IP6OTS - IPV6 OPERATIONS AND TROUBLESHOOTING

Course Code: 860036

IPv6 Operations and Troubleshooting (IP6OTS) is an NterOne-exclusive 5-day course that provides network engineers and technicians that are working in the enterprise and federal government sectors with the knowledge and skills that are needed to operate, configure, and troubleshoot Cisco IPv6-enabled networks. This course was designed and developed by NterOne working with the Cisco Federal Team to address and align to the 2025 Federal System IPv6 Mandate.

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The course provides the following:

- Overview of IPv6 technologies
- IPv6 design and implementation
- IPv6 operations include: addressing, routing and transitionary methods
- Deployment of IPv6 in enterprise, government and service provider networks
- Case studies useful for deployment scenarios
- Current standards for deploying IPv6 in a single stack or dual stack environment

What You'll Learn

Upon completing this course, the learner will be able to meet these overall objectives:

- Describe the factors that led to the development of IPv6 and possible uses of this new IP structure.
- Describe the structure of the IPv6 address format, how IPv6 interacts with data link layer technologies, and how IPv6 is supported in Cisco IOS XE Software.
- Implement IPv6 services and applications.
- Understand the updates to IPv4 routing protocols needed to support IPv6 topologies.

- Understand multicast concepts and IPv6 multicast specifics.
- Evaluate the scenario and desired outcome and identify the best transition mechanism for the situation.
- Describe security issues, how security for IPv6 is different than for IPv4, and emerging practices for IPv6-enabled networks.
- Describe the deployment strategies with cloud providers and emerging technologies.

Who Needs to Attend

The primary audience for this course is as follows:

- Network engineers and technicians that are working in the enterprise or service provider sectors.

Prerequisites

The knowledge and skills that a learner should have before attending this course are as follows:

- Cisco CCNA certification or equivalent skillset

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VIRTUAL CLASSROOM LIVE	$4,292 USD	5 Day

Virtual Classroom Live Outline

Module 1: Introduction to IPv6

- Lesson 1: Explaining the Rationale for IPv6 IP Address Allocation
  - History of IPv4
  - Next Generation of IP
  - Legacy: Dual Stack
  - Modern: Single Stack
- Lesson 2: Evaluating IPv6 Features and Benefits
  - Features and Benefits of IPv6
  - IPv6 Addresses
  - IPv6 Autoconfiguration and Aggregation
  - Advanced IPv6 Features
  - Transition Strategies to IPv6
  - Single Stack Environments, Advantages and Features
- Lesson 3: Understanding Market Drivers
  - Market Growth for IPv6
  - Native IPv6 Content
  - Exhaustion of Core IPv4 Address Space
  - Mergers and Acquisitions Driving Change
    - Private IPv4 Addressing Conflicts
    - Exhaustion of the Private IPv4 Space
  - Growth of Internet
  - Number of devices
  - IOT
  - Multi-National Compliance Efforts & References (infographic displaying worldwide efforts)

Module 2: IPv6 Operations

- Lesson 1: Understanding the IPv6 Addressing Architecture
  - IPv6 Addressing Architecture
  - IPv6 Address Formats and Types
  - IPv6 Address Uses
  - Required IPv6 Addresses
- Lesson 2: Describing the IPv6 Header Format
  - IPv6 Header Changes and Benefits
  - IPv6 Header Fields
  - IPv6 Extension Headers
- Lesson 3: Enabling IPv6 on Hosts
  - Enabling IPv6 on Hosts
  - Enabling IPv6 on Windows
  - Enabling IPv6 on Mac OS X
  - Enabling IPv6 on Linux
- Lesson 4: Enabling IPv6 on Cisco Routers (IOSXE)
  - Enabling IPv6 on Cisco Routers
  - IPv6 Address Configuration
  - Autoconfiguration options
- Lesson 5: Using ICMPv6 and Neighbor Discovery
  - ICMPv6
    - ICMP Errors
    - Informational (e.g. Echo)
  - IPv6 over Data Link Layers
  - Neighbor Discovery
  - Stateless Autoconfiguration
  - Value of Autoconfiguration
  - Renumbering
  - Cisco Neighbor Discovery Command Syntax
  - Cisco Network Prefix Renumbering Scenario
  - ICMP MLD
  - General Overview of IPv6 Mobility

