

# Course overview

## CompTIA Convergence+ Certification

(N001eng)



### Overview and objectives

This 5–day course prepares students for the CompTIA Convergence+ Certification Exam CT0-101. Beyond certification preparation, this comprehensive course gives students a thorough understanding of the essential concepts of networking, voice, and data communications and their convergence on a single network.

This course also prepares students for many real-world tasks they will likely face each day as network administrators. They will learn the basics for converged data, voice, and multimedia network requirements analysis, how to specify, implement, and manage the basic network components. And, students will learn basic problem analysis, troubleshooting, and issue resolution for converged technologies. This course will show how different types of network engineering quality of service issues affect payload transport between devices in different network structures. Students will be able to differentiate between VoIP communication protocols and encoding schemes. This course covers the essential principles of network operation, maintenance, and design as students learn to use network devices to optimize network traffic for multimedia traffic. Students will learn the essential requirements for building reliable, redundant, and recoverable multi-payload type network infrastructures.

By studying these and other intricate details of network design, operation, and administration, from network engineering to protocols, management, and security, students will gain valuable knowledge and the experience needed to implement a complete network solution to suit a converged network environment.

On course completion, students will be able to:

- Demonstrate application of traffic engineering concepts, quality of service (QoS) and network performance.
- Describe fundamentals of voice systems including dialing plans and identification of network endpoints.
- Describe networking technologies used in a converged network including the OSI model layers and network models.
- Identify methods of encoding, decoding, and compression for rich media transmission.
- Identify different types of messaging, collaboration, contact center, and mobility applications.
- Identify benefits of using different video and audio standards and the impact on the performance on the network.
- Identify the functions of hardware components as used on a converged network.
- Identify common symptoms and problems on a converged network.
- Describe and use tools and commands to monitor network performance including proper administration procedures.
- Explain concepts and components of security design and how they affect the converged network.

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### Certification track

This course will prepare students to take the CT0-101 CompTIA Convergence+ Certification exam, for the objectives released in 2007.

CompTIA Convergence+ Certification has been created as a benchmark for knowledge and skills in the area of communications technologies, where IP networks are used to deliver data, voice, video, and other broadcast media. The qualification is endorsed by Avaya, Siemens, and Intel among other leading vendors.



### Target audience

This course is designed for network engineers with responsibility for designing, implementing, and managing converged networks and IP telephony solutions.

### Course prerequisites

CompTIA Network+ Certification is an essential prerequisite for this course. Candidates are also encouraged to have had 18 to 24 months of work experience in the areas of data networking, VoIP, and other convergence related technologies.

### Course contents

- **Telecommunications Traffic Engineering** • Trunks • Types of Trunks • Special Access Trunks • Carried Load • Probability • Grade of Service • Trunk Usage Measurements • The Erlang B Traffic Formula • Erlang C and Poisson Tables • No Formula Is Perfect • Estimating Total System Capacity • Data Prioritization • Protocol Reservation • Session Fairness • Traffic Shaping
- **Voice System Fundamentals** • Legacy Hybrid and IP Telephony Systems • Key Systems • Hybrid Systems • IP Telephony Systems • Voice Transmission Fundamentals • Encoding, Decoding, and Compression • Digitizing the Voice • How a Call is Made • Long Distance Voice Routing • Signaling
- **Number and Dialing Plan Components** • Prefixes • Telephone Numbering System • Special Area Codes • Number Formats • Number Blocking • Digit Translation • Toll Fraud • ENUM • Local Number Portability (LNP) • Emergency Service
- **Converged Network Endpoints** • Voice Terminals • IP Phones • TDM Phones • Analog Phones • Dialup Hard Phone • PC-Based Soft Phones • Microphones and Headsets or Speakers • USB Hand Sets • SIP Phones • PDA Soft Phones • WiFi Phones
- **General QoS Concepts** • Network Requirements for Convergence • Converged Network Architecture • Voice Quality • The QoS Parameters • IP Header Features • RSVP • CBQ • COPS • MPLS • Policy Routing • RED • WFQ • WRED • Traffic Prioritization • 802.1Q VLAN Standard • 802.1p Traffic Prioritization Standard • Using QoS to Optimize Voice Quality in VoIP Networks

