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 IPv6Addressing (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

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

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

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 groups 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
6. Lecture Notes and Related RFCs

Prerequisite: Networking & Communications Fundamentals