

CSE3151 COMPUTER NETWORKS



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CSE3151: Computer Networks
75 Marks [70% Exam, 20% Quizzes/Class Tests, 10% Attendance]
3 Credits, 33 Contact hours, Exam Time: 4 hours

Introduction: Computer Networks and Applications, OSI reference model, TCP/IP model and terminology, Connectionless and Connection Oriented services, Service primitives, The ARPANET

Physical Layer: Circuit switching and Packet switching, X-25 protocol, Frame relay and Cell relay, ATM reference model.

Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non-persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

Data Link Layer: Types of errors, framing, error detection & correction methods; Flow control, Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC.

Network Layer: Internet address, classful address, subnetting, static vs. dynamic routing, shortest path algorithms, flooding, distance vector routing, link state routing, ARP, RARP, IP, ICMP.

Transport Layer: UDP, TCP, Connection management, Addressing, Establishing and Releasing Connection, Congestion control algorithm, Flow control and Buffering, Multiplexing.

Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent Encoding.

Application Layer: Internet and intranets, Internet services and goals, DNS, SMTP, FTP, Telnet, HTTP, World Wide Web (WWW), DHCP and BOOTP.

Networking in Practice: Designing LAN, Cabling, Establishing Client-Server network, Configuring: Directory Server, Proxy server, FTP server, E-mail server, web server, DB server, Firewall, Network troubleshooting, network maintenance, network monitoring, Network programming.

Books Recommended:

- | | |
|------------------------|---|
| 1. Behrouz A. Forouzan | : TCP/IP Protocol Suite, McGraw-Hill |
| 2. Andrew S. Tanenbaum | : Computer Networks, Prentice Hall |
| 3. William Stallings | : Data and Computer Communications, Prentice Hall |
| 4. Behrouz A. Forouzan | : Data Communications and Networking, McGraw-Hill |

Computer Network?

- Collection of **autonomous computers interconnected** by a single technology.
- Two computers are said to be **interconnected** if they are **able** to **exchange information**.
- The connection need not be **via** a copper wire; fiber optics, microwaves, infrared, and communication satellites can also be used.

3 of 27

Computer Network vs Distributed System

- There is considerable confusion in the literature between a computer network and a distributed system.
- Distributed system... appear as a single system to user.
- A distributed system is a software system built on top of a network.



4 of 27

Uses of Computer Network

- Application of Computer Network
 - Business Applications
 - Home Applications
 - Mobile Users
 - Social Issues

5 of 27

Business Applications

- PRIMARY GOAL**
- Resource sharing:**
 - The goal is to make all programs, equipment, and especially data available to anyone on the network without regard to the physical location of the resource or the user
 - Share printer
 - more important than sharing physical resources –sharing data
 - Share customer records...
- VPNs (Virtual Private Networks)**
- Client Server Model:**
 - Web application

6 of 27

Business Applications



7 of 27

Business Application

- **SECONDARY GOAL**
- **Powerful communication medium:**
 - Email, VOIP, video calling
- **Desktop sharing**
 - TeamViewer,
- **TERTIARY GOAL**
- **e-commerce (electronic commerce)**

Tag	Full name	Example
B2C	Business-to-consumer	Ordering books online
B2B	Business-to-business	Car manufacturer ordering tires from supplier
G2C	Government-to-consumer	Government distributing tax forms electronically
C2C	Consumer-to-consumer	Auctioning second-hand products online
P2P	Peer-to-peer	Music sharing

Figure 1-4. Some forms of e-commerce.

of 27

Home Application

- **Connectivity**
 - to remote computers
 - home users can access information, communicate with other people, and buy products and services with e-commerce.
 - People can surf the net for **fun**, movie, chatting...
 - People can surf the net for **news** portals
 - People can surf the net for **research** like IEEE, Springers...
 - Mainly Client server model but... peer to peer model

9 of 27

Home Application



Peer-to-peer model (BitTorrent (Cohen, 2003))

10 of 27

Home Application

- Instant messaging
- Twitted, Facebook, WhatsApp
- Wikipedia – a group of people creating contents...
- E-commerce...

