- Section 3 Review
- Chapter 4 - Implement the DiffServ QoS Model
- Introducing Classification and Marking
- Classification
- Marking
- Classification and Marking at the Link Layer
- Classification and Marking in the LAN with IEEE 802.1Q
- Classification and Marking in the Enterprise
- DiffServ Model
- IP Precedence and DSCP Compatibility
- Per Hop Behaviors
- EF PHB
- AF PHB
- DSCP Summary
- Mapping CoS to Network Layer QoS
- QoS Service Class Defined
- Example: Defining QoS Service Class
- Implementing QoS Policy Using a QoS Service Class
- Example: Application Service Classes
- Trust Boundaries
- Trust Boundaries: Classify Where?
- Trust Boundaries: Mark Where?
- Section 1 Review
- Using NBAR for Classification
- Network Based Application Recognition
- NBAR Application Support
- Packet Description Language Module
- Protocol Discovery
- NBAR Protocol Discovery
- Configuring and Monitoring Protocol Discovery
- Configuring NBAR for Static Protocols
- Example
- Configuring Stateful NBAR for Dynamic Protocols
- Example
- Demo -Working with Modular QoS and NBAR
- Section 2 Review
- Introducing Queuing Implementations
- Congestion and Queuing

- Speed Mismatch
- Aggregation
- Queuing Algorithms
- Definition
- Congestion and Queuing (Cont.)
- Queuing Algorithms (Cont.)
- FIFO
- Priority Queuing
- Round Robin
- Weighted Round Robin
- Router Queuing Components
- The Software Queue
- The Hardware Queue
- Congestion on Software Interfaces
- Section 3 Review
- Configuring WFQ
- Weighted Fair Queuing
- WFQ Architecture and Benefits
- WFQ Architecture
- WFQ Classification
- WFQ Insertion and Drop Policy
- Benefits and Drawbacks of WFQ
- Configuring and Monitoring WFQ
- Configuring WFQ (Cont.)
- Additional WFQ Configuration Parameters
- Monitoring WFQ
- Section 4 Review
- Configuring CBWFQ and LLQ
- Describing Advanced Queuing Mechanisms
- Queuing Methods Combined
- Class-Based Weighted Fair Queuing
- CBWFQ Architecture and Benefits
- CBWFQ Architecture
- Classification
- Scheduling
- Available Bandwidth
- CBWFQ Benefits and Drawbacks
- Configuring and Monitoring CBWFQ
- Configuring CBWFQ
- Example of CBWFQ
- Monitoring CBWFQ
- Low Latency Queuing
- LLQ Architecture and Benefits
- LLQ Architecture
- LLQ Benefits
- Configuring and Monitoring LLQ

- Configuring LLQ
- Monitoring LLQ
- Demo - LLQ Configuration
- Section 5 Review
- Introducing Congestion Avoidance
- Managing Interface Congestion with Tail Drop
- Tail Drop Limitations
- TCP Synchronization
- TCP Delay, Jitter, and Starvation
- Random Early Detection
- RED Profiles
- RED Modes
- TCP Traffic Before and After RED
- Weighted Random Early Detection
- WRED Building Blocks
- Class-Based WRED
- Configuring CBWRED
- Changing the WRED Traffic Profile
- CBWFQ Using IP Precedence with CBWRED
- WRED Profiles: DSCP-Based WRED (Assured Forwarding)
- Configuring DSCP-Based CBWRED
- Changing the WRED Traffic Profile
- CBWRED Using DSCP with CBWFQ
- Monitoring CBWRED
- Demo - CBWRED Using DSCP with CBWFQ
- Section 6 Review
- Introducing Traffic Policing and Shaping
- Traffic Policing and Shaping Overview
- Why Use Policing?
- Why Use Shaping?
- Why Use Traffic Conditioners?
- Traffic Policing Example
- Traffic Policing and Shaping Example
- Policing vs. Shaping
- Measuring Traffic Rates
- Single Token Bucket
- Single Token Bucket Class-Based Policing
- Cisco IOS Traffic Policing and Shaping Mechanisms
- Cisco IOS Traffic Policing Mechanism
- Cisco IOS Traffic-Shaping Mechanisms
- Applying Traffic Conditioners
- Applying Rate Limiting
- Section 7 Review
- Understanding WAN Link Efficiency Mechanisms
- Link Efficiency Mechanisms Overview
- Compression

- Link Efficiency Mechanisms
- Layer 2 Payload Compression
- Layer 2 Payload Compression Results
- Header Compression
- Header Compression Results
- Large Packets “Freeze Out” Voice on Slow WAN Links
- Link Fragmentation and Interleaving
- Applying Link Efficiency Mechanisms
- Example
- Section 8 Review
- Implementing QoS Preclassify
- Virtual Private Networks
- VPN Types
- Encryption Overview
- VPN Protocols
- Implementing QoS with Preclassification
- QoS Preclassify
- QoS Preclassify Applications
- GRE Tunneling
- IPsec AH
- IPsec ESP
- QoS Pre-classification Deployment Options
- Configuring QoS Preclassify
- QoS Preclassify: Example
- Section 9 Review
- Deploying End-to-End QoS
- QoS SLAs
- Enterprise Network with Traditional Layer 2 Service
- Enterprise Network with IP Service
- Know the SLA Offered by Your Service Provider
- Typical SLA Requirements for Voice
- Deploying End-to-End QoS
- Enterprise Campus QoS Implementations
- Campus QoS General Guidelines
- Campus Access / Distribution Layer QoS Implementation
- WAN Edge QoS Implementations
- Traffic Leaving Enterprise Network
- Traffic Leaving Service Provider Network
- Managed Customer Edge with Three Service Classes
- WAN Edge Design
- What Is CoPP?
- Cisco Router Planes
- CoPP Deployment
- CoPP Example
- Section 10 Review
- Chapter 5 - Implement Cisco AutoQoS

