

Date Submitted: 2-1-2014  
**Course Title:** **Advanced IPv6 Migration**  
**Course Number:** **9110**  
Pricing & Length – Classroom: 4 days, (onsite and public offering)

**Course Description:**

This advanced, hands-on course covers all you need to know about IPv6 migration and deployment strategies. You will gain a complete understanding of how to implement IPv6 using both interior and exterior routing protocols. Configure MPLS, BGP, multicasting along with advanced OSPFv3. Gain an understanding of different IPv6 security vulnerabilities and learn how to protect your company's network from current IPv6 attacks.

**What You'll Learn in Class: Migration strategies for implementing IPv6**

- Configure different IPv6 transition methods for tunneling IPv6 traffic over current IPv4 networks
- Configure assigned router for multicasting IPv6 traffic through the classroom network.
- Review different advanced deployment methods DHCPv6 (Statefull operation)
- Learn to implement IPv6 over EIGRPv6, OSPFv3, IS-ISv6, BGP and MPLS networks
- Discuss current security concerns related to IPv6. Learn how to protect your companies infrastructure from new IPv6 vulnerabilities.
- Learn to plan and manage your migration strategy

**Who Needs to Attend:**

Networking professionals who are migrating from an IPv4 to IPv6 protocol-based network environment requiring a thorough understanding of how to implement IPv6. Professionals requiring the knowledge to implement both interior and exterior protocols for IPv6. IPv6 only and dual-stack methods of deploying IPv6 over an existing IPv4 backbone network using different tunneling and encapsulating technologies. MPLS and 6PE is discussed as a cost effective way to migrate any ISP for supporting IPv6 over their MPLS backbone.

**Prerequisites:**

- IPv6 Foundations Course

**Follow on Courses**

- IPv6 Security

## Course Outline:

# Advanced IPv6 Course Outline

### Section 1: Advanced Addressing Methods

- IPv6 address length
- IPv6 addresses
- IPv6 address space
- IPv6 prefixes and MAC addresses
- ICMPv6 router solicitation
- ICMPv6 router advertisement
- Advanced Subnetting
  - Assigning a router `::/80`
  - Autoconfiguration Issues `::/80`
  - Prefix assignment of `::/128`
- Static IPv6 Assignment
- Anycast Address Deployment
  - Anycast configuration
  - Show IPv6 interface
  - Anycast learned address
  - Local anycast example
  - Remote anycast example
- Loopback address assignment
  - Loopback address advertisement
  - Learned loopback address
  - Creating a second interface IPv6 address
  - Learned second address
- Sub-interfacing using IPv6
- Preferred Global and Temporary Addressing
- Host IPv6 addressing
- Router multiple prefix addresses
  - Advertising multiple prefixes
  - Viewing via Unix

### Section 2: EIGRPv6

- EIGRPv6 Overview
- IPv6 Unicast-Routing
- EIGRPv6 Neighbor Discovery
- Hello packet capture
- Show ipv6 EIGRP Neighbors
- Successor and Feasible Successors
- EIGRP Neighbor Discovery Process
- Stateful Configuration
- EIGRP Key Differences
- Variance Example
- EIGRPv6 Configuration Example
- EIGRPv6 Show Commands
- Routing Table
- Authentication Example
- Authentication Configuration
- Summarization

### Section 3: Advanced OSPFv3

- OSPFv3 Overview
- OSPF areas
- Link State Advertisement
- LSDB Exchange
- Routing Table Update
- OSPFv3 Routing Table
- OSPF Cost
- Updated features for OSPFv3
- Configuring a Router-id
- OSPFv3 Neighbors
- Viewing an OSPFv3 Neighbor Table
- DR and BDR Election Process
- PT-PT WAN links over Ethernet
- OSPF network links
- OSPF header
- OSPF Packet types
  - OSPF Type 1
  - Forming adjacency
  - Data description packet (Type 2)
  - Forming adjacency
  - OSPFv3 packet (Type 3)
  - Link-state type 4: Updates
- OSPF Areas
- LSA Types
  - LSA 1-5
  - New type 8
  - New type 9
- Area Types
  - Stub Area
  - Totally Stubby
  - Not-So-Stubby Area
- Viewing show commands
- Stub and Totally-Stubby
  - Stub router configuration
  - Viewing results
- IPv6 summarization
  - Configuring router summarization
  - Viewing summarization results
- Dual ABR
  - Setting Preferred Metric Cost
- IPsec Authentication
  - Configuring IPsec authentication
  - AH and ESP Authentication
  - Interface configuration example
  - OSPFv3 Authentication Header
  - Cisco and Juniper commands

