



# **COMPUTER NETWORK**

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**TEACHER : MY DEAR GREAT TEACHER**

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# **UNDERSTANDING COMPUTER HARDWARE**

Computers begin as a hardware device but can grow to encompass virtual machines that are entirely constructed out of software and appear to all purposes to be a remote machine that users can access via remote protocols and methods

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# COMPUTER NETWORK



- A computer network is a group of computers/devices(Nodes) that use a set of common communication protocols over digital interconnections for the purpose of sharing resources located on or provided by the network nodes.
- The nodes of a computer network may include personal computers, servers, networking hardware, or other specialised or general-purpose hosts.
- The interconnections between nodes are formed from a broad spectrum of telecommunication network technologies, based on physically wired, optical, and wireless technologies.
- A communication protocol is a set of rules for exchanging information over a network.

# ADVANTAGES /USES OF NETWORK

## SIMULTANEOUS ACCESS

There are moments in any business when several workers may need to use the same data at the same time.

## PERSONAL COMMUNICATIONS

- Videoconferencing
- Voice over Internet Protocol (VoIP):-VoIP transmits the sound of voice over a computer network using the Internet Protocol (IP ) rather than sendingthe signal over traditional phone wires

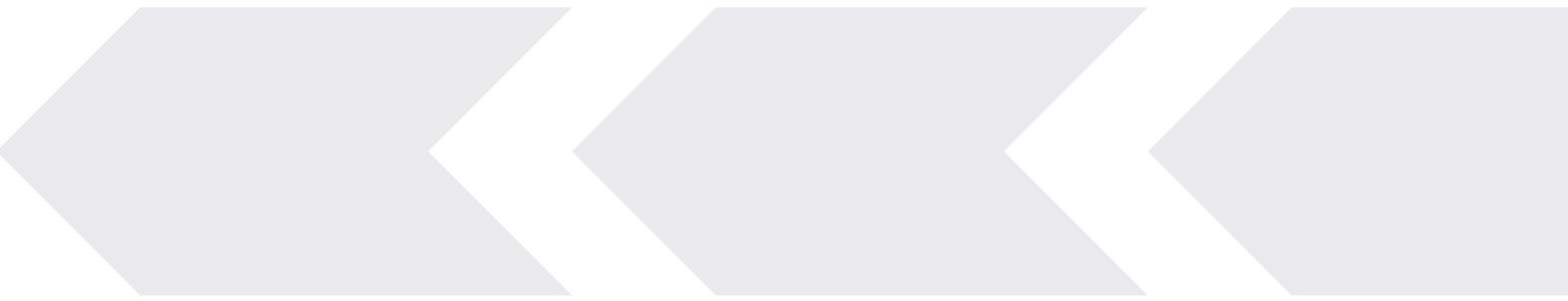
## SHARED PERIPHERAL DEVICES

## EASIER DATA BACKUP

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# AGENDA



# REPEATERS

- A repeater is a network device used to regenerate a signal.



## REPEATERS INFO:

- Repeaters regenerate analog or digital signals that are distorted by transmission loss due to attenuation.
- A repeater does not make an intelligent decision concerning forwarding packets



# HUBS

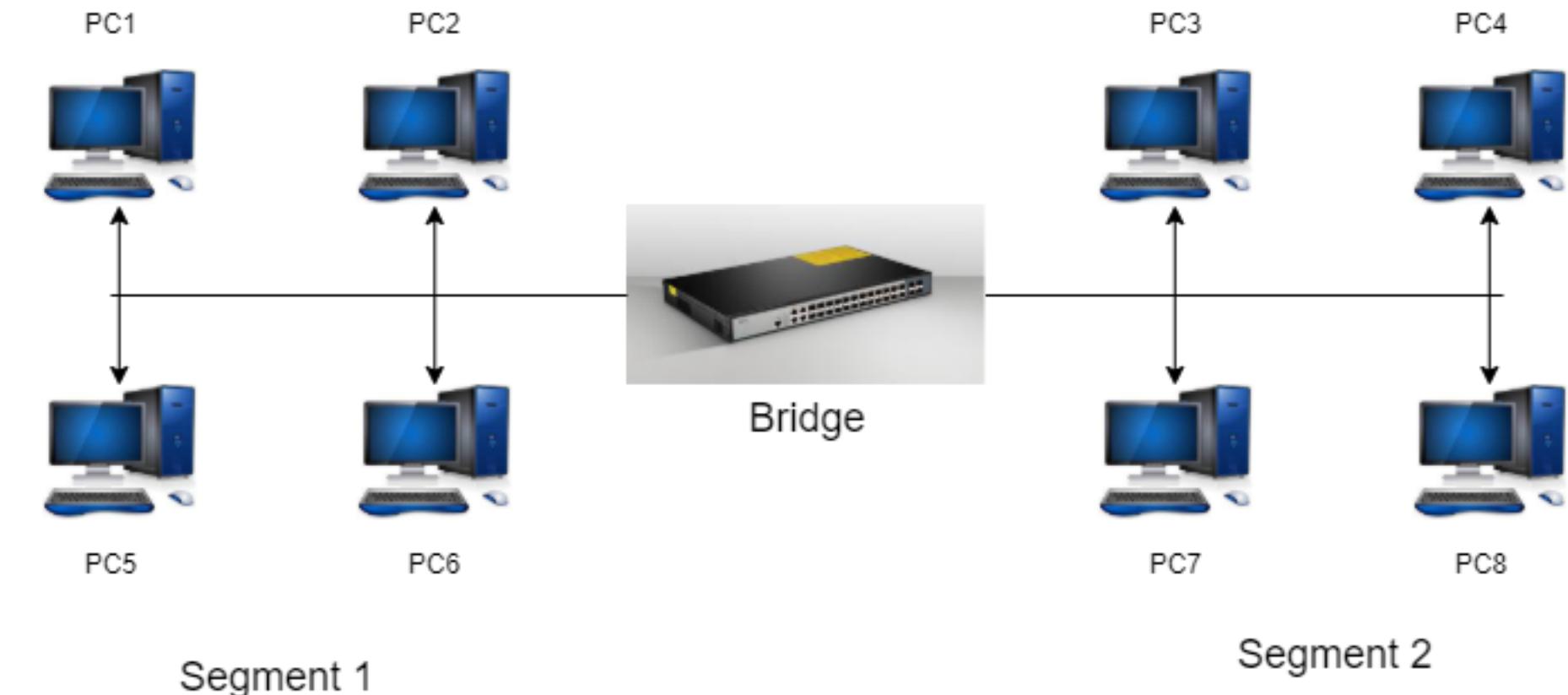
- A network hub is a node that broadcasts data to every computer or Ethernet-based device connected to it.

## HUBS INFO:

- Hubs concentrate on connections.
- In other words, they take a group of hosts and allow the network to see them as a single unit. This is done passively, without any other effect on the data transmission.
- Active hubs concentrate hosts and also regenerate signals.