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- **Network Performance** • Network Performance Issues • Voice Quality • Latency • Packet Loss • Port Settings • Bandwidth • Network Capacity Baseline • Bottlenecks • Network Throughput • Link Utilization • Throughput • Impact to the Network when Adding/Modifying Converged Applications
- **Switches** • LAN Switching • LAN Switch Features • Switching Techniques • Ethernet Switch Bandwidth • Multilayer Switch Technology • Process of Switching Frames • Redundancy and Active Loops • Spanning Tree Algorithm • Selecting Switches • Switch Configurations • Switch Features and Backbone Switch Considerations • Summary of Switch Features
- **Physical and Logical Port Settings** • Features Common to Both User Datagram Protocol and Transmission Control Protocol
- **Network Classifications and Topologies** • Network Classification • Network Topologies
- **Routing** • Introduction to Routers • How Routers Move Packets Between Networks • Routing Tables • Related Devices • Direct Routing • Indirect Routing • Static Routing • Default Routes • Dynamic Routing
- **Protocols** • The TCP/IP Protocol Suite • TCP/IP Protocol Layers and the OSI Model • Communication Using TCP/IP • Features Common to Both UDP and TCP • UDP • TCP • IP • Real-time Transport Protocol • Compressed RTP • Real-Time Transport Control Protocol
- **Transmission Mediums** • Cables • Coaxial Cable • Twisted Pair Cabling • Other Twisted Pair Cabling Characteristics • Fiber Optic Cable • Digital Subscriber Line • Wireless Transmission • How Wireless Transmission Works • Competition for the Finite RF Spectrum • Wireless Networking Applications • Ethernet • Advantages and Disadvantages of Ethernet • Ethernet Configurations • Fast Ethernet • Gigabit Ethernet • Evolution-Data Optimized (EVDO) • Cable Applications • Virtual Private Networks (VPNs)
- **Signaling Basics** • Types of Signals • Supervisory Signals • Address Signals • Alerting Signals • Control Signals • In-Band vs. Out-of-Band Signaling
- **Methods of Encoding, Decoding and Compression** • Analog to Digital • Voice Conversations • Standards • MPEG, MP3 • MPEG.x
- **Messaging Applications** • Voice Mail Systems • Voice Mail Features • Automated Attendants • Text Messaging: E-Mail, News, and Chat • E-Mail • E-Mail Addresses • E-Mail Protocols • Mail Server Configuration • Store-and-Forward Mail Systems • Chatting • Instant Messaging • Video Messaging • Unified Messaging
- **Collaboration Applications** • Audio Conferencing • Internet Multimedia • Basic IP Videoconferencing System • Types of Videoconferencing Systems • Data Sharing
- **Computer Telephony Integration and Call Center Automation** • CTI in Action • Evolution of CTI • Levels of Call Center Automation
- **Computer Telephony Integration Concepts** • Media Processing and Call Control • CTI Components • Key CTI Implementation Issues • Enabling CTI in the Avaya Communication Manager

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- **Web-Enabled Call Centers** • Internet Callback • Callback Architectures • Web Chats • Customer Interaction
- **Call Routing** • Call Routing Patterns • Reports • Configurations • Customer Handling Procedures • Priority Queuing • ANI Routing • DNIS Routing • SBR • EBR • Intelligent Call Queuing • Call Queuing • Call Recording
- **Interactive Voice Response** • Audio Computer Application • Data Input • Links to Outside Systems • Data Output • Trend Toward Integrated Solutions • System Configurations • Common IVR Mistakes
- **Mobility Components** • Softphone • Application Layer • Transport Layer • Network Layer • Network Interface Layer • Destination Station • Presence • Cellular Integration Services • Find-Me/Follow-Me: 500 Numbers
- **H.323 Standard for Packet Multimedia** • Overview of the H.323 Standard • Other Standards of the H.323 Family • Fundamental H.323 Network Components • MGCP • The H.323 Protocols and Their Effect • on Voice Stream QoS • Integration with the Digital PSTN • Network Infrastructure Requirements
- **H.323 Call Processing** • H.323 Call Progression Phases • H.323v2 fastStart • SIP • SS7 to ITSP Call Progression
- **Session Initiation Protocol** • SIP • SIP Messages • SIP Servers • SIP Clients • SDP • Creating a SIP Session
- **Rich Media Transmission Methods** • Webcasting • Audio and Video Streaming • Unicasting vs. Multicasting (audio and video)
- **Video Standards** • H.323 • H.320 • H.261 • H.263 and H.263+ • H.264 (MPEG-4 Part 10) or Advanced Video Coding (AVC) • Advanced video coding for generic audiovisual services • MPEG (MPEG-1, MPEG-2, MPEG-4) • CIF/FCIF • SIF • QCIF • HD • G.711 Companding Algorithms • G.722 • G.724—ADPCM • G.729a • Document Conferencing: T.120 Series • iLBC • NTSC • PAL • SECAM
- **The OSI Model Layers** • The Physical Layer • The Network Layer • The Transport Layer • The Session Layer • The Presentation Layer • The Application Layer
- **Network Modules** • Centralized Network vs. Decentralized Network • Configuration of Converged Application Resources • Branch vs. Edge Network Solutions • Network Flattening vs. Tier Network
- **Routers and Switches** • Routers • Router Functionality • Multiprotocol Routing • How Routers Move Packets Between Networks • Switches—Managed vs. Unmanaged • Switch Functionality • Traffic Isolation With Switches
- **Media Servers** • S8700 Media Server • S8500 • S8300 Media Server with G700 Gateway • S8100
- **Gateways** • Media Gateways • TDM/IP Gateway • SIP Gateway