Module 3: IPv6 Services

- Lesson 1: Describing DNS in an IPv6 Environment
  - DNS Objects and Records
  - DNS Tree Structure
  - Dynamic DNS
- Lesson 2: Understanding DHCPv6 Operations
  - DHCPv6
  - DHCPv6 Operation
  - DHCPv6 Multicast Addresses
  - DHCPv6 Prefix Delegation Process
  - DHCPv6 Troubleshooting
- Lesson 3: Understanding QoS Support in an IPv6 Environment
  - IPv6 Header Fields Used for QoS
  - IPv6 and the Flow Label Field

        - IPv6 QoS Configuration
- Lesson 4: Using Cisco IOSXE Software Features
    - Cisco IOSXE Software Features
    - Cisco IOSXE IPv6 Tools
    - IPv6 Support for Cisco Discovery Protocol
    - Cisco Express Forwarding IPv6
    - IP Service Level Agreements

Module 4: IPv6-Enabled Routing Protocols

- Lesson 1: Itemizing IPv6 Aware Routing Protocol Types
    - Interior Gateway Routing Protocols
        - Distance Vector
        - RIPng
        - Legacy
        - EIGRPv6
        - Link-State
        - OSPFv3
        - Integrated ISIS
        - Gaining Popularity in Software Defined Spaces
    - Exterior Gateway Protocols
        - MP-BGPv4
- Lesson 2: Examining OSPFv3
    - OSPFv3 Key Characteristics
    - OSPFv3 Enhancements
    - OSPFv3 Configuration
    - OSPFv3 IPsec ESP Authentication and Encryption
    - OSPFv3 Advanced Functionalities
- Lesson 3: Examining EIGRP for IPv6
    - EIGRP for IPv6
    - Cisco IOSXE EIGRP for IPv6 Commands
- Lesson 4: Understanding MP-BGP
    - MP-BGP Support for IPv6 (AFI)
    - IPv6 as Payload and Transport Mechanism in MP-BGP
    - BGP Peering options
    - BGP Prefix Filtering
    - MP-BGP Configuration and Troubleshooting
- Lesson 5: Configuring IPv6 Policy-Based Routing
    - Policy-Based Routing
- Lesson 6: Configuring FHRP for IPv6
    - First-Hop Redundancy Protocols and Concepts
    - HSRP for IPv6
    - GLBP for IPv6
    - VRRP v3
- Lesson 7: Configuring Route Redistribution
    - Route Redistribution

Module 5: Troubleshooting IPv6 Unicast Operations and Services

- Lesson 1: Hands on Troubleshooting IPv6
    - Troubleshooting Live Lab and Lecture
        - Review and explore working IPv6 environment
        - Explore the Topology with Pre-configuration (like a consultant would see)
        - Addressing Schema
        - Validation
        - Explore CLI tools
        - Show commands
        - Use case
        - Command Options
        - Debug Operations
        - Use Case
        - Command Options
        - Traffic Analysis
        - CLI commands to visualize pathing and pathing issues
    - Using scripts insert Trouble Tickets
        - 3 Tier Levels
        - 3 Tickets per Tier
        - Tier 1 must be completed the remaining tiers exist to keep all students engaged and the facilitate the learning process due to increasing complexity.
        - Allow students to troubleshoot each ticket
        - Students will report the issue to the instructor and the tools used to identify it via direct chat.
        - If the Cited Issue is correct the instructor will tell the direct the student to remediate the fault.
        - Potential Gamification to stimulate interest and engagement
        - Make this more then a copy paste style

Module 6: IPv6 Multicast Services

- Lesson 1: Implementing Multicast in an IPv6 Network
    - IPv6 Multicast Addressing
    - PIM for IPv6
    - Rendezvous Points
    - MP-BGP for the IPv6 Multicast Address Family
    - How to Implement Multicasting in an IPv6 Network
    - IPv6 Multicast Application Example
- Lesson 2: Using IPv6 MLD
    - Multicast Listener Discovery
    - MLD Snooping and MLD Group Limits
    - Multicast User Authentication and Group Range Support

Module 7: IPv6 Transition Mechanisms

- Lesson 1: Implementing Dual-Stack
    - Dual-Stack Applications

        - Dual-Stack Node
        - The Dual-Stack Approach
- Lesson 2: Legacy Mechanisms
    - Overlay Tunnels
    - Manually Configured Tunnels
    - Automatic Tunnels
- Lesson 3: Transition to Single Stack Deployments
    - Advanced Use Case Scenario – Valley Health System
        - Environment cannot be Interrupted – No Downtime
        - Legacy Resources that will never support IPv6 must be supported
        - Transition to DNSv6 is Essential
    - DNSv6 (Migrating from A to AAAA)
    - Translation Options
        - NAT64
        - DNS64
        - SLB64