### Section 4: DHCPv6

- DHCPv6 Overview
- DHCPv6 Process
- DHCPv4 and DHCPv6 comparison chart

- DHCPv6 Headers
- DHCPv6 Message Types
- Auto-Configuration example
- Stateless-vs-Stateful
- Router Advertisement flags field
- Stateful configuration bits
- Other bit capture
- DHCPv6 relay agent
  - DHCPv6 relay configuration
  - Viewing configuration results
- Default stateless and stateful addressing
  - Controlling stateless and stateful addressing
- DHCP-PD
  - DUID Unique Identifier  
DUID-LLT, DUID-LLT Capture
  - DUID-EN
  - Router client server example
- Configuring XP for DHCPv6
- Configuring Windows 7 for DHCPv6
- Configuring Linux for DHCPv6
- 2008 (R2) DHCPv6 Server

## Section 5: IPv6 Multicast Routing

- Multicasting Introduction
- Unicast Example
- Multicast Example
- Multicast Address Types
- Multicast Address Structure
- IPv4 and IPv6 Multicast Comparison
- Hop-by-Hop Header in ICMPv6 MLD
- MLDv1 and MLDv2
- Multicast Listener Query
- Multicast Listener Report
- Multicast Listener Done
- Multicast General and Specific Query
- RP Registration
- Static Multicast Configuration
- IPv6 PIM-DM
- IPv6 PIM-SM
  - RP Registration
  - Static Multicast Configuration
  - DR and RP Registration Example
  - Static RP Tunnel
- IPv6 PIM Join Message
- IPv6 PIM Hello Message
- Multicast Diagram Example
- Show Multicast Commands
- Multicast Configuration Examples

## Section 6: Advanced BGP4+

- BGP Overview

- Administrative Distance Chart
- BGP Neighbors
- Configuring BGP Neighbors
- BGP Router-ID
- Common MP-BGP commands
- Single IPv6 EBGP Neighboring
- Dual IPv6 and IPv4 Neighboring
- IBGP configuration example
- IGP protocol used to learn routes
- Neighboring external interface
- External Link Failures Issues
- Peering using IPv6 Loopback
- Next-Hop Attribute
- Next-Hop Self Command
- IPv6 Peer Groups
  - Peer group configuration example
- Filtering with a prefix list
- BGP best practice example
- BGP Network Command
- Redistribute OSPF into BGP
- Configuring Distribute List
- Distribute List Example
- Route-Maps for IPv6
- Route-Map Example
- Route-Map Voice and Data Example
- Neighbor Relationship
- IBGP Full-Meshing
- GRE Tunneling
- IPv6 Internal Routing
- Viewing BGP Attributes
  - Weight Values
  - Local Preference
  - MED Announcements
  - A/S Path Attribute
  - Origin Attribute
- Peer Group Configuration
- Route Redistribution
- BGP Configuration Example

## Section 7: MPLS for IPv6

- MPLS and OSI
- Traditional IP Routing
- MPLS Overview
  - RIB, FIB, LIB, LFIB
  - MPLS Label Header
  - MPLS Labeling
  - MPLS Route Tagging
  - VRF, Route Targets
  - Route Distinguisher
- MPLS Terms
- LDP Labeling
- Viewing the LIB and LFIB Table
- MPLS VPN Example

- 6PE Overview
- 6PE Configuration Example
- BGP Peering over IPv4 only MPLS Network
- IPv6 Route Distinguisher
- 6PE Traffic Flow
- IPv6 MPLS Configuration Example

### **Section 8: Advanced Reflexive ACLs**

- IPv6 ACL Overview
- IPv6 ACL Flow Chart
- Firewall Vendors Supporting IPv6
- TCP, UDP Sessions
- Reflexive ACL
- Required ACL Rules
- Time Based ACL
- Reflexive ACL Criteria
- Reflexive ACL Configuration Example
- Reflexive ACL Show Commands