# BRIDGE

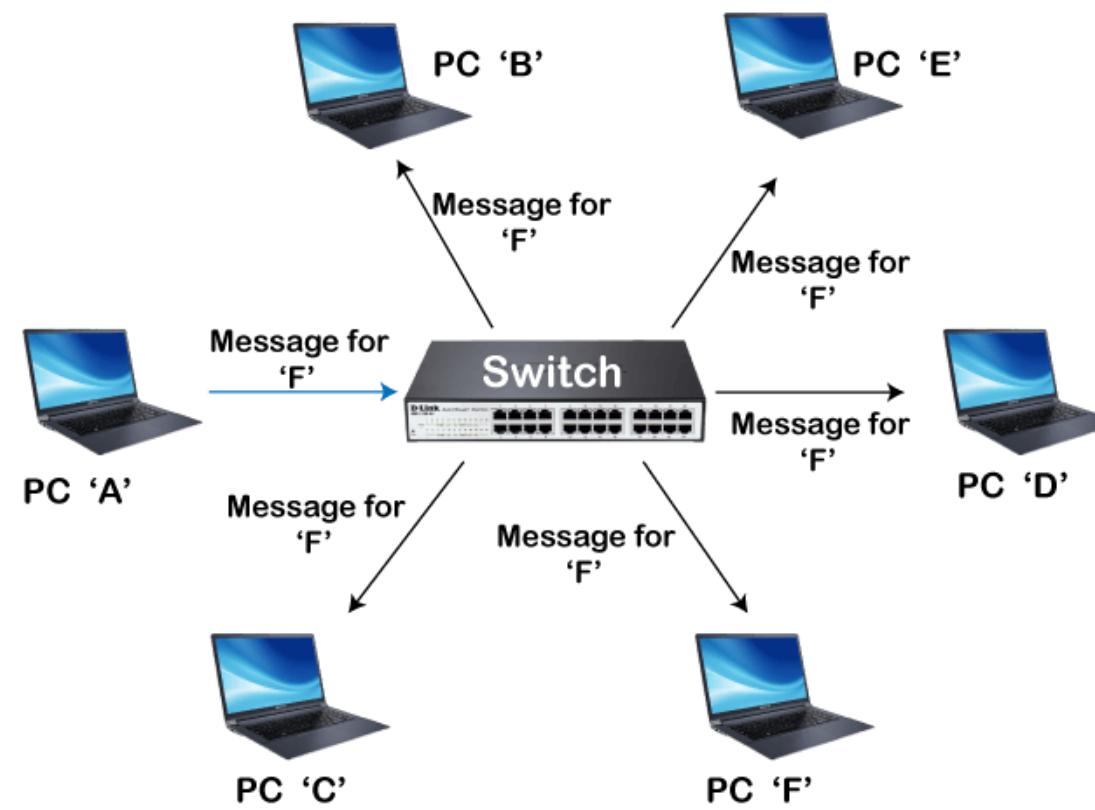
- A bridge in a computer network is a device used to connect multiple LANs together with a larger Local Area Network (LAN).



## BRIDGE INFO:

- Bridges convert network data formats and perform basic data transmission management.
- Bridges provide connections between LANs.
- They also check data to determine if it should cross the bridge. This makes each part of the network more efficient

# SWITCH



- Switches are networking devices operating at layer 2 or a data link layer of the OSI model.

## SWITCH INFO:

- Switches add more intelligence to data transfer management.
- They can determine if data should remain on a LAN and transfer data only to the connection that needs it.
- Another difference between a bridge and switch is that a switch does not convert data transmission formats

# ROUTERS

- A router is a device that connects two or more packet-switched networks or subnetworks

## ROUTERS INFO:

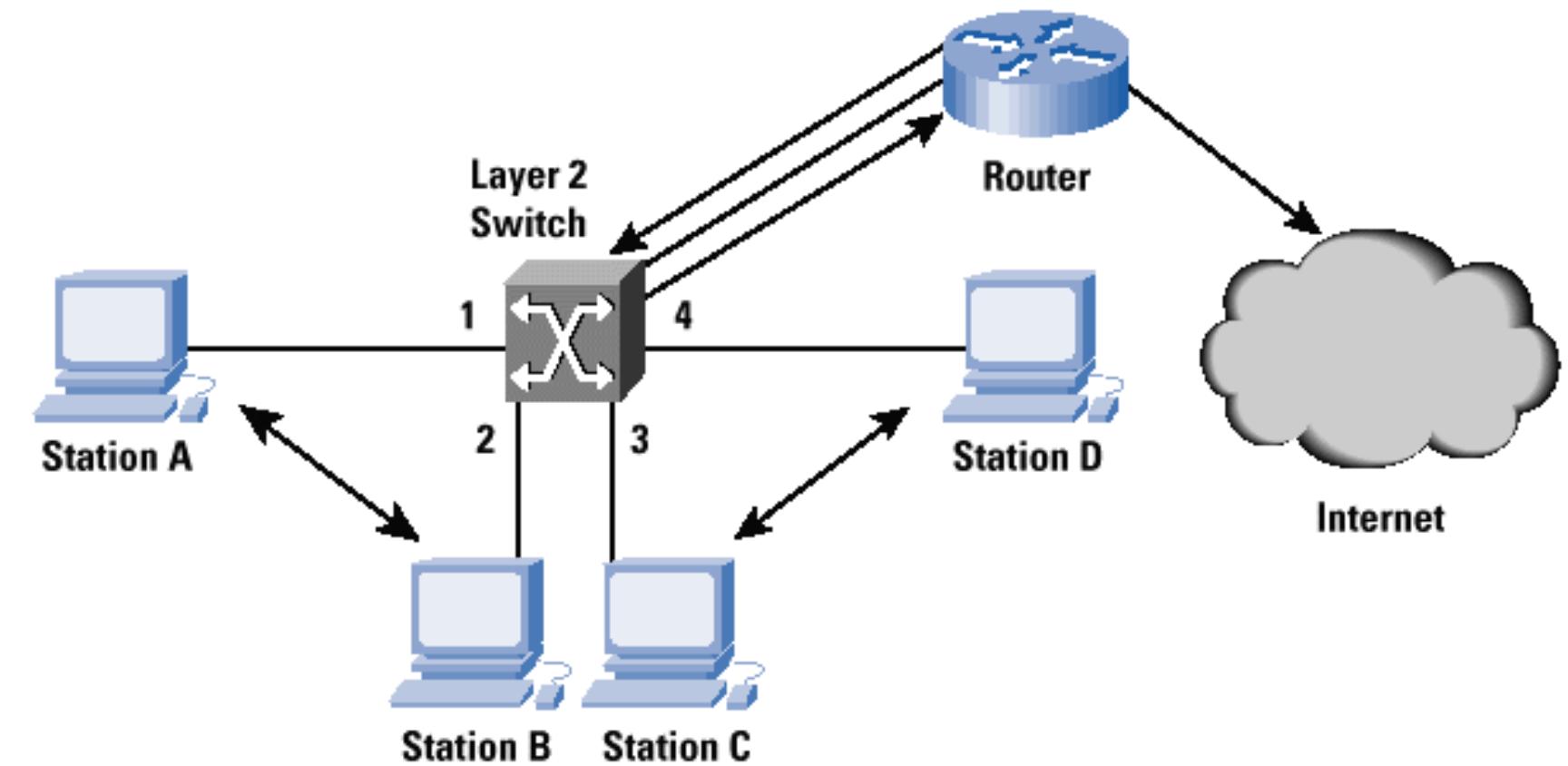
- Routers have all the capabilities listed above.
- Routers can regenerate signals, concentrate multiple connections, convert data transmission formats, and manage data transfers.
- They can also connect to a WAN, which allows them to connect LANs that are separated by great distances.



