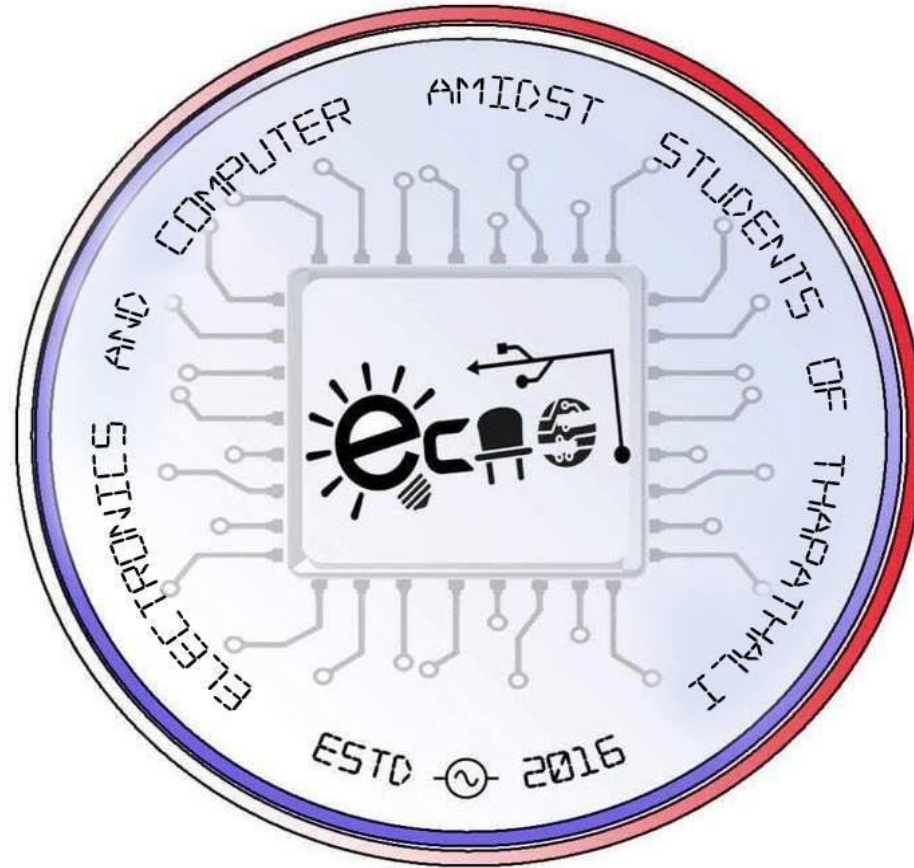


NETWORKING FUNDAMENTALS



Prepared By:
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Topics that will be covered in todays session:

- 1) What is networking?
- 2) Scope of Networking?
- 3) OSI Model(Open system Interconnection)

What is Networking?

Networking refers to the process of connecting computers, cell phones, and Internet of Things (IoT) devices. The connection also works concerning the hardware and software including wired and wireless technology. These devices can even connect to networks like the Internet. It includes applications from fields like Computer Engineering, Computer Application, Computer Science, IT Engineering, Electrical Engineering, etc. Local Area Network ([LAN](#)) or a Wide Area Network ([WAN](#)) are the two types of networks connections.

Networking comprises of the below stages.

- ▶ Designing the Network Infrastructure
- ▶ Construction and Use of the Network
- ▶ Maintenance of the Networks
- ▶ Diagnosing and Trouble Shooting Networks