- Introducing Cisco AutoQoS
- Cisco AutoQoS
- Enterprise QoS Challenges
- Cisco AutoQoS: Automating the Delivery of Network QoS
- Cisco AutoQoS Evolution
- Cisco AutoQoS: Automating Elements of QoS Deployment
- Protocol Discovery with NBAR
- Cisco AutoQoS Enterprise: Router Deployment Restrictions
- AutoQoS on Enterprise: Deployment Restrictions
- Cisco AutoQoS: Router Design Considerations
- Configuring Cisco AutoQoS: Router Prerequisites
- Deploying AutoQoS for Enterprise: Two-Phase
- Configuring AutoQoS: Traffic Profiling with Autodiscovery
- Configuring AutoQoS: QoS Policies
- Cisco AutoQoS for Enterprise: Router Configuration Example
- Deploying Cisco AutoQoS VoIP on Switches
- AutoQoS on Catalyst 2950 (EI) and 3550 Switches
- Cisco AutoQoS VoIP Switch Configuration Example
- Verifying AutoQoS
- How to Verify Cisco AutoQoS
- Monitoring AutoQoS
- Section 1 Review
- Mitigating Common Cisco AutoQoS Issues
- Automation with Cisco AutoQoS
- QoS Mechanisms Must Meet Enterprise QoS Requirements
- DiffServ QoS Mechanisms Enabled by Cisco AutoQoS
- Automated Cisco AutoQoS DiffServ Class Provisioning
- Interpreting AutoQoS Configurations
- Interpreting Generated Cisco AutoQoS Configuration
- Interpreting the show auto qos Command Output
- Modifying the Active AutoQoS Configuration with MQC
- When Is Manual Modification of AutoQoS Configuration Required?
- Classification
- Policy
- Section 2 Review
- Chapter 6 - Implement Wireless Scalability
- Implementing WLAN QoS
- WLAN and LAN
- The Need for WLAN QoS
- The Need for QoS Wireless
- WLAN QoS Description
- WLAN QoS Queuing Overview
- WLAN QoS RF Backoff Timing
- Lightweight Access Point Split MAC Architecture
- QoS WLAN Deployment Issues
- QoS Description

- WLAN QoS Implementation
- QoS Implementation Overview
- QoS Implementation— Ethernet to Controller
- Feature: QoS Packet-Marking Translations
- From Access Point to Wireless Client
- From Client to Access Point
- Traffic from Access Point to Controller
- From Controller to Ethernet Switch
- QoS Implementation
- WLAN QoS Configuration
- QoS-Configurable Profiles
- Configuring WLAN IDs for QoS
- Section 1 Review
- Introducing 802.1x
- The Need for WLAN Security
- Security Methods Authentication and Encryption
- WLAN Security Issues
- WEP Attacks
- Overview of WLAN Security
- 802.11 WEP
- 802.11 Open Authentication
- 802.11 Shared Key Authentication
- Cisco Enhanced 802.11 WEP Security
- Enhanced 802.11 Security
- Encryption—TKIP and MIC
- Encryption—AES
- 802.1x Overview
- 802.1x Authentication Overview
- 802.1x Authentication Key Benefits
- 802.1x and EAP Authentication Protocols
- Components Required for 802.1x Authentication
- EAP-Cisco Wireless
- Cisco LEAP
- Cisco LEAP Authentication
- EAP-FAST
- EAP-FAST: Flexible Authentication via Secure Tunneling
- EAP-FAST Authentication
- EAP-TLS
- EAP-TLS Authentication
- EAP-PEAP
- EAP-PEAP Authentication
- Wi-Fi Protected Access
- 802.11i and WPA Authentication and Key Management Overview
- WPA Issues
- IEEE 802.11i—WPA2
- Wireless Intrusion Detection Systems

- WPA and WPA2 Modes
- WPA2 Issues
- Section 2 Review
- Configuring Encryption and Authentication on Lightweight Access Points
- Open Authentication
- Static WEP Key Authentication
- Static WEP Key
- WPA Preshared Key
- Web Authentication
- 802.1x Authentication
- WPA with 802.1x
- WPA2
- Section 3 Review
- Managing WLANs
- Business Drivers
- Cisco Unified Wireless Network
- Cisco WLAN Implementation
- Describing WLAN Components
- Wireless LAN Components
- Comparison of WLAN Solutions
- The WLAN Solution Engine
- CiscoWorks WLSE Software Features
- CiscoWorks WLSE Key Benefits
- CiscoWorks WLSE and CiscoWorks WLSE Express
- Simplified CiscoWorks WLSE Express Setup
- CiscoWorks WLSE Configuration Template
- CiscoWorks WLSE Benefits
- The Cisco Wireless Control System
- Cisco WCS Overview
- Cisco WCS Location Tracking Options
- Cisco WCS Feature Set Overview
- Cisco WCS Base Software Features
- Cisco WCS Location Software Features
- Cisco WCS System Requirements
- Cisco WCS Network Summary Page
- Cisco WCS Controller Summary Page
- Wireless Location Appliance
- Cisco Wireless Location Appliance Overview
- Cisco Wireless Location Appliance Architecture
- Cisco Wireless Location Appliance Applications
- Cisco WCS Configuration Example
- Cisco WCS Server Login
- Cisco WCS Network Summary
- Adding a Controller
- Configure > Controller > Add Controller > Go
- Configure > Access Points

- Cisco WCS Maps
- Monitor > Maps > New Campus > Go
- Adding a New Building
- Rogue AP Detection
- Detecting and Locating Rogue Access Points
- Rogue Access Points Alarms
- Rogue Access Points Location
- Section 4 Review
- Course Closure