# L-3 / LAYER 3 SWITCH

- A layer 3 switch combines the functionality of a switch and a router. It acts as a switch to connect devices that are on the same subnet or virtual LAN at lightning speeds and has IP routing intelligence built into it to double up as a router

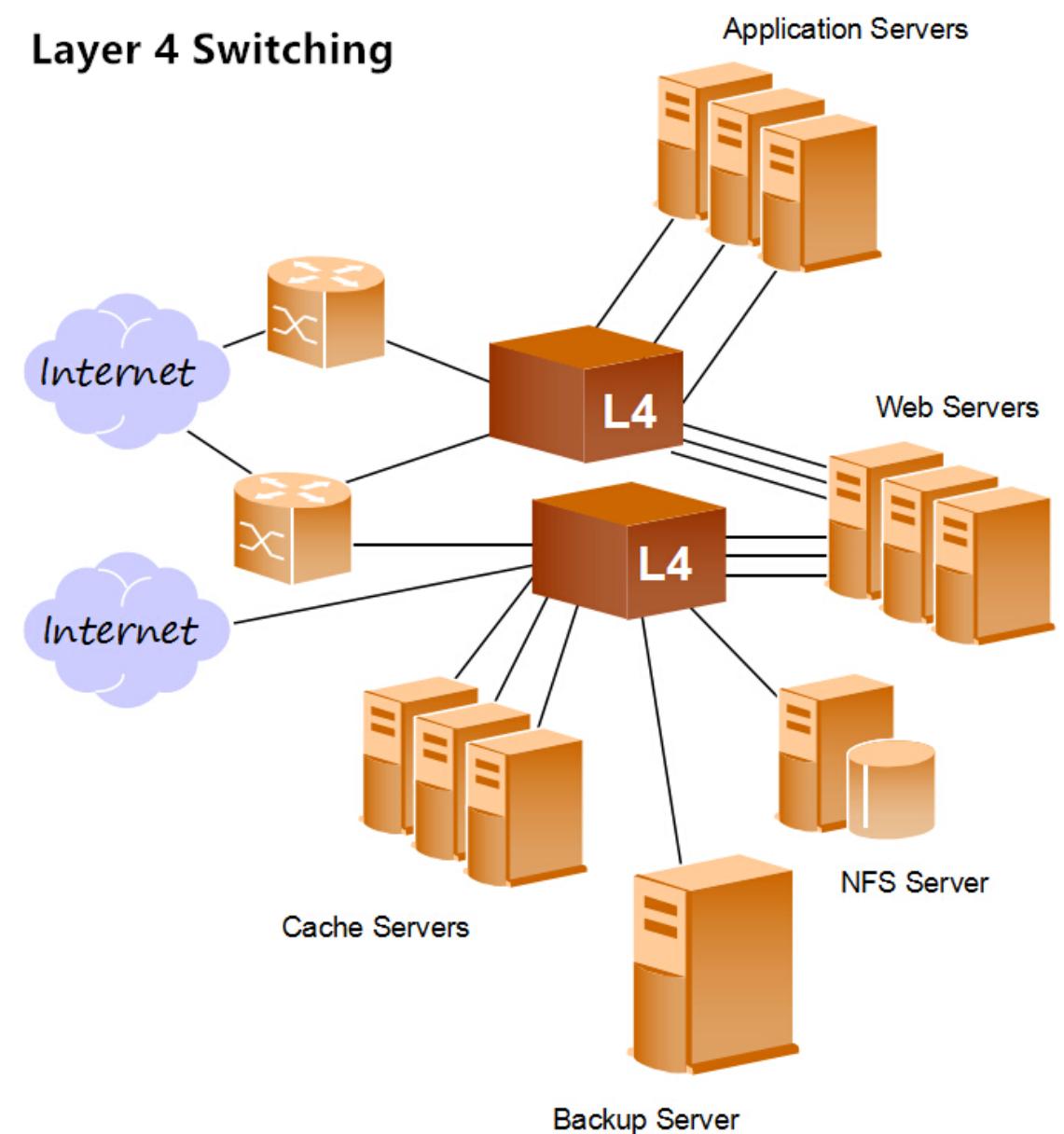
***L-3 / LAYER 3 SWITCH DIAGRAM***



# L-4 / LAYER 4 SWITCH

- A layer 4 switch is primarily responsible for the analysis and control of network traffic at layer 4 or the transport layer of OSI mode. It inspects each packet and makes forwarding and routing decisions based on layer 4-7 data

## *L-4 / LAYER 4 SWITCH DIAGRAM*

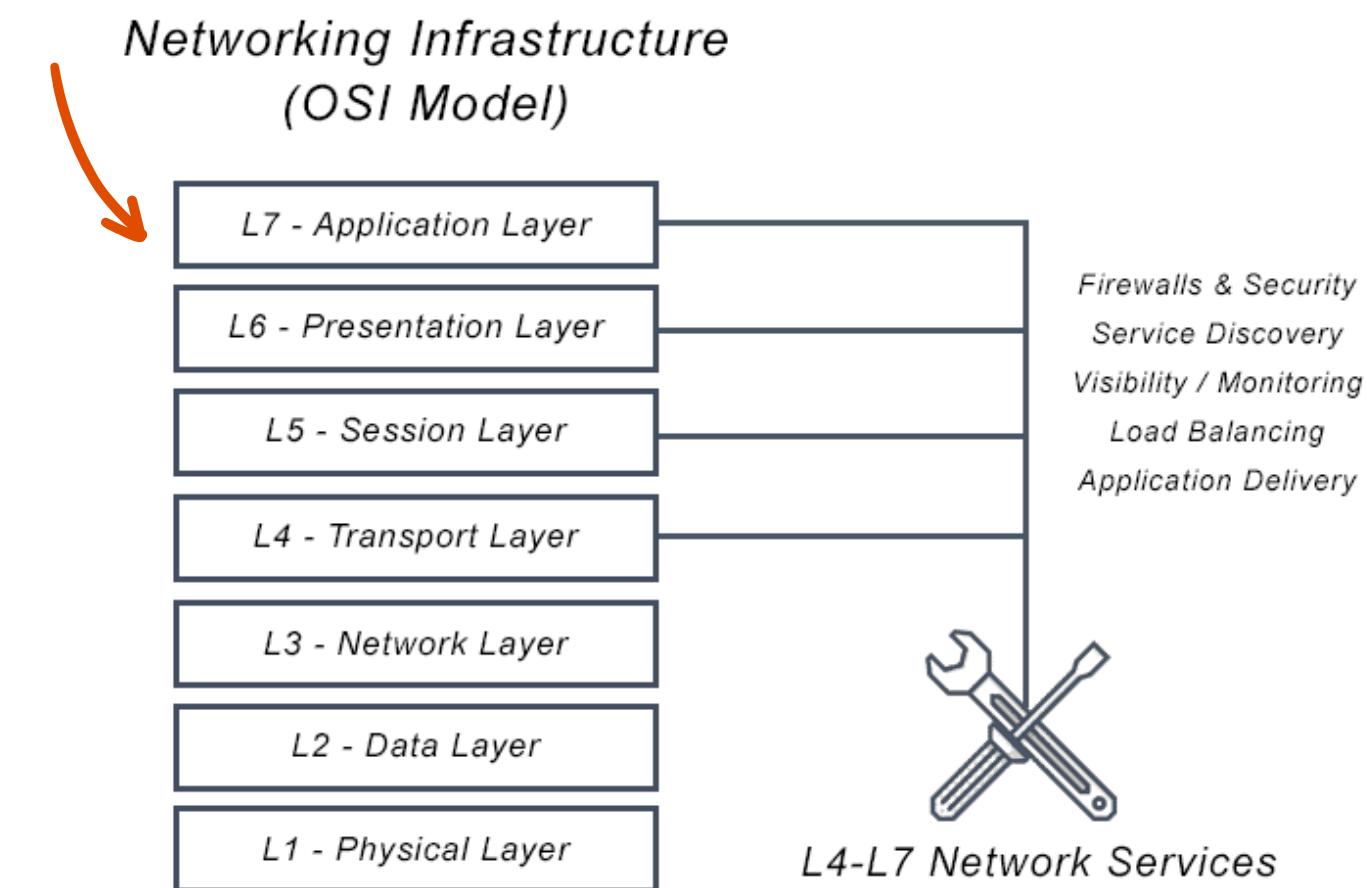




# L-7 / LAYER 7 SWITCH

A Layer 7 switch is a network device that is integrated with routing and switching capabilities. It can pass traffic and make forwarding and routing decisions at Layer 2 speed, but uses information from Layer 7 or application layer.

