IT214: Data Communication & Computer Networks

Module Objectives

The objective of this module is to provide a fundamental concept of the electrical characteristics of digital signals and the basic methods of data transmission, underlying principles in the design of a layered network architecture, identify the general characteristics of local area networks (LANs) and wide area networks (WANs), and concept of TCP/IP protocol stack as an example of a layered network architecture.

Contents

Introduction to Data Communication, Data Communication principles, Overview of Digital Communication, Computer Communication Architecture, Data Link Layer, Medium Access (MAC) Sub-layer, Packet Switching, Routing Algorithms, The Network Layer in the Internet, Transport Layer, Application Layer and Other technologies overview

Detailed Course

Unit 1: Introduction to Data Communication **LH 2**

1.1 A basic Communication model

1.2 Data Communication Networking: WAN, MAN, LAN

Unit 2: Data Communication principles **LH 4**

2.1 Basic Concept: Signal, Frequency, Amplitude, Bandwidth, Digital signal, Analog signals, Digital data and analog data, Transmission Impairments, Channel capacity, Overview of analog and digital transmission, Synchronous and asynchronous transmission

2.2 Data Encoding

2.2.1 Digital data and digital signals- NRZ-L, NRZI, Manchester

2.2.2 Digital data and analog signals- ASK, FSK, PSK, QPSK

2.3 Multiplexing Techniques (FDM, TDM, WDM)

Unit 3: Overview of Digital Communication **LH 3**

3.1 Media Concepts and classification of media

Guided Media (Twisted Pair, Coaxial cable, Fiber optics)

Unguided Media (description and working principle of VSAT and Satellite)

3.2 Transmission characteristics(Attenuation, Noise, Signal to Noise ratio, Propagation delay)

Unit 4: Computer Communication Architecture **LH 3**

4.1 OSI(Open systems Interconnection) Reference Model

4.2 TCP/IP (Transmission Control Protocol/Internet Protocol) Protocol Suite

Unit 5: Data Link Layer **LH 5**

5.1 Service Provided to Network Layer

5.2 Framing

5.3 Error Detection methods: Parity, Checksum , CRC

5.4 Data Link Protocols

5.4.1 A simplex stop and wait protocol

5.4.2 Sliding window protocols

5.4.2.1 A One Bit Sliding Window Protocol

5.4.2.2 A Protocol Using Go Back N

5.4.2.3 A Protocol Using Selective Repeat

Unit 6: Medium Access (MAC) Sub-layer **LH 4**

6.1 Multiple access Protocols

6.1.1 ALOHA (Pure and Slotted ALOHA)

6.1.2 Carrier Sense Multiple Access(CSMA)

6.1.2.1 CSMA/CD

6.1.2.2 CSMA/CA

6.2 Topologies

6.3 Overview of IEEE Standard 802 for LANS and MANS

6.3.1 Brief introduction Ethernet

6.3.2 Brief introduction Token Ring

6.4 Introduction to Wireless Communication

6.5 Introduction to Bridge, Switch and Router

Unit 7: Packet Switching LH 2

7.1 Packet Switching Principles

7.2 Switching Techniques

7.2.1 Datagram Approach

7.2.2 Virtual Circuit Approach

Unit 8: Routing Algorithms **LH 4**

8.1 Fixed Path Routing

8.2 Shortest Path Routing

8.3 Flooding

8.4 Distance Vector Routing

8.5 Link State Routing

Unit 9: The Network Layer in the Internet **LH 7**

9.1 IP Protocol IP V4

9.2 IP Addresses

9.3 Subnets

9.4 Supernet

9.5 VLSM(variable length subnet masking), CIDR(Classless Inter-Domain Routing) and NAT (Network Address Translator)

9.6 Overview of Internet Control Protocols

9.6.1 ICMP,IGMP

9.7 Routing Protocols

9.7.1 Interior Routing Protocol: OSPF

9.7.2 Exterior Routing Protocol: BGP

9.8 Introduction to IPv6

Unit 10: Transport Layer LH 4

10.1Transport Services

10.2Addressing

10.3Internet Transport Protocols TCP (Transmission Control Protocol) and UDP (User Datagram Protocol)

Introduction to UDP (Operation of UDP, Characteristics of UDP, Application of UDP)

Introduction to TCP (Operation of TCP, Characteristics of TCP, TCP three-way handshake process, Application of TCP)

Relationship between TCP & IP

Standard TCP / IP services

Port numbers and socket address

10.4Overview of BSD Socket API

Unit 11: Application Layer LH 3

11.1. DNS (ARP and RARP), Mail protocol (SMTP, POP, IMAP), DHCP, Web services (WWW, HTTP, HTTPS, FTP), telnet, DHCP.

11.2. Client server and P2P application

11.3. Relation between Application layer and Transport layer.

Unit 12: Other technologies overview LH 3

PSTN, ISDN and its type, Frame relay, DSL and ADSL, VoIP, Bluetooth, Wi-Fi, Overview of GSM, Wi-Max, 3G and 4G(LTE), Near field Communication(NFC).

- Lab Work
  - Lab 1, 2, 3, 4:- Cabling (straight cable, Cross cable) and Installation of client and server OS. Connecting the computers in Local Area Network with guided media/unguided media and Working with basic network commands.

- Lab 5, 6:- Sharing Resources such as file, printer, internet, hardware, and disk in peer to peer model
- Lab 7, 8:- Configuring server and Sharing Resources such as file, printer, internet, hardware, and disk.
- Lab 9, 10:- Creating Network user, setting up permissions, setting up fileserver.
- Lab 11:-Installing and configuring DNS
- Lab 12:- Installing and configuring DHCP
- Lab 13:- Installing and configuring web server
- Lab 14:- Setting Up wireless devices and access points.
- Lab 15:- Securing Wireless devices.

v Project Work: The instructor should assign a project to the students on focusing the designs of a small LAN.

v Field work, seminar/ presentation are essential in this subject.

Text Book

Behrouz A. Forouzan, Data Communications and Networking, 5th edition, McGraw-Hill

References

A.S Tanenbaum, Computer Networks. 4th Edition. PHI.

D.E. Corner, Internetworking with TCP/IP. Vol.1. 3rd ed. PHI.

S. Keshav, An Engineering Approach to Computer Networking Addison Wesley, Longman.

W. Stalling, Data and Computer Communications. 8th Edition. PHI.

W.R. Stevens, TCP/IP Illustrated Volume I, II and III, Addision Wesley Longman

Behrouz A. Forouzan, Firouz Mosharraf, Computer Networks: A Top-Down Approach, McGraw-Hill