Hands-on IPv6

Introduction

IPv6 standards have been around for well over a decade now. However, the takeup of IPv6 has been really very low and realistically, there has been no need to implement it until now. Indeed, there has never been and actually still is no real 'killer application' that demands the use of IPv6. However, now has come the time where there is a real business case for at least exploring, if not implementing IPv6. The business case is driven by the fact that the pool of IPv4 addresses available for allocation has practically been exhausted. Wihout IPv6, IP networks cannot grow any longer.

Who should attend the course?

This course will be beneficial to those wishing to gain a detailed and hands-on understanding of IPv6. An understanding of IPv4 networking would be helpful but not necessary.

Learning Objectives

At the end of the course, the delegates will understand:

- The key differences between IPv6 and IPv4
- The reasons why IPv6 is important
- IPv6 addressing
- The IPv6 header
- The Auto-configuration features of IPv6
- New aspects of ICMP - ICMPv6
- IPv6 Neighbour Discovery
- Strategies in migrating to IPv6
- plus others...

Hands-on Exercises

Hands on exercises include:

- End-station IPv6 configuration - Windows & Linux
- IPv6 Network monitoring and capture/analysis of IPv6 packets
- IPv6 Auto-configuration
- IPv6 router configuration
- IPv6 security using IPsec
- Using DNS with IPv6
- Configuring OSPF3 for IPv6
- Network design and implementation exercise

Course Length

2 days

Course Agenda

- Introduction to IPv6
- IPv6 Addressing

- The IPv6 Header
- ICMPv6 (Internet Control Message Protocol) Version 6
- IPv6 Neighbour Discovery
- IPv6 Transition Technologies
- IPv6 Other Considerations

1 Introduction to IPv6

- Limitations of IPv4
  - IP address exhaustion (major driver for IPv6)
  - Lack of security mechanisms
  - Need for better QoS support
- What happened to IPv5? - Internet Stream Prototcol
- IPv6 Features Overview
  - Revised header
  - Larger address space
  - IPv6 autoconfiguration
  - IPv6 Neighbour Discovery
  - IPv6 Router Discovery
  - Required IPsec header support
  - IPv6 extension headers
  - Restoral of end-to-end communications
- Section summary and end-of-section review questions

2 IPv6 Addressing

- IPv6 address space
- Binary, Decimal and Hexadecimal
- IPv6 address representation
- Address Notation exercise
- IPv6 Address Prefixes
- IPv6 Interface Identifiers
  - Manual
  - Modified EUI-64
  - Randomly generated
  - Stateful configuration using DHCPv6
- IPv6 address types
  - Unicast
  - Multicast
  - Anycast
- IP unicast addresses
  - Global unicast
  - Local use
    - Link local
    - Site local
  - Unique local
  - Special addresses
    - Unspecified
    - Loopback
  - Transition addresses

- Multicast addresses
  - Multicast scopes
  - A node's multicast addresses
    - All nodes in the link-local
    - Solicited node multicast address
  - Multicasts on Ethernet
- Developing an IPv6 Addressing Plan
- Addressing plan exercise
- Section summary and end-of-section review questions

3 The IPv6 Header

- IPv6 header structure
- IPv6 extension headers
  - Hop-by-hop options
  - Destination options (with routing options)
  - Routing header
  - Fragment header
  - Authentication header
  - Encapsulation Security Payload (ESP) header
  - Destination options
  - Mobility header
- Section summary and end-of-section review questions

4 ICMPv6 (Internet Control Message Protocol) Version 6

- ICMPv6 overview
- ICMP error messages
  - Destination unreachable
  - Packet too big
  - Time exceeded
  - Parameter problem
- ICMPv6 informational messages
  - Echo request
  - Echo reply
- Path MTU discovery
- Neighbour discovery ICMP messages
- Section summary and end-of-section review questions

5 IPv6 Neighbour Discovery

- Neighbour Discovery ICMP messages
  - Router advertisement
  - Router solicitation
  - Neighbour solicitation
  - Neighbour advertisement
  - Redirect
- Neighbour Discovery functions
  - Router discovery
  - Prefix discovery
  - Parameter discovery

  - Address autoconfiguration
  - Address resolution
  - Next-hop determination
  - Neighbour unreachability detection
  - Duplicate address detection
  - Redirect
- Section summary and end-of-section review questions

6 IPv6 Transition Technologies

- An overview of and discussion of a number of different 'transition' technologies
  - NAT64
  - ISATAP (Intra-Site Automatic Tunnel Addressing Protocol)
  - 6to4
  - Teredo
  - 6rd (rapid deployment)
  - DS-Lite (Dual-Stack Lite)
  - 6over4
  - 6in4
  - SIIT (Stateless IP/ICMP Translation)
  - TRT (Transport Relay Translation)
- Section summary and end-of-section review questions

7 IPv6 Other Considerations

- Routing and IPv6
  - RIPng
  - OSPFv3 for IPv6
  - IS-IS for IPv6
- DNS for IPv6
  - AAAA resource records
  - IP6.ARPA for IPv6 reverse queries
  - Coexistence with IPv4
- IPv6 security
  - IPsec and IPv6
  - Other IPv6 security considerations
  - Using IPv6 Access Control Lists
- Mobile IPv6
- QoS with IPv6
- Section summary and end-of-section review questions

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