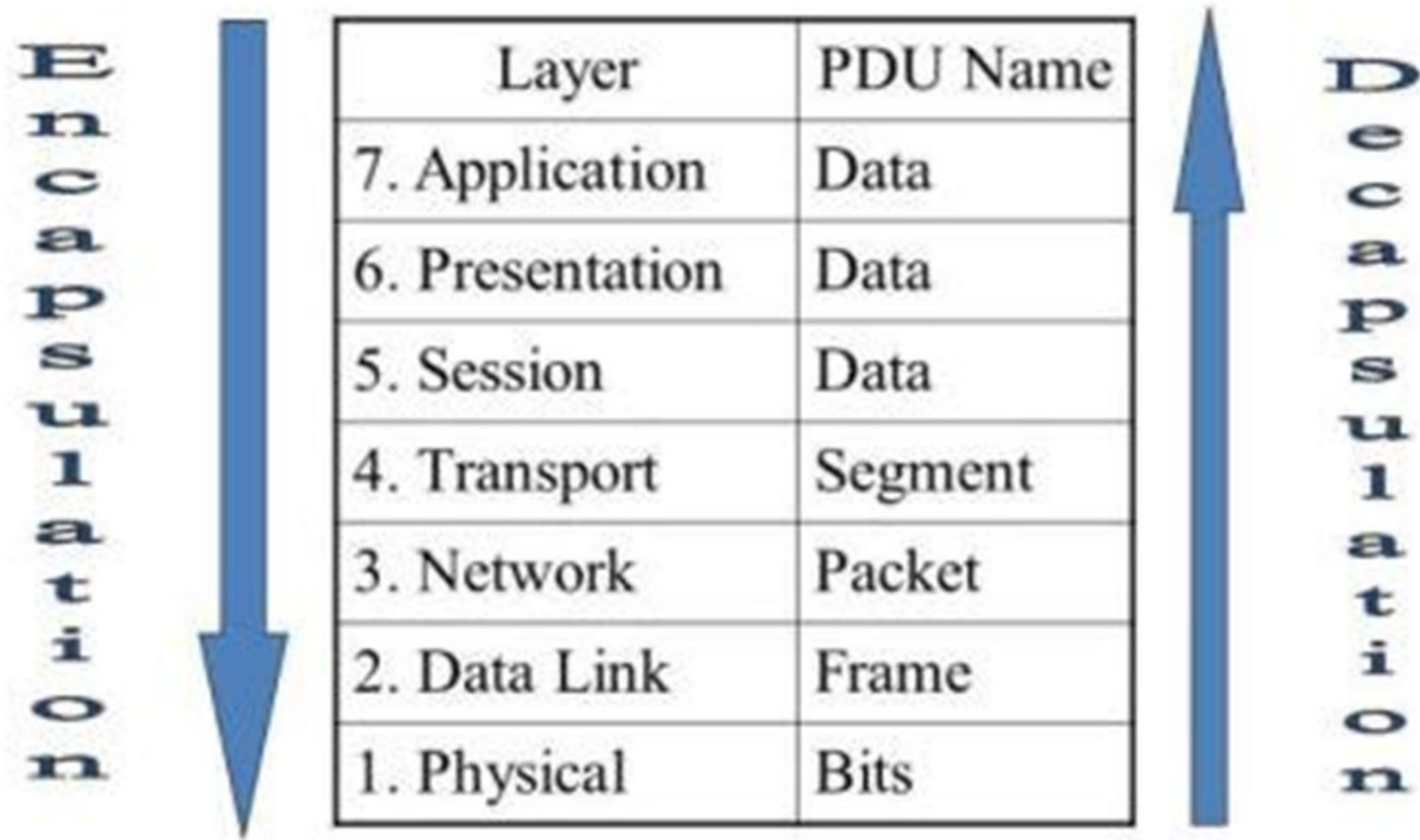
Which career path needs networking?

- 1) Network Engineer
- 2) Network Security
- 3) System Administrator
- 4) Cyber security and Ethical Hacking
- 5) Cloud Computing
- 6) Programming

OSI REFERENCE MODEL

- **OSI WAS DEVELOPED BY THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO) AND INTRODUCED AROUND 1980.**
- **IT IS A LAYERED ARCHITECTURE (CONSISTS OF SEVEN LAYERS) WHICH DEFINES AND EXPLAINS HOW THE COMMUNICATION HAPPENS IN BETWEEN TWO OR MORE NETWORK DEVICES WITHIN THE ORGANIZATION OR INTERNET.**
- **EACH LAYER DEFINES A SET OF FUNCTION IN DATA COMMUNICATION**

Layers in OSI model



APPLICATION LAYER (LAYER 7)

- ➤ Network process to application
- ➤ Application layer is responsible for providing an interfaces for the users to interact with Applications services or Networking services. Or,
- Layer 7, supports application and end-user processes. Communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified. Everything at this layer is application-specific. This layer provides application services for file transfers, e-mail, and other network software services. Telnet and FTP are applications that exist entirely in the application level. Tiered application architectures are part of this layer.

PRESENTATION LAYER (LAYER 6)

- Presentation layer is responsible for defining a standard format for the data.
- It deals with data presentation. providing freedom from compatibility problems. It is sometimes called the syntax layer.

• Presentation examples include encryption, ASCII, EBCDIC, TIFF, GIF, MP3, JPEG, MPEG, MIDI

-Extended Binary Coded Decimal Interchange Code(EBCDIC)

-American Standard Code for Information Interchange(ASCII)

- The major functions described at this layer are:

- **Encoding – Decoding**

- **Encryption-Decryption**

- **Compression-Decompression**

SESSION LAYER (LAYER 5)

- It is responsible for establishing, maintaining and terminating the sessions.
- It deals with sessions or interactions between the applications.
- Session ID is used to identify a session or interaction.