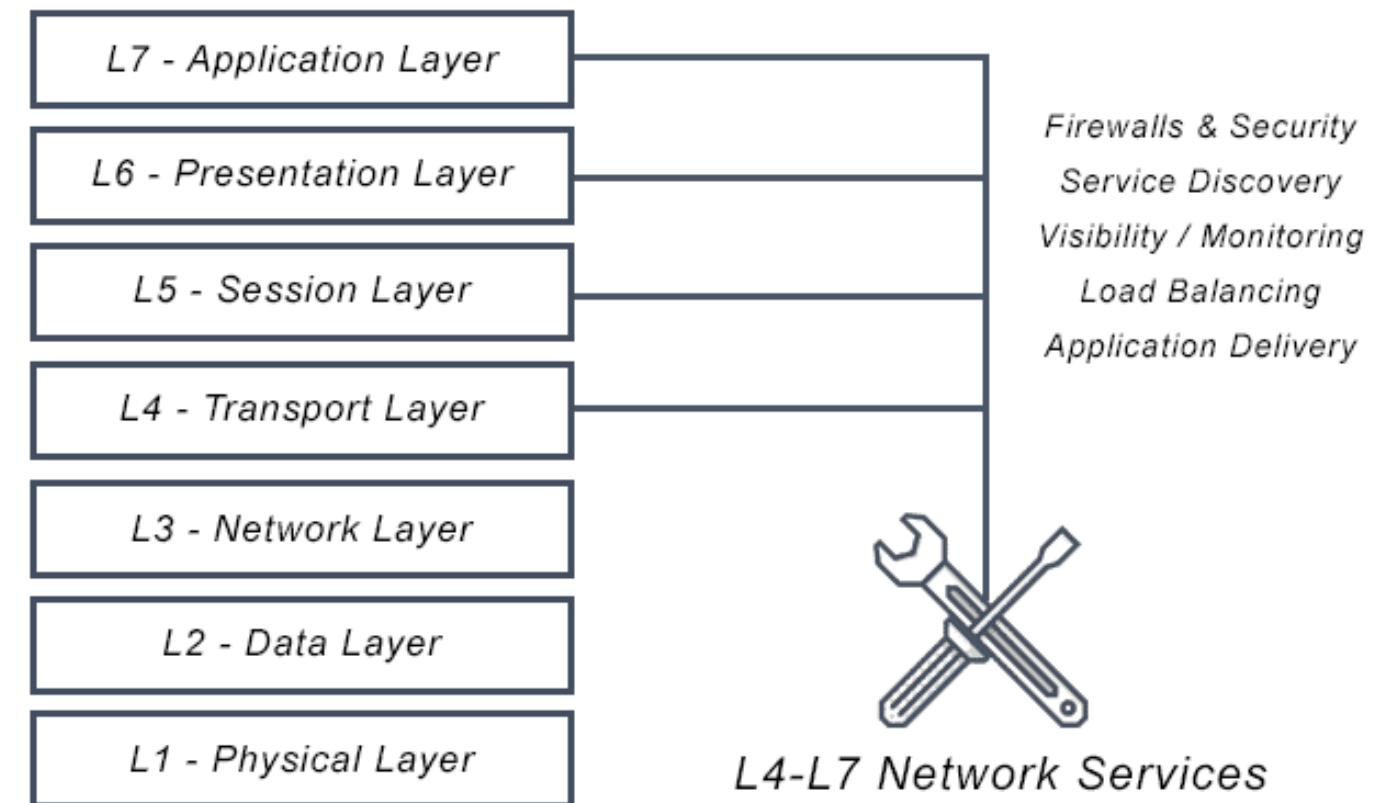
## L-7 / LAYER 7 SWITCH DIAGRAM



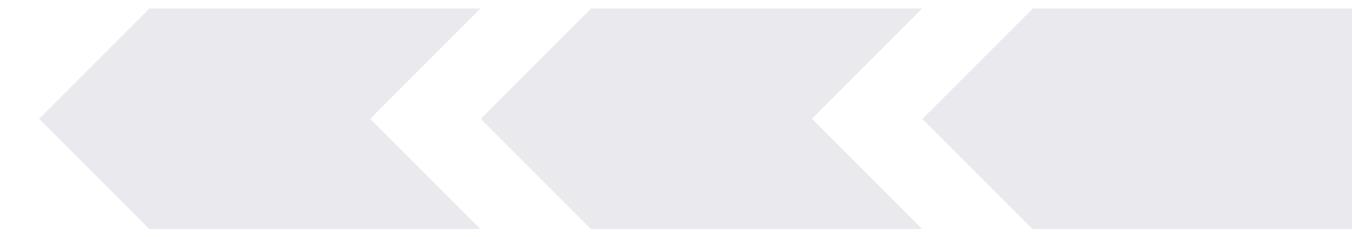
# WHAT ARE L4-L7 SERVICE NETWORKS?

L4-L7 service networks are application services running within those OSI layers. L7 service network is at the application layer and helps with the distribution of traffic. The L4 service network is known as a transport layer that includes TCP and UDP. L4-L7 network services provide data storage, manipulation, and communication services.

*Networking Infrastructure  
(OSI Model)*



# PROXY

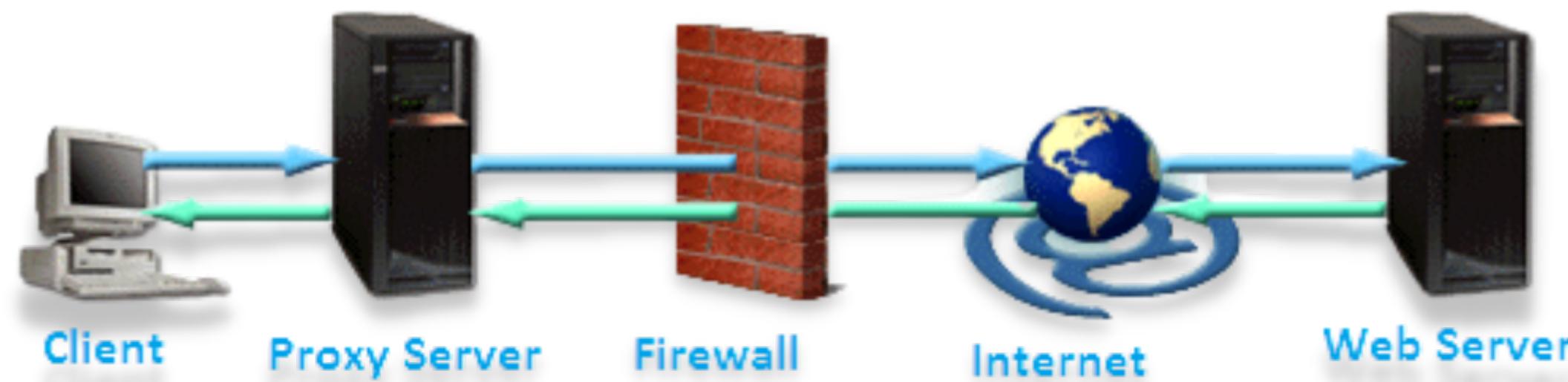


- The proxy server is a computer on the internet that accepts the incoming requests from the client and forwards those requests to the destination server. It works as a gateway between the end-user and the internet. It has its own IP address. It separates the client system and web server from the global network.
- In other words, we can say that the proxy server allows us to access any websites with a different IP address. It plays an intermediary role between users and targeted websites or servers. It collects and provides information related to user requests. The most important point about a proxy server is that it does not encrypt traffic.
- Two main purpose of Proxy Server:
  - To keep the system behind it anonymous.
  - To speed up access to a resource through caching.