11 of 27

Others

- **Mobile Users**
 - Connectivity
 - Mobile hotspot
 - Texting, sms
 - GPS
 - M-commerce
 - NFC (Near Field Communication)
- **Social Issues**

12 of 27

Network Hardware

- Two types of **transmission technology** that are in widespread use:
 - **broadcast links** &
 - **point-to-point links**.
- Point-to-point** links connect individual pairs of machines.
- To go from the **source** to the **destination** on a network made up of point-to-point links, **short messages**, called **packets** in certain contexts, may have to first visit **one or more intermediate machines**.
- Often **multiple routes**, of different lengths, are possible, so finding good ones is important in point-to-point networks.
- Point-to-point transmission with exactly one sender and exactly one receiver is sometimes called **unicasting**.

13 of 27

Network Hardware



- On a broadcast network, the **communication channel** is shared by all the machines on the network; packets sent by any machine are received by all the others.
- An address field within each packet specifies the intended recipient.
- Upon receiving a packet, a machine checks the address field. If the packet is intended for the receiving machine, that machine processes the packet; if the packet is intended for some other machine, it is just ignored

14 of 27

Network Hardware

- This mode of operation is called **broadcasting**.
- Some broadcast systems also support transmission to a subset of the machines, which known as **multicasting**.

15 of 27

Network Hardware

- An alternative criterion for classifying networks is by **scale**.

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	
100 m	Building	
1 km	Campus	Local area network
10 km	City	
100 km	Country	Metropolitan area network
1000 km	Continent	
10,000 km	Planet	Wide area network
		The Internet

Figure 1-6. Classification of interconnected processors by scale.

16 of 27

Personal Area Networks

- Personal Area Networks
 - bluetooth



Figure 1-5. Bluetooth PAN configuration.

17 of 27

Local Area Networks

10 m	Room	Local area network
100 m	Building	
1 km	Campus	



Figure 1-8. Wireless and wired LANs: (a) 802.11, (b) Switched Ethernet.

18 of 27

Metropolitan Area Networks

- MAN
- Cable headed
- WiMAX



Figure 1.8. A metropolitan area network based on cable TV.

19 of 27

Wide Area Networks

- WAN



BdRen

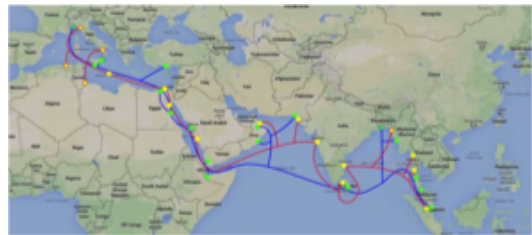
20 of 27

Internetworks



21 of 27

Internetworks



22 of 27

Network Software

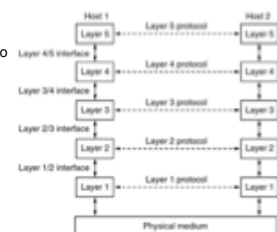
- The first computer networks were designed with the **hardware as the main concern** and the software as an afterthought.
- This strategy **no longer** works.
- To reduce their design complexity, most networks are organized as a stack of **layers or levels**, each one built upon the one below it.

23 of 27

Network Software

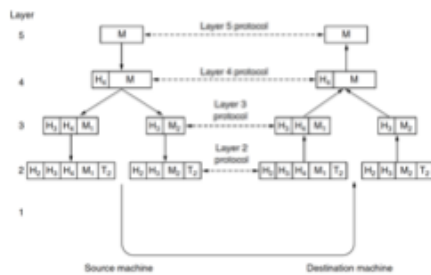
- A protocol is an agreement between the communicating parties on how communication is to proceed.

- **Peer** – both host
- A set of layers and protocols is called a **network architecture**.
- A list of the protocols used by a certain system, one protocol per layer, is called a **protocol stack**.



24 of 27

Network Software



25 of 27

Design Issues for the Layers

- **Reliability**
 - uses codes for error detection.
 - error correction
 - They are used at low layers,
- **Routing**
 - Finding a working path through a network
 - addressing or naming,
 - internetworking.

26 of 27

Design Issues for the Layers

- **Resource allocation.**
 - Who will get priority
 - flow control.
 - Quality of service
- **Confidentiality**
 - authentication
 - Integrity

27 of 27