:RPC , NETBIOS

TRANSPORT LAYER (LAYER 4)

- It is responsible for end-to-end transportation of data between the applications.
- The major functions described at the Transport Layer are...
- ✓ Identifying Service

- ✓ Segmentation
- ✓ Sequencing & Reassembling

Identifying a Service:

Services are identified at this layer with the help of port No's. The major protocols which takes care of data transportation at transportation layer are... TCP, UDP

TCP	UDP
<ul style="list-style-type: none">● Transmission Control Protocol.● Connection Oriented.● Reliable Communication (with ACK's)● Slower data Transportation.● Protocol No is 6● Ex: HTTP, FTP, SMTP	<ul style="list-style-type: none">● <u> </u> User Datagram Protocol● <u> </u> Connection Less● <u> </u> Unreliable Communication (no ACK's)● <u> </u> Faster data Transportation● <u> </u> Protocol No is 17● <u> </u> Ex: DNS, DHCP, TFTP

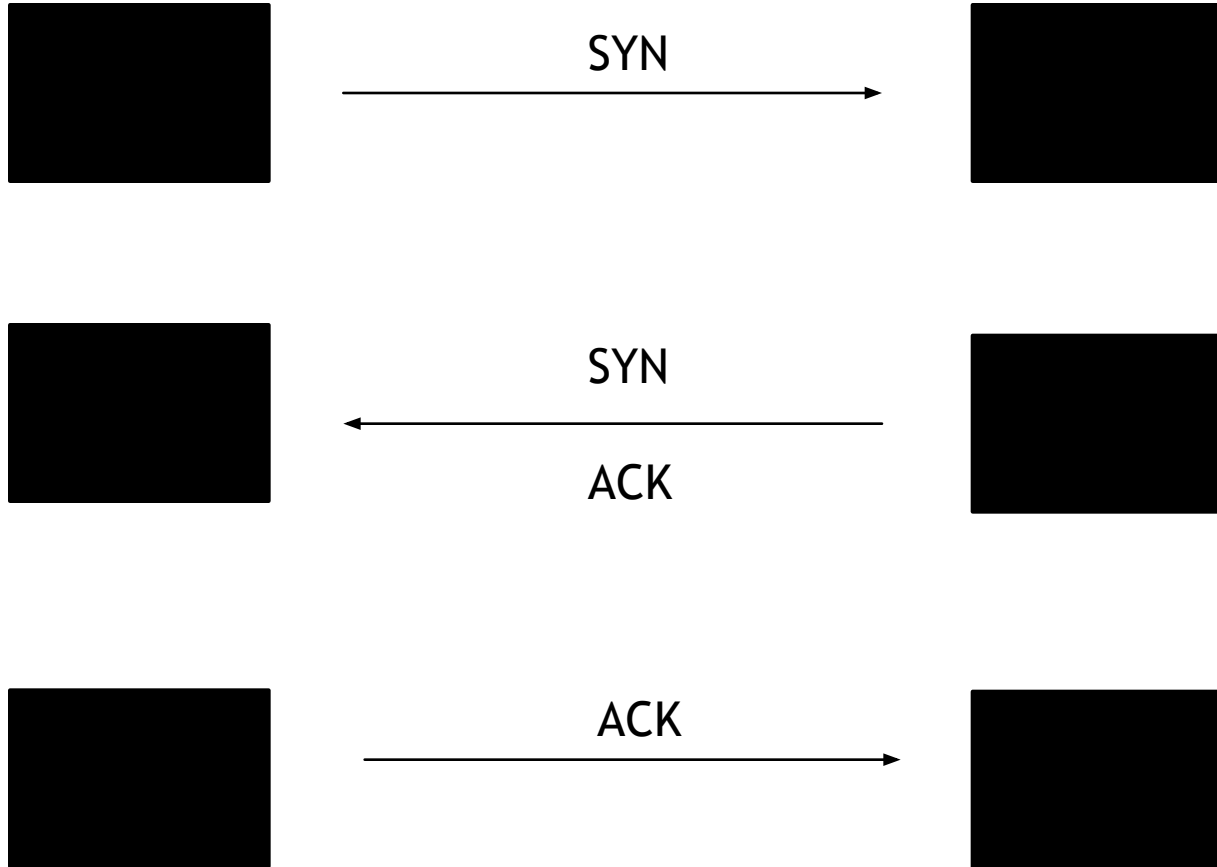
TCP/UDP Port Numbers

7 Echo	554 RTSP	2745 Bagle.H	6891-6901 Windows Live
19 Chargen	546-547 DHCPv6	2967 Symantec AV	6970 Quicktime
20-21 FTP	560 rmonitor	3050 Interbase DB	7212 GhostSurf
22 SSH/SCP	563 NNTP over SSL	3074 XBOX Live	7648-7649 CU-SeeMe
23 Telnet	587 SMTP	3124 HTTP Proxy	8000 Internet Radio
25 SMTP	591 FileMaker	3127 MyDoom	8080 HTTP Proxy
42 WINS Replication	593 Microsoft DCOM	3128 HTTP Proxy	8086-8087 Kaspersky AV
43 WHOIS	631 Internet Printing	3222 GLBP	8118 Privoxy
49 TACACS	636 LDAP over SSL	3260 iSCSI Target	8200 VMware Server
53 DNS	639 MSDP (PIM)	3306 MySQL	8500 Adobe ColdFusion
67-68 DHCP/BOOTP	646 LDP (MPLS)	3389 Terminal Server	8767 TeamSpeak
69 TFTP	691 MS Exchange	3689 iTunes	8866 Bagle.B
70 Gopher	860 iSCSI	3690 Subversion	9100 HP JetDirect
79 Finger	873 rsync	3724 World of Warcraft	9101-9103 Bacula
80 HTTP	902 VMware Server	3784-3785 Ventrilo	9119 MXit
88 Kerberos	989-990 FTP over SSL	4333 mSQL	9800 WebDAV
102 MS Exchange	993 IMAP4 over SSL	4444 Blaster	9898 Dabber
110 POP3	995 POP3 over SSL	4664 Google Desktop	9988 Rbot/Spybot
113 Ident	1025 Microsoft RPC	4672 eMule	9999 Urchin
119 NNTP (Usenet)	1026-1029 Windows Messenger	4899 Radmin	10000 Webmin

TCP 3 WAY HANDSHAKE

SYSTEM A

SYSTEM B



NETWORK LAYER (LAYER 3)