# PROXY (MOST COMMON)

## OPEN OR FORWARD PROXY SERVER

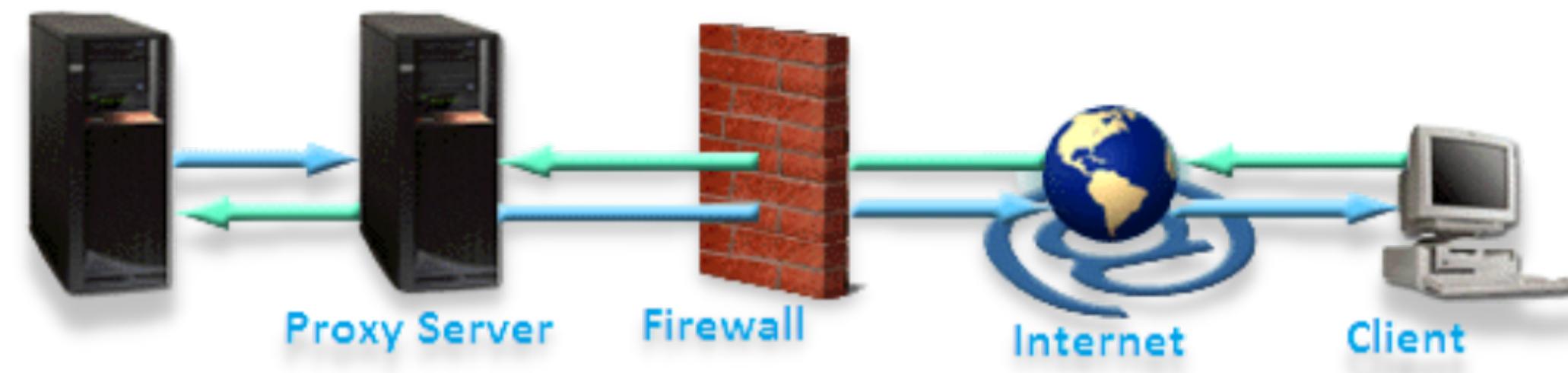
Open or Forward Proxy Server: It is the most widely recognized type of intermediary worker that is gotten to by the customer. An open or forward proxy server refers to those sorts of intermediaries that get demands from web clients and afterward peruse destinations to gather the mentioned information. After collecting the data from the sites, it forwards the data to the internet users directly. It bypasses the firewall made by authorities. The following image shows forward proxy configuration.



# PROXY (MOST COMMON)

## REVERSE PROXY SERVER

Reverse Proxy Server: It is a proxy server that is installed in the neighborhood of multiple other internal resources. It validated and processes a transaction in such a way that the clients do not communicate directly. The most popular reverse proxies are Varnish and Squid. The following image shows the reverse proxy configuration.



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# REPEATERS

- A repeater is a network device used to regenerate a signal.

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# OSI MODEL & TCP/IP



# OSI MODEL & TCP/IP

## INTRODUCTION TO OSI

- The Open System Interconnection Reference Model (OSI Reference Model or OSI Model) is an abstract description for layered communications and computer network protocol design.
- It divides network architecture into seven layers which, from top to bottom, are the Application, Presentation, Session, Transport, Network, Data Link, and Physical Layers. It is therefore often referred to as the OSI Seven Layer Model.

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# OSI MODEL & TCP/IP



## OSI HISTORY

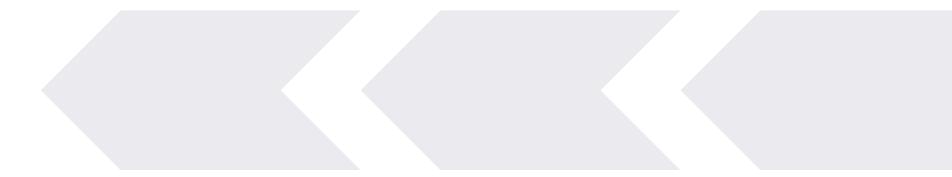
- In 1978, the International Standards Organization (ISO) began to develop its OSI framework architecture.
- OSI has two major components: an abstract model of networking, called the Basic Reference Model or seven-layer model, and a set of specific protocols.
- The concept of a 7 layer model was provided by the work of Charles Bachman, then of Honeywell.
- Various aspects of OSI design evolved from experiences with the Advanced Research Projects Agency Network (ARPANET) and the fledgling Internet.

# OSI MODEL & TCP/IP

OSI Model			
	Data unit	Layer	Function
<b>Host layers</b>	Data	7. <a href="#">Application</a>	Network process to application
		6. <a href="#">Presentation</a>	Data representation, encryption and decryption
		5. <a href="#">Session</a>	Interhost communication
<b>Media layers</b>	Segments	4. <a href="#">Transport</a>	End-to-end connections and reliability, Flow control
	Packet	3. <a href="#">Network</a>	Path determination and <a href="#">logical addressing</a>
	Frame	2. <a href="#">Data Link</a>	Physical addressing
	Bit	1. <a href="#">Physical</a>	Media, signal and binary transmission

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# LAYER 1



## LAYER 1: PHYSICAL LAYER

- The Physical Layer defines the electrical and physical specifications for devices. In particular, it defines the relationship between a device and a physical medium.
- This includes the layout of pin, voltages, cable specification, hubs, repeaters, network adapters, host bus adapters, and more.

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# LAYER 1



## LAYER 1: PHYSICAL LAYER

- The major functions and services performed by the Physical Layer are:
  - Establishment and termination of a connection to a communication medium.
  - Participation in the process whereby the communication resources are effectively shared among multiple users. For example, flow control.
  - Modulation, or conversion between the representation of digital data in user equipment and the corresponding signals transmitted over a communications channel. These are signals operating over the physical cabling (such as copper and optical fiber) or over a radio link.

# LAYER 1

## LAYER 1: PHYSICAL LAYER CON.

- The same applies to local-area networks, such as Ethernet, token ring , FDDI(Fiber Distributed Data Interface), ITU-T( International Telecommunication Union Telecommunication Standardization Sector) G.hn and IEEE802.11.
- Personal area networks such as Bluetooth and IEEE 802.15.4.

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# LAYER 2



## LAYER 2: DATA LINK LAYER

- The Data Link Layer provides the functional and procedural means to transfer data between network entities and to detect and possibly correct errors that may occur in the Physical Layer.
- Originally, this layer was intended for point-to-point and point-to-multipoint media, characteristic of wide area media in the telephone system.
- The data link layer is divided into two sub-layers by IEEE.

# LAYER 2

## LAYER 2: DATA LINK LAYER

- One is Media Access Control (MAC) and another is Logical Link Control (LLC).
- Mac is lower sub-layer, and it defines the way about the media access transfer, such as CSMA/CD/CA(Carrier Sense Multiple Access/Collision Detection/Collision Avoidance)
- LLC provides data transmission method in different network. It will re-package date and add a new header.

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# LAYER 3



## LAYER 2: NETWORK LAYER

- The Network Layer provides the functional and procedural means of transferring variable length data sequences from a source to a destination via one or more networks, while maintaining the quality of service requested by the Transport Layer.

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# LAYER 3



## LAYER 2: NETWORK LAYER

- The Network Layer performs
  - network routing functions,
  - perform fragmentation and reassembly,
  - report delivery errors.
- Routers operate at this layer—sending data throughout the extended network and making the Internet possible.

