Data Communication & Networking Notes

---

1. Components of Data Communication, Distributed Processing
Sender, receiver, message, transmission medium, protocol. Distributed processing means multiple computers share processing.

2. Standards and Organizations
Important orgs: ISO, IEEE, ITU-T, ANSI, IETF—set networking standards.

3. Line Configuration, Topology

- Line: Point-to-point, Multipoint
- Topology: Physical layout of network (Bus, Star, Ring, Mesh, Hybrid)

4. Transmission Mode

- Simplex (one-way)
- Half Duplex (both ways, one at a time)
- Full Duplex (both ways, simultaneously)

5. Categories of Networks

- LAN: Local area
- WAN: Wide area
- PAN: Personal area

6. Network Topologies

- Bus: One backbone cable
- Star: Devices connected to central hub
- Ring: Devices in a circle
- Star Bus: Combines star and bus
- Star Ring: Combines star and ring

- Mesh: Each device connected to every other

7. Hub, Repeaters, Bridges

- Hub: Connects multiple devices (no filtering)
- Repeater: Boosts signal
- Bridge: Connects different LANs

8. Gateways, Routers

- Gateway: Connects different networks with different protocols
- Router: Routes data between networks

9. OSI Model: Layers and Functions

1. Physical
2. Data Link
3. Network
4. Transport
5. Session
6. Presentation
7. Application

10. TCP/IP Model: Layers and Functions

1. Network Access
2. Internet
3. Transport
4. Application

11. Comparison of OSI and TCP/IP

- OSI: 7 layers, theoretical
- TCP/IP: 4 layers, practical and widely used

12. Transmission Media: Guided

- Twisted pair
- Coaxial cable
- Optical fiber

13. Unguided Transmission Media

- Radio waves
- Microwaves
- Infrared

14. CSMA/CA (Collision Avoidance)
Avoids collision by signaling before transmission, mostly used in wireless.

15. CSMA/CD (Collision Detection)
Detects collisions during transmission and retries. Used in Ethernet.

16. Ethernet, FDDI

- Ethernet: Wired LAN technology
- FDDI: Fiber Distributed Data Interface (used for backbone)

17. Token Ring, Wireless LAN

- Token Ring: Access through token
- WLAN: Wireless local network (uses Wi-Fi)

18. DLL: Basic Functions
Framing, error control, flow control, MAC addressing.

19. Circuit Switching
Dedicated path for communication. Used in telephone networks.

20. Datagram Network
Each packet treated independently. No fixed path.

21. Packet Switching & Message Switching

- Packet: Message split into packets
- Message: Entire message sent to next switch

22. Flow Control, Error Control

- Flow: Controls data speed
- Error: Detects and corrects errors

23. Medium Access Control (MAC)
Determines how devices access shared medium.

24. MAC Layers
Part of Data Link Layer, handles addressing and access control.

25. Design Issues of Network Layer
Addressing, routing, packet delivery, congestion control.

26. Routing Algorithms

- Distance Vector
- Link State

27. IPv4 Addressing
32-bit address, written in dotted decimal (e.g., 192.168.1.1)

28. Subnetting
Divides a large network into smaller sub-networks.

29. Unicast Routing Algorithms
Routes packets from one source to one destination.

30. Protocols, Multicasting Basics

- Protocol: Set of rules (e.g., IP, TCP)
- Multicasting: One sender to multiple receivers

31. IPv6 Addressing – IPv6 Protocol
128-bit address, written in hexadecimal. Solves IPv4 limitations.

32. ARP – RARP

- ARP: IP to MAC mapping
- RARP: MAC to IP mapping

33. DHCP – ICMP

- DHCP: Assigns IP dynamically
- ICMP: Error and control messages

34. Transport Layer: Process-to-Process Delivery
Ensures data is delivered between correct processes on different hosts.

35. Functions of Transport Layer
Segmentation, connection control, flow and error control, reliability.

36. Data Traffic
Refers to the flow of data across the network.

37. Congestion Control: Open vs Closed Loop

- Open: Prevent congestion
- Closed: React after congestion

38. Flow Control and Error Control
Flow control: Prevents overflow
Error control: Detects/corrects errors

39. UDP (User Datagram Protocol)
Connectionless, faster, no error checking

40. TCP (Transmission Control Protocol)
Connection-oriented, reliable, uses acknowledgments

41. Application Layer: Client-Server Model
Client requests, server responds. Example: Web browsing

42. DNS, DNS in Internet
Translates domain names into IP addresses

43. Email, SMTP, FTP

- Email: Send/receive messages
- SMTP: Email protocol
- FTP: Transfer files

44. HTTP, World Wide Web

- HTTP: Protocol for web communication
- WWW: System of web resources

45. Revision

Revise OSI, TCP/IP, devices, transmission media, protocols, layers, and switching techniques.