- Logical addressing & path determination (Routing) are described at this layer.
- The protocols^I works at network layer are

Routed Protocols:

- Routed protocols acts as data carriers and defines logical addressing.
- IP, IPX, AppleTalk... etc. (**IPX by Novell NetWare network operating system**)

Routing Protocols:

- Routing protocols performs path Determination (routing).
- RIP, IGRP, EIGRP, OSPF... Etc.

Protocol	Description
IP	IP is the "mother protocol" of TCP/IP, featuring routable 32-bit addressing.
ICMP	Internet Connection Management Protocol. Incorporates ping and traceroute, which are Layer 3 link-testing utilities.
OSPF, EIGRP, RIP, ISIS	Dynamic routing protocols that learn about remote networks and the best paths to them from other routers running the same protocol.
ARP	Address Resolution Protocol. ARP learns what MAC address is associated with a given IP address.

PING

```
Microsoft Windows [Version 10.0.17763.1282]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\Redemption8848>ping google.com

Pinging google.com [172.217.160.174] with 32 bytes of data:
Reply from 172.217.160.174: bytes=32 time=95ms TTL=54
Reply from 172.217.160.174: bytes=32 time=95ms TTL=54
Reply from 172.217.160.174: bytes=32 time=95ms TTL=54
Reply from 172.217.160.174: bytes=32 time=96ms TTL=54

Ping statistics for 172.217.160.174:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 95ms, Maximum = 96ms, Average = 95ms

C:\Users\Redemption8848>
```

TRACERT

```
C:\Users\Redemption8848>tracert google.com

Tracing route to google.com [172.217.160.174]
over a maximum of 30 hops:

  0  3 ms    1 ms    2 ms  192.168.0.1
  1  1 ms    1 ms    1 ms  192.168.100.1
  2  7 ms    2 ms    3 ms  10.51.0.1
  3  5 ms    5 ms    5 ms  103.1.92.89
  4  6 ms    5 ms    7 ms  202.94.66.210
  5  7 ms    5 ms    7 ms  202.94.66.230
  6 187 ms   187 ms  189 ms  1.6.134.209
  7  *        *        *      Request timed out.
  8 284 ms   285 ms  282 ms  100.67.56.103
  9  99 ms   98 ms   97 ms  72.14.210.200
10  99 ms   97 ms   98 ms  108.170.248.161
11  96 ms   97 ms   98 ms  216.239.62.237
12 100 ms   96 ms   95 ms  bom05s12-in-f14.1e100.net [172.217.160.174]

Trace complete.

C:\Users\Redemption8848>
```