Module 8: IPv6 Security

- Lesson 1: Configuring IPv6 ACLs
    - IPv6 ACLs
    - TCAM and Application Specific Integrated Circuits
    - IPv6 ACL Configuration
    - Wildcard ACLs
    - Cisco IOSXE IPv6 Header Filtering
    - Cisco IOSXE New ICMPv6 Types
    - Editing of ACLs
    - How to Configure ACLs in an IPv6 Environment
- Lesson 2: Using IPsec, IKE, and VPNs
    - IPsec, IKE, and VPNs Basics
    - IPsec and IKE
    - VPN Connections Using IPv6
- Lesson 3: Discussing Security Issues in an IPv6 Transition Environment
    - Dual-Stack Issues
    - Single-Stack Issues
    - Tunnel Security Issues
    - Security at the Network Edge
    - Private IPv6 addressing vs Public IPv6 addressing
    - Issues in IP overloading
- Lesson 4: Understanding IPv6 Security Practices
    - Global Unicast Addresses (GUA) as "Private Space"
    - Build Distributed Security Capability
    - Secure the Local Link
    - ICMPv6 at Edge—Manage ICMPv6 Traffic
    - Secure the Routing Plane
    - IPv6 First Hop Security
    - RFC 9099

- Lesson 5: Configuring Cisco ASA to support IPv6
  - IPv6 Addressing
  - IPv6 Routing
  - IPv6 ACLs
  - IPv6 VPN Support
  - ICMPv6 Inspection
  - IPv6 Multicast

Module 9: Deploying IPv6

- Lesson 1: Examining IPv6 Address Allocation
  - IPv6 Internet
  - IPv6 Address Allocation
  - Connecting to the IPv6 Internet
- Lesson 2: IPv6 NAT and DNS
  - IPv6 Static NAT
  - IPv6 NPTv6
  - DNS64/NAT64
- Lesson 3: Understanding the IPv6 Multihoming Issue
  - IPv6 Multihoming Aspects and Issues
  - IPv6 Multihoming Status
- Lesson 4: Identifying IPv6 Enterprise Deployment Strategies
  - Enterprise Networks
  - Impacts of Network Services
  - WAN Networks
  - Dual Stack: Disadvantages
  - Tunneling: Disadvantages
  - Single Stack: The way Forward
  - Where to start

Module 10: IPv6 Case Studies

- Lesson 1: IPv6 Cloud and Software Defined Deployments
  - Cisco SDWAN
  - Cisco SDA
  - Cloud Native Deployment
- Lesson 2: Planning and Implementing IPv6 in Enterprise Networks
  - Enterprise Network Definition
  - Implementing IPv6 in an Enterprise Campus Network
  - IPv6 in an Enterprise WAN Network
- Lesson 3: Planning and Implementing IPv6 in Branch Networks
  - Branch Deployment Overview
  - Branch Deployment Profiles: Single-Tier Profile Implementation
- Lesson 4: IPv6 and Cloud Deployments
  - IaaS (AWS/Azure)
  - SaaS (O365/Webex)
- Bonus section (Examples)
  - New RFCs

- Updated RFCs
- Items to be aware of
- RIP NG

Virtual Classroom Live Labs

Labs are designed to assure learners a whole practical experience, through the following practical activities:

- Enabling IPv6 on Hosts
- Using Neighbor Discovery
- Using Prefix Delegation
- Deploy HSRP for IPv6
- Routing with OSPFv3
- Routing with EIGRP
- Routing with BGP and MP-BGP
- Troubleshooting Lab 1 – Automated Tickets
- Multicasting
- Configure NAT64 Services using Jool
- Configure DNS64 Services using Jool
- Deploy a Cisco ASA to support IPv6
- Configuring Advanced ACLs
- Implementing IPsec and IKE
- Troubleshooting Lab 2 – Automated Tickets (Optional)

Jul 7 - 11, 2025 | 10:00 AM - 6:00 PM EDT

Sep 8 - 12, 2025 | 10:00 AM - 6:00 PM EST

Nov 17 - 21, 2025 | 10:00 AM - 6:00 PM EST

Visit us at www.globalknowledge.com or call us at 1-866-716-6688.

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