

**Course Title: Advanced Networking with IPv6**

**Course no:** CSC-453

**Credit hours:** 3

**Nature of course:** Theory (3 Hrs.) + Lab (3 Hrs.)

Full Marks: 60+20+20

Pass Marks: 24+8+8

**Course Synopsis:** Study of Advanced Networking with IPv6

**Goal:** The course covers about: principles underlying IPv6 Network Design; Internet routing protocols (unicast, multicast and unidirectional) with IPv6; algorithmic issues related to the Internet; IPv6 Migration; measurement and performance; next generation Internet (IPv6, QoS) and applications.

## **Course Contents:**

### **1 Networking Protocols 6Hrs.**

- 1.1 OSI Model
- 1.2 Internet IP/UDP/TCP
- 1.3 Routing in the Internet & CIDR
- 1.4 Multicasting
- 1.5 Unidirectional Link Routing

### **2 Next Generation Internet 8Hrs.**

- 2.1 Internet Protocol Version 6 (IPv6)
- 2.2 History of IPv6
- 2.3 IPv6 Header Format
- 2.4 Feature of IPv6
- 2.5 International trends and standards
- 2.6 IPv6 Addressing (Unicast, Anycast & Multicast)

### **3 ICMPv6 and Neighbor Discovery 6Hrs.**

- 3.1 ICMPv6 General Message Format
- 3.2 ICMP Error and Information Message Types
- 3.3 Neighbor Discovery Processes and Messages
- 3.4 Path MTU Discovery
- 3.5 MLD overview

### **4 Security and Quality of Service in IPv6 6Hrs.**

- 4.1 Types of Threats
- 4.2 Security Techniques
- 4.3 IPSEC Framework
- 4.4 QoS Paradigms
- 4.5 QoS in IPv6 Protocols

## 5 IPv6 Routing

4Hrs.

- 5.1 RIPng
- 5.2 OSPF for IPv6
- 5.3 BGP extensions for IPv6
- 5.4 PIM-SM & DVMRP for IPv6

## 6 IPv4/IPv6 Transition Mechanisms

8Hrs.

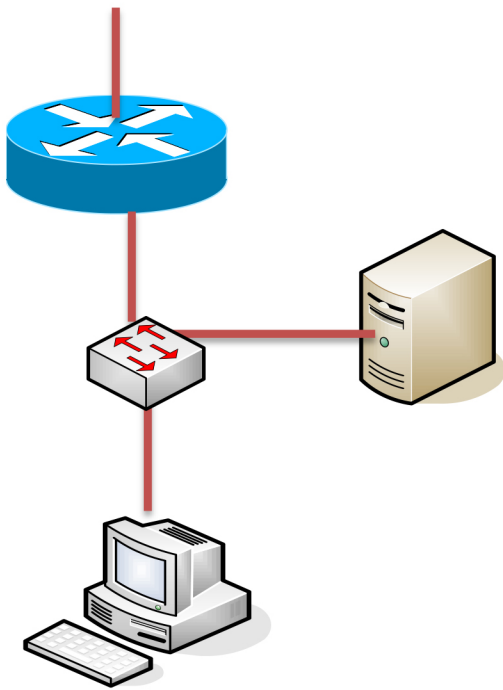
- 6.1 Migration Strategies
- 6.2 Tunneling
  - 6.2.1 Automatic Tunneling
  - 6.2.2 Configured tunneling
- 6.3 Dual Stack
- 6.4 Translation
  - 6.4.1 NAT-PT

## 7 IPv6 Network and Server Deployment

7Hrs.

- 7.1 IPv6 Network Configuration in Linux and Windows Machines
- 7.2 IPv6 enabled WEB/PROXY/DNS/MAIL Server Configuration
- 7.3 IPv6 Deployment: Challenges and Risks
- 7.4 IPv6 and the NGN

**Laboratory work:** For the lab work, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group of 3 students. The working environment and machine connectivity will look like the following:



**Tools Needed:** TCPDUMP & WIRESHARK, VMWare Environment, Linux/FreeBSD, Windows

Lab 1: Enable IPv6 in Windows/Linux

Lab 2: IPv6 Header Analysis

Lab 3: IPv6 Packet analysis (neighbor/router solicitation/discovery)

Lab 4: Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis

Lab 5: Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis

Lab 6: IPv6 DNS/WEB/Proxy implementation & test

Lab 7: Case Study

### **Reference Book:**

1. *Silvia Hagen: IPv6 Essentials*, O'reilly
2. *Joseph Davies: Understanding IPv6*; eastern economy edition
3. *J. F. Kurose and K. W. Ross: Computer Networking - A Top-Down Approach Featuring the Internet*, Addison-Wesley, 2000.
4. *S. A. Thomas: IPng and the TCP/IP Protocols*, Wiley, 1995
5. *O. Hersent, D. Gurle, J.-P. Petit: IP Telephony*, Addison-Wesley, 2000.
6. *Lecture Notes and Related RFCs*

**Prerequisite:** Networking & Communications Fundamentals