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# LAYER 4



## LAYER 4: TRANSPORT LAYER

- The Transport Layer provides transparent transfer of data between end users, providing reliable data transfer services to the upper layers.
- The Transport Layer controls the reliability of a given link through flow control, segmentation/desegmentation, and error control.

# LAYER 4

Feature Name	TP0	TPI	TP2	TP3	TP4
Connection oriented network	Yes	Yes	Yes	Yes	Yes
Connectionless network	No	No	No	No	Yes
Concatenation and separation	No	Yes	Yes	Yes	Yes
Segmentation and reassembly	Yes	Yes	Yes	Yes	Yes
Error Recovery	No	Yes	No	Yes	Yes
Reinitiate connection (if an excessive number of <u>PDUs</u> are unacknowledged)	No	Yes	No	Yes	No
multiplexing and demultiplexing over a single <u>virtual circuit</u>	No	No	Yes	Yes	Yes
Explicit flow control	No	No	Yes	Yes	Yes
Retransmission on timeout	No	No	No	No	Yes
Reliable Transport Service	No	Yes	No	Yes	Yes

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# LAYER 5

## LAYER 5: SESSION LAYER

- The Session Layer controls the dialogues (connections) between computers.
- It establishes, manages and terminates the connections between the local and remote application.
- It provides for full-duplex, half-duplex, or simplex operation, and establishes checkpointing, adjournment, termination, and restart procedures.

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# LAYER 5



## LAYER 5: SESSION LAYER

- The OSI model made this layer responsible for graceful close of sessions, which is a property of the Transmission Control Protocol, and also for session check pointing and recovery, which is not usually used in the Internet Protocol Suite. The Session Layer is commonly implemented explicitly in application environments that use remote procedure calls.

# LAYER 6

## LAYER 6: PRESENTATION LAYER

- The Presentation Layer establishes a context between Application Layer entities, in which the higher-layer entities can use different syntax and semantics, as long as the presentation service understands both and the mapping between them.
- This layer provides independence from differences in data representation (e.g., encryption) by translating from application to network format, and vice versa.
- This layer formats and encrypts data to be sent across a network, providing freedom from compatibility problems.
- It is sometimes called the syntax layer.

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# LAYER 7



## LAYER 7: APPLICATION LAYER

- The application layer is the OSI layer closest to the end user, which means that both the OSI application layer and the user interact directly with the software application.
- Application layer functions typically include:
  - identifying communication partners,
  - determining resource availability,
  - synchronizing communication.

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# LAYER 7



## LAYER 7: APPLICATION LAYER

- **Identifying communication partners**
  - Determines the identity and availability of communication partners for an application with data to transmit.
- **Determining resource availability**
  - Decide whether sufficient network or the requested communication exist.
- **Synchronizing communication**
  - All communication between applications requires cooperation that is managed by the application layer.

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# LAYER 7

## LAYER 7: APPLICATION LAYER

- Some examples of application layer implementations include
  - Hypertext Transfer Protocol (HTTP)
  - File Transfer Protocol (FTP)
  - Simple Mail Transfer Protocol (SMTP)

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## OSI FEATURE

- Open system standards over the world
- Rigorously defined structured, hierarchical network model
- Complete description of the function
- Provide standard test procedures

# OSI MODEL & TCP/IP

## INTRODUCTION TO TCP/IP

- The **Internet Protocol Suite (commonly known as TCP/IP)** is the set of communications protocols used for the Internet and other similar networks.
- It is named from two of the most important protocols in it:
  - the Transmission Control Protocol (TCP) and
  - the Internet Protocol (IP), which were the first two networking protocols defined in this standard.

# TCP/IP LAYER

OSI	TCP/IP
Application Layer	Application Layer TELNET, FTP, SMTP, POP3, SNMP, NNTP, DNS, NIS, NFS, HTTP, ...
Presentation Layer	
Session Layer	
Transport Layer	Transport Layer TCP, UDP, ...
Network Layer	Internet Layer IP, ICMP, ARP, RARP, ...
Data Link Layer	
Physical Layer	Link Layer FDDI, Ethernet, ISDN, X.25, ...

