IPv6 Foundations

IPv6 was conceived as a replacement of IPv4 that delivers significantly larger addressing resources. The new protocol was meant to be and evolution, not a revolution of the Internet Protocol that built on the lessons learned from operating IPv4. While sharing many similarities, IPv6 and IPv4 do not interoperate and several aspects of the protocol have been completely re-written. The course leverages your existing IPv4 experience to help you gain an understanding of basic IPv6 concepts and to contextualize them to the specifics of your environment.

What Students Will Learn:

IPv6 Foundations is a 4-day instructor-led, hands-on, lab-heavy training class ideally suited for network and systems engineers of all skill and experience levels. Covered is an understanding of the fundamentals of IPv6, its similarities and differences with respect to IPv4. Also covered in the course are the mechanisms developed to facilitate transition, how IPv6 is accommodated in supporting technologies, such as routing protocols, DHCP and DNS, and multicasting as well as security. The course concludes with an overview of the IPv6 transition process.

Who Should Attend:

- Network & System engineers
- Network operations staff
- IT staff
- Infrastructure support staff
- Infrastructure project management staff
- Application developers
- Test engineers

Course Structure:

Approximately 14 hours of lecture content
Approximately 14 hours of lab content

Course Outline

IPv6 Foundation Topics

1. IPv6 Overview

- 1.1. IPv6 Technology Overview
- 1.2. IPv6 Myths
- 1.3. Adoption Drivers
  - 1.3.1. Business
  - 1.3.2. Information Technology
  - 1.3.3. Technology
- 1.4. Market Overview

2. IPv6 Address Structure

- 2.1. Address Structure Overview
- 2.2. Address Types
- 2.3. IPv6 Address Scoping
- 2.4. Interface Identifier (IID)
  - 2.4.1. Constructing the Interface ID
  - 2.4.2. IID Alternatives (random, EUI, CGA, manual)
- 2.5. Global Address Management Policies

3. IPv6 Header Formats

- 2.1. Nomenclature
- 2.2. IPv4/IPv6 Packet Structure Comparison
- 2.3. Packet Header
- 2.4. Extension header
  - 3.1.1. Descriptions
  - 3.1.2. Chaining
  - 3.1.3. Processing

4. ICMPv6

- 4.1. ICMPv6 overview
  - 4.1.1. Compare and contrast ICMP/ICMPv6
- 4.2. Neighbor Discovery (ND)
- 4.3. Comparison between ARP and The Neighbor Discovery Process
- 4.4. Supported ND Features
  - 4.4.1. SeND
- 4.5. Stateless Address AutoConfiguration (SLAAC)
  - 4.5.1. Renumbering
- 4.6. IPv6 Fragmentation
- 4.7. Path MTU Discovery
  - 4.7.1. Host MTU Management
  - 4.7.2. Operational Consideration

Hands-on Lab: IPv6 on Windows 7

Hands-on Lab: Enabling IPv6 on Cisco IOS

Hands-on Lab: Investigating ND & SLAAC

Demo: First Hop Redundancy Protocols and IPv6

5. DHCPv6

5.1. Compare/Contrast with DHCPv4
5.2. The DHCPv6 process
5.3. Stateful Autoconfiguration
5.4. Stateless DHCPv6 (aka DHCP-Lite)
5.5. DHCPv6 Prefix Delegation
5.6. Renumbering

Hands-on Lab: Deploying DHCPv6

6. DNS & IPv6

6.1. New record types (AAAA)
6.2. Forward and Reverse Zones
6.3. DNS Flow
6.4. Global DNS support
6.5. Dynamic Name Resolution Services

Hands-on Lab: Understanding DNS and IPv6

IPv6 Routing and Core Topics

7. Routing Overview and Static Routing

7.1. Routing protocol overview
7.2. RIP, EIGRP, OSPF, ISIS, and BGP

8. OSPF

8.1. Protocol review (e.g. areas, metrics)
8.2. OSPFv3 & OSPFv2 comparison
8.3. OSPFv3 Address Family Support

Hands-on Lab: Enabling OSPFv3

9. IS-IS

9.1. Protocol review
9.2. IPv6 enhancements and extensions

Hands-on Lab: Enabling IS-IS

10. MP-BGP

10.1. Protocol review
10.2. IPv6 enhancements and extensions
10.3. MP-BGP mechanisms and packet exchanges
10.4. Forced Aggregation
10.5. IPv6 PI address allocations
10.6. Multi-homing IPv6 Networks
10.6.1. Policy challenges
10.6.2. Technical strategies for IPv6 multi-homing

Hands-on Lab: Enabling MP-BGP

11. MPLS

11.1. MPLS & IPv6
11.2. MPLS tunnels
11.3. 6PE
11.4. 6VPE
11.5. MPLS w/ IPv6 control plane

Hands-on Lab: Enabling 6VPE

IPv6 Integration and Transition Topics

12. Dual Stack

12.1. Definition of Dual-Stack strategy, suitable environments
12.2. Configuration elements
12.3. Deployment considerations

13. Manual Tunnels

13.1. Manual Tunnel definition, applicability
13.2. Configuration elements
13.3. Deployment considerations

Hands-on Lab: Establishing manual tunnels

14. ISATAP

14.1. ISATAP definition, applicability
14.2. Configuration elements
14.3. Deployment considerations

Hands-on Lab: Enabling ISATAP

15. 6to4

15.1. 6to4 definition, applicability
15.2. Configuration elements
15.3. Deployment considerations

Hands-on Lab: Implementing 6to4

16. 6rd

16.1. 6rd defined, applicable environments
16.2. Configuration elements
16.3. Deployment considerations

17. Teredo

17.1. Teredo definition, applicability
17.2. Configuration elements
17.3. Deployment considerations

18. IP-HTTPS

18.1. IP-HTTPS definition, applicability
18.2. Configuration elements
18.3. Deployment considerations

19. Translation

19.1. NAT-PT
19.2. NAT64/DNS64
19.3. NAT444/CGN/LSN
19.4. NAT66/NPTv6
19.4.1. Temporarily Disabling IPv6
19.4.2. Getting Ready for IPv6 Implementation
19.4.3. Methods for Disabling IPv6 on a Temporary Basis

IPv6 Support Service Topics

20. IPv6 Security Overview

20.1. Threat Review & Mitigation
20.1.1. Attack Vectors similar to those found in IPv4
20.1.2. Attack Vectors New for IPv6
20.2. Transition mechanisms and the impacts on IT security
20.3. Tools for supporting IPv6 security policy
20.4. IPv6 ACLs

Hands-on Lab: Introduction to IPv6 ACLs

21. Mobile IPv6

21.1. Mobile IP Review

21.2. IPv6 Mobility Concepts and Terminology
21.3. IPv6 Mobility Operations and Capability

22. IPv6 Multicasting

22.1. Overview of IPv6 Multicast
22.2. Multicast's Role in IPv6 Operation
22.3. IPv6 Multicast Deployment Considerations

Hands-on Lab: IPv6 Multicasting

23. QoS in IPv6

23.1. Overview of QoS in IPv6 Networks
23.2. Flow label discussion

Hands-on Lab: Implementing IPv6 QoS

24. IT Infrastructure Appliances

24.1. Proxies
24.2. Load Balancers
24.3. IDS/IPS

IPv6 Deployment Topics

25. Preparing for IPv6 Deployment

25.1. IPv6 and IT Initiatives
25.2. Address Planning
  25.2.1. Process
  25.2.2. IPAM
25.3. Assessment
25.4. Design and Planning