

Advanced Networking with IPv6 (CSC-453)
Tribhuvan University
Soch College of Information Technology
Bachelor of Science in Computer Science and Information Technology

Course Title: Advanced Networking with IPv6

Course no.: CSC-453 ----- Full Marks: 60+20+20

Credit Hours: 3 ----- Pass Marks: 24+8+8

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

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 ----- 6 Hrs.

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 ----- 8 Hrs.

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 ----- 6 Hrs.

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 -----6 Hrs.

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 ----- 4 Hrs.

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 ----- 8 Hrs.

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 Hrs.

7.1 IPv6 Network Configuration in Linux and Windows Machines

7.2 IPv6 enables 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 Needs: 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:

Silvia Hagen: IPv6 Essentials, O'Reilly

Joseph Davies: Understanding IPv6; eastern economy edition

J. F. Kurose and K. W> Ross: Computer Networking – A Top-Down Approach Featuring the Internet, Addison-Wesley, 2000

S. A. Thomas: IPng and the TCP/IP Protocols, Wiley, 1995

O. Hersent, D. Gurle, J. P. Petit: IP Telephony, Addison-Wesley, 2000

Lecture Notes and Related RFCs