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- **Private Branch Exchange** • PBX Components • Making a Call on a PBX • Call Routing • Supplementary PBX Features • PBX Enhancements • PBX Costs and Requirements • Hybrid PBX • IP Only PBX
- **Router Firewalls** • LAN Firewalls • Internet Firewalls • Types of Firewalls
- **CSU and DSU** • Channel Service Unit (CSU) • Data Service Unit (DSU) • Connecting to Digital Networks • DTE/CSU Interface • Smart Jack • Subrate Facilities • Digital Data Services (DDS)
- **Network Termination Device One (NT1)** • NT1: Network Termination Device, Type 1
- **Admission Control and Traffic Shaping** • Admission Control • Traffic Shaping • Network Admission Policies • Admission Control and Traffic Shaping Applications
- **Session Border Controller** • Session Border Controller Overview
- **In-line Power Components** • In-line Power Components (Power over Ethernet) • PoE
- **Access Points** • What Is a Wireless Access Point? • Wireless APs • Access Point Modes • Common Access Point Options • Access Point Configuration and Management • Mounting
- **Modems** • Modem Concepts • Analog Modem Standards • Cable Modem Technology • DSL • DSLAMs
- **Converged Network Analysis and Problem Solving** • Network Troubleshooting Steps • Troubleshooting Methods
- **Common Symptoms and Problems** • Symptoms • Problems
- **Network Performance Monitoring Tools** • LAN Monitoring Tools • Baselineing • Software Tools for Baselineing and Testing • SNMP • Ping • Pathping • Traceroute • QoS Monitoring Tools • LAN and WAN Bandwidth Monitoring Tools • Voice/Video Quality Monitoring Tools
- **LAN Protocol Analyzer Operations** • Analyzers Overview
- **Traffic Management** • Data Sources • Gathering Data • Experiments • Sampling • Planning a Study
- **QoS Parameters, Router Parameters, Load Balancing** • IP Header Features • DiffServ • IntServ • CBQ • COPS • MPLS • Policy Routing • PQ • RED • Traffic Shaping • WFQ • WRED
- **Mean Opinion Score** • Mean Opinion Score • Administration Tasks and Procedures • Monitoring Log Files • Reporting • Managing Configuration Changes • Policy Management (e.g., QoS, Admission Controls, Registration) • Patching, Upgrades, and Backups • Grandfather/Father/Son • MAC (Moves, Adds, Changes) • Call Detail Record
- **Firewalls** • Firewalls • Firewall Functions • Firewalls Components • Screened Subnet Firewall
- **Internet Firewalls** • Types of Firewalls • Stance of a Firewall • Cost of a Firewall • Components of a Firewall System
- **Authentication** • User Authentication • Wireless Authentication • IEEE 802.1x • EAP

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- **Proxies** • Web Servers • Servers
- **Virtual Private Networks** • VPNs in Action • Why Enterprises are Using VPNs • Tunneling: The Underlying Technology for VPNs • Point-to-Point Tunneling Protocol (PPTP) • Layer 2 Forwarding Protocol • Layer 2 Tunneling Protocol • PPP Authentication Protocols • Internet Protocol Security • Open Standards Help Ensure Interoperability • Providing Effective Security • Data Encryption • PPP Callback Control • Filtering • Firewalls and VPNs • User Administration • Considerations For Choosing a VPN Solution • VPN Tunnel
- **NAPT** • NAT • A NAT Overview • Static Address Translation • Dynamic Address Translation • Masquerading/NAPT
- **Encryption** • Commonly Used Encryption Systems
- **IDS and IPS** • IDS • IPS • Types of IPSs
- **Antivirus** • Antivirus • Malicious Programming
- **VLANs** • Switched VLANs • Routed VLANs • VLAN Tagging • QoS • The Future of VLANs
- **Demilitarized Zone** • Demilitarized Zone
- **Glossary**
- **Course Quiz**
- **Index**