Microsoft Windows [Version 10.0.17763.1282]
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C:\Users\Redemption8848>arp -a

Interface: 169.254.220.210 --- 0x6

Internet Address	Physical Address	Type
224.0.0.22	01-00-5e-00-00-16	static

Interface: 192.168.200.1 --- 0x7

Internet Address	Physical Address	Type
224.0.0.22	01-00-5e-00-00-16	static

Interface: 192.168.177.1 --- 0x12

Internet Address	Physical Address	Type
224.0.0.22	01-00-5e-00-00-16	static

Interface: 192.168.0.103 --- 0x18

Internet Address	Physical Address	Type
192.168.0.1	74-da-88-50-2c-7c	dynamic
224.0.0.22	01-00-5e-00-00-16	static

C:\Users\Redemption8848>

DATA-LINK LAYER (LAYER 2)

➤ It is responsible for end-to-end delivery of data between the devices on a LAN network segment. Data Link Layer comprises of two sub-layers.

1. MAC (Media Access Control)

- ✓ It deals with hardware addresses (MAC addresses).
- ✓ MAC addresses are 12 digit Hex-decimal identifiers used to identify the devices uniquely on the network segment.

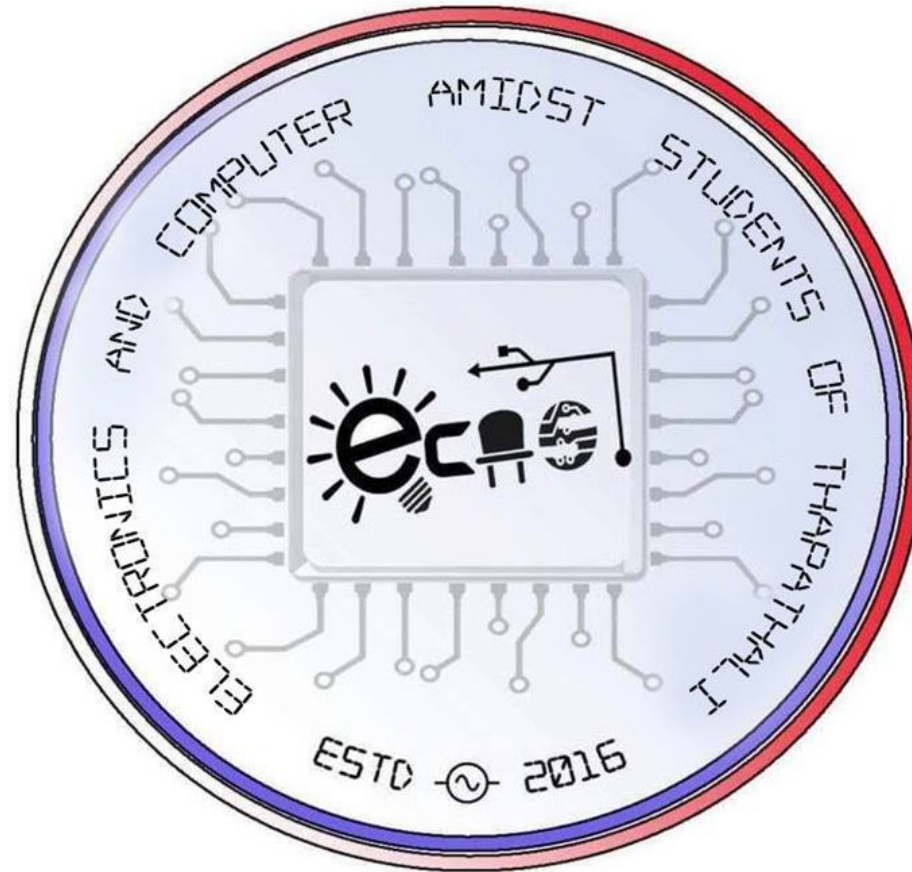
2. LLC (Logical Link Control)

- ✓ It deals with layer # (Network Layer)
- ✓ The LLC layer controls frame synchronization, flow control and error checking.
- ✓ Devices works at Data Link Layer are Switch, Bridge, NIC card

OSI Model – Physical Layer

- **Physical**
 - Physical interface between devices
 - handles the transmission of bits over a communications channel
 - Choice of Wired / wireless medium
 - Data is converted into signals
 - Includes voltage levels, connectors, media choice
 - modulation techniques
 - EIA/TIA-232, RJ45, NRZ.

THANK YOU



ELECTRONICS AND COMPUTER COMMUNITY AMIDST STUDENTS OF THAPATHALI