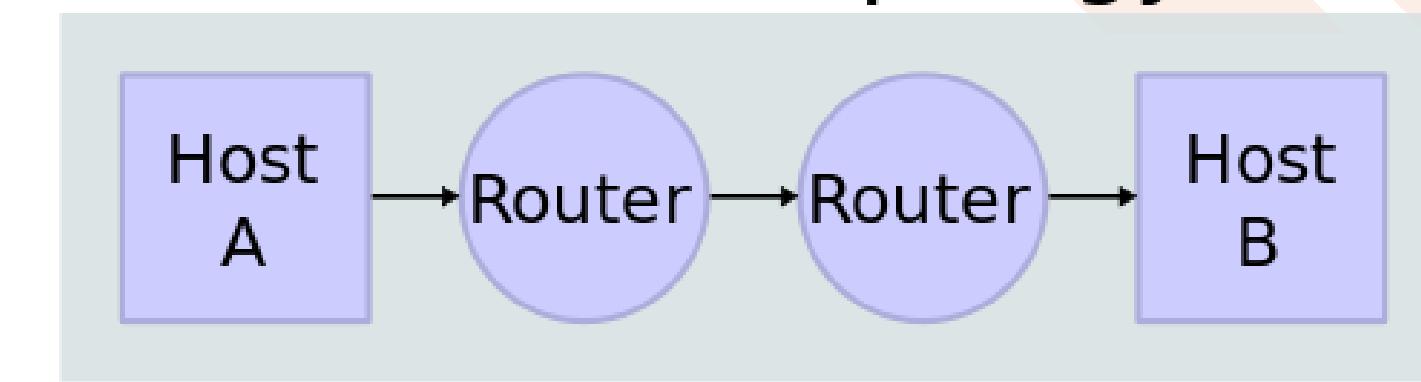


# TCP/IP LAYER

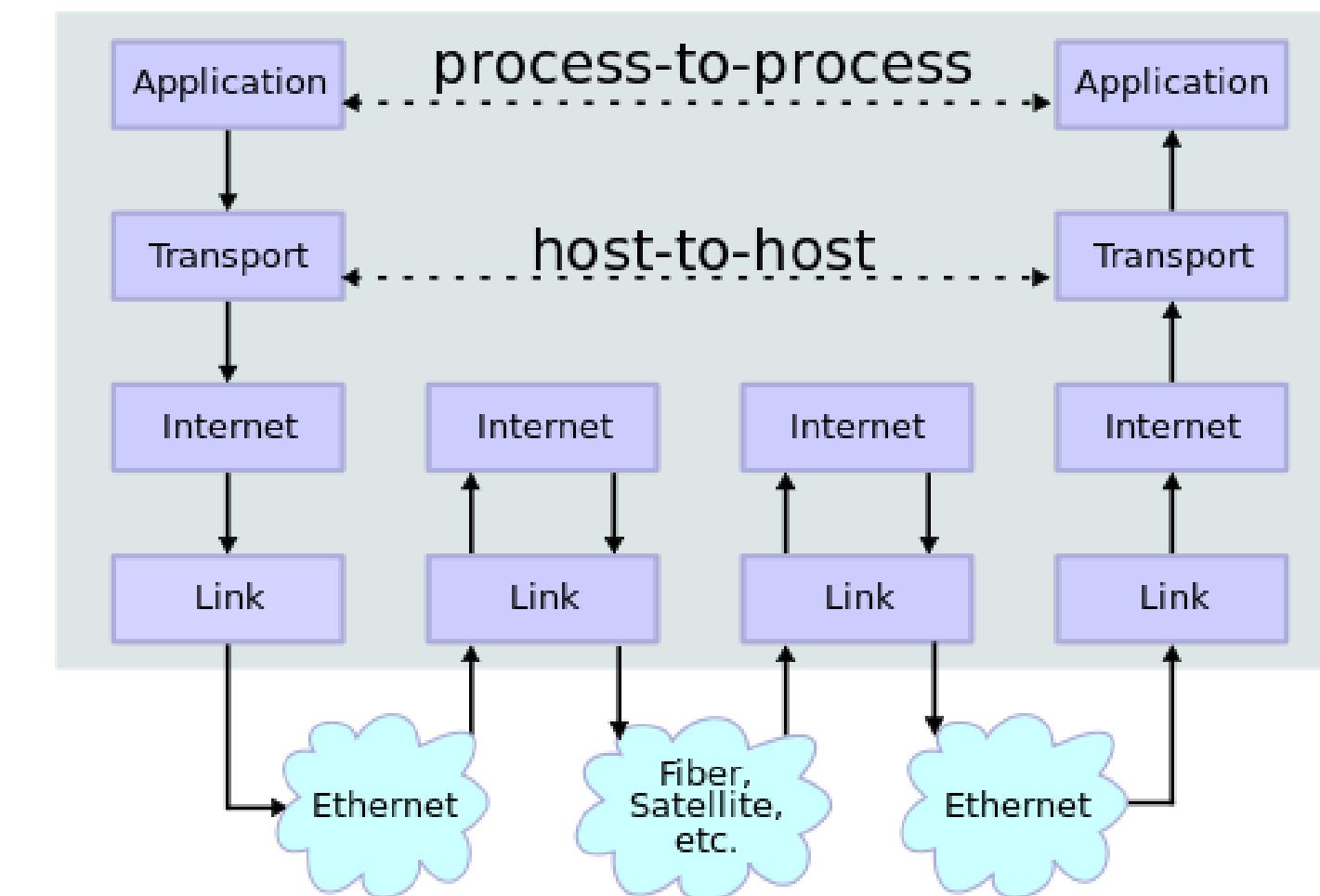
# TCP/IP STACK

Conceptual data flow in a simple network topology of two hosts (A and B) connected by a link between their respective routers.

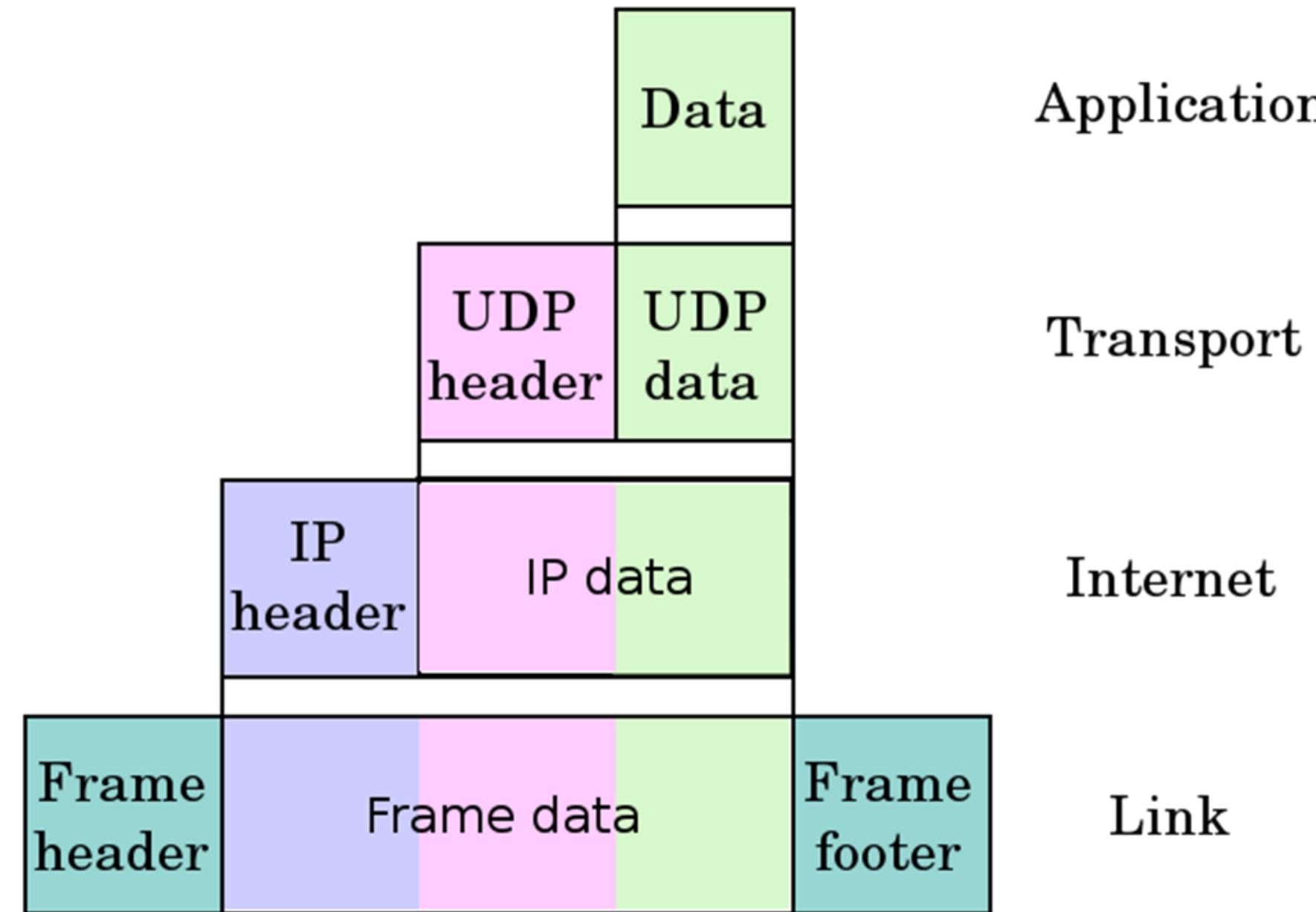
## Network Topology



## Data Flow



# TCP/IP ENCAPSULATION



# TCP/IP SOME PROTOCOL

Layer	Protocol
<u>Application</u>	<u>DNS</u> , <u>TFTP</u> , <u>TLS/SSL</u> , <u>FTP</u> , <u>Gopher</u> , <u>HTTP</u> , <u>IMAP</u> , <u>IRC</u> , <u>NNTP</u> , <u>POP3</u> , <u>SIP</u> , <u>SMTP</u> , <u>SMPP</u> , <u>SNMP</u> , <u>SSH</u> , <u>Telnet</u> , <u>Echo</u> , <u>RTP</u> , <u>PNRP</u> , <u>rlogin</u> , <u>ENRP</u>
	Routing protocols like <u>BGP</u> and <u>RIP</u> which run over TCP/UDP, may also be considered part of the Internet Layer.
<u>Transport</u>	<u>TCP</u> , <u>UDP</u> , <u>DCCP</u> , <u>SCTP</u> , <u>IL</u> , <u>RUDP</u> , <u>RSVP</u>
	<u>IP</u> ( <u>IPv4</u> , <u>IPv6</u> ), <u>ICMP</u> , <u>IGMP</u> , and <u>ICMPv6</u>
<u>Internet</u>	<u>OSPF</u> for <u>IPv4</u> was initially considered IP layer protocol since it runs per IP-subnet, but has been placed on the Link since <u>RFC 2740</u> .
<u>Link</u>	<u>ARP</u> , <u>RARP</u> , <u>OSPF</u> (IPv4/IPv6), <u>IS-IS</u> , <u>NDP</u>

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# NETWORK TOPOLOGY



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# NETWORK TOPOLOGY



## INTRODUCTION TO TOPOLOGY

- Network topology is the layout pattern of interconnections of various elements of a computer network
- Computer network topology is the way various components of a network (like nodes, links, peripherals, etc) are arranged. Network topologies define the layout, virtual shape or structure of network, not only physically but also logically. The way in which different systems and nodes are connected and communicate with each other is determined by topology of the network.