### **Section 9: IPv6 Security**

- Security Overview
- Hacker Types
- Assessing your Threats
- CIA Triad
- Authentication Methods
- 802.1x
- IPSec
- Distribute List Example
- Route-Map Example
- ACL
- Extension Header Hacks
- Hop-by-Hop Header Hack
- Routing Header Hack
- Hacker Threats for IPv6
  - Neighbor Discovery
  - DHCPv6
  - Denial of Service
  - Neighbor spoofing attack
  - Neighbor poisoning
  - ICMPv6 Attacks
  - Anycast threat
- Suggested Security Steps
- Secure Neighbor Discovery (SEND)
- Host Denial of Service Hack
- DAD Attack
- IPSec
  - IKE
  - Building a Security Association SPD, SAD
  - Diffie-Helman
  - IPSec Configuration Example
- Router Hacks
- Using /127 Serial Links

## Section 10: Advanced Deployment Methods

- Saving backup configurations
- Inventory list
- Possible IPv6 subnet assignment
- Scanning and management tools
- Migration path
- IPv6 bandwidth requirements
- DNS query and response
- Enterprise migration steps
- Identifying the team leads
  - Security lead
  - Application lead
  - Operating system lead
  - Voice lead
  - Routing lead
  - WAN and tunneling lead
- Service provider migration
- IPv6 Tunneling Methods
  - NAT-PT
  - 6to4 Manual
  - 6to4 Automatic
  - ISATAP
  - Teredo
- Connecting to IPv6 network
- ISP Carrier Deployment
  - Carrier Options
  - NAT44
  - NAT444
  - LSN, CGN and NAT464
  - DS-Lite
  - NAT64, DNS64
  - DNS64
  - NAT64 and DNS64 Illustrated

## Section 11: Advanced IS-IS

- IS-ISv6 Overview
- IS-IS Introduction
- Address Families
- NSAP Address Breakdown
- IS-IS Metric
- IS-IS Areas
- LSP L1 and L2
- Hello Packets
- Electing the Designated DIS
- Packet Synchronization
- IPv6 only IS-IS Configuration
- Dual-Stack IS-IS Configuration
- L1, L2 Databases
- New TLV Values
- IS-IS Multi-Topology Support

- Common Show Commands
- Summarization
- Configuration Examples

## **Section 12: HSRPv2 Deployment for IPv6**

- HSRP Overview
- HSRP Addressing
- HSRP Configuration
- Router Solicitation using HSRP
- Default Gateway Issue
- Link-Local Addressing
- Viewing Configuration Results
- HSRP Preempt Command

## **Advanced IPv6 Labs**



**Lab 1: Initial Dual Stack Network Configuration**

- Configure dual stacks on router
- Configure DNS for name and address resolution
- Configure host workstation for dual stack

**Lab 2: EIGRPv6 Configuration**

- Configure Cisco's EIGRPv6 routing protocol
- Deploy EIGRPv6 protocol
- Configure both summarization and password authentication

**Lab 3: Configuring OSPFv3 Areas**

- Advanced IPv6 Area Summarizations
- Creating Dual ABR Routers
- Configure Router Summarizations
- Configure Totally Stubby Areas

**Lab 4: DHCPv6 Deployment**

- Deploy DHCPv6 in a Windows 7 network
- Use Windows 2008 (R2) server for DHCPv6
- Configure Cisco routers to forward DHCPv6 request

**Lab 5: Multicasting Using IPv6**

- Configure PIM-SM for IPv6 multicasting
- Send and receive multicast video over IPv6 only network
- Use show commands to view configuration result

**Lab 6: Initial MP-BGP Configuration**

- BGP4+ Deployment
- IBGP and EBGP Peering
- Test and verify proper BGP configuration
- Configure IPv6 Route Map
- Configure IPv6 Distribute List

**Lab 7: MP-BGP Route Policy Configuration**

- Configure a BGP route policy
- Test route policy for proper configuration

**Lab 8: MP-BGP Weight Values**

- Configure weight values to control local BGP routing
- Test BGP weight value for proper configuration

**Lab 9: MPLS 6PE Configuration**

- Configure an MPLS Dual-Stack Deployment
- Configure 6PE routers for MPLS tagging
- Route traffic over an IPv4 only MPLS Network
- Build EBGP 6PE peering neighbors over MPLS network
- View and test MPLS "P" routers for proper tagging operation
- Use show commands to verify proper configuration

**Lab 10: Configuring IPv6 IS-IS**

- Configure IS-IS to route IPv6
- View both L1 and L2 route tables
- Verify proper operation using show commands

### **Lab 11: Configuring HSRP Protocol**

- Configure and test HSRP protocol operation
- Work in pairs to test HSRP redundancy between routers
- Use show commands to verify proper HSRP operation