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# NETWORK TOPOLOGY



**NETWORK TOPOLOGY CAN BE PHYSICAL OR LOGICAL**

- **Physical Topology** is the physical layout of nodes, workstations and cables in the network.
- **Logical topology** is the way information flows between different components.

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# **TYPES OF PHYSICAL TOPOLOGY**



## **PHYSICAL TOPOLOGY:**

- Bus Topology
- Star Topology
- Ring Topology
- Mesh Topology
- Tree Topology
- Hybrid Topology

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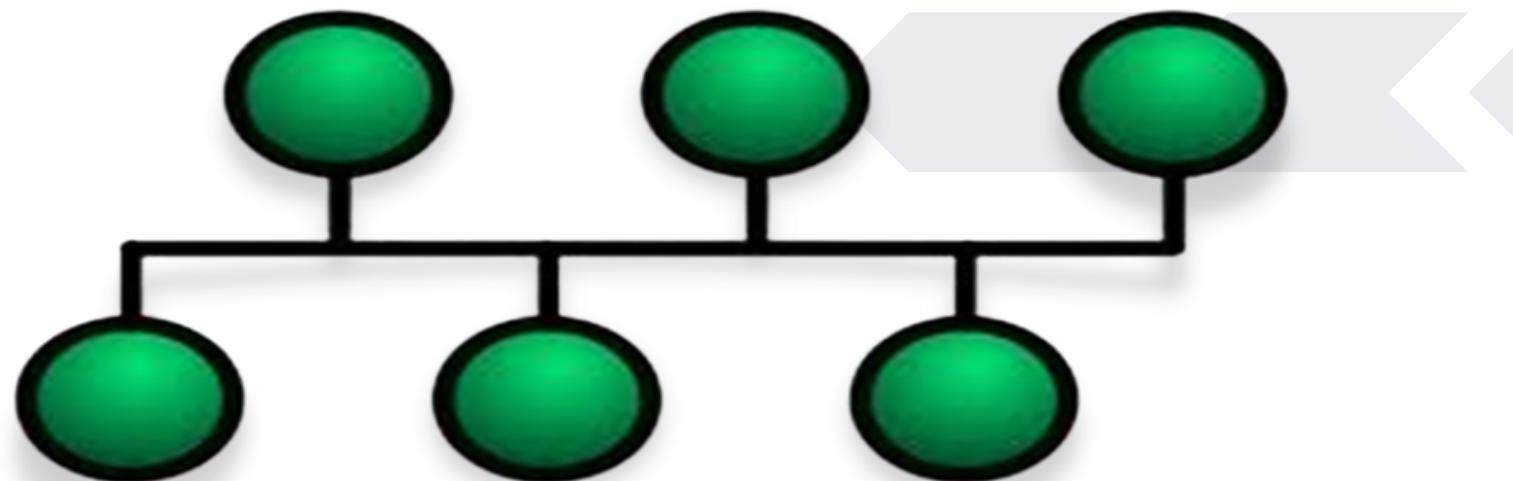
# **TYPES OF PHYSICAL TOPOLOGY**



## **BUS TOPOLOGY**

In the bus topology, the computers are connected through a common communication media. A special type of central wire is used as communication media. This central wire is called Bus. The computer are attached through the bus the ends of the bus are closed with the terminator .The terminators are used to absorb signals.

# BUS TOPOLOGY

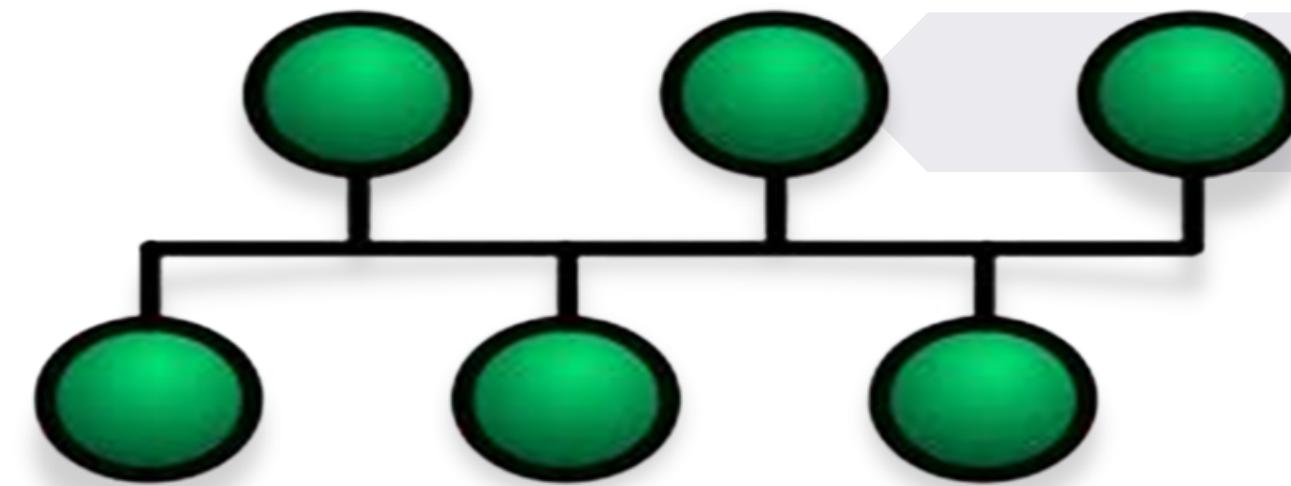


## INFO:

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# BUS TOPOLOGY



## ADVANTAGES:

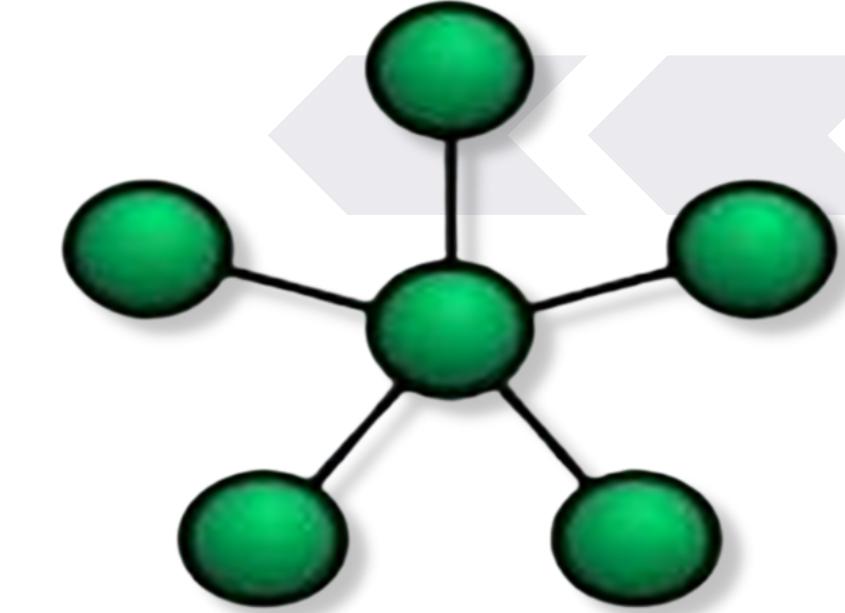
- Easy to install and configure
- Inexpensive
- Easily extended

## DISADVANTAGES:

- Performance decreases
- Weak signals
- Difficult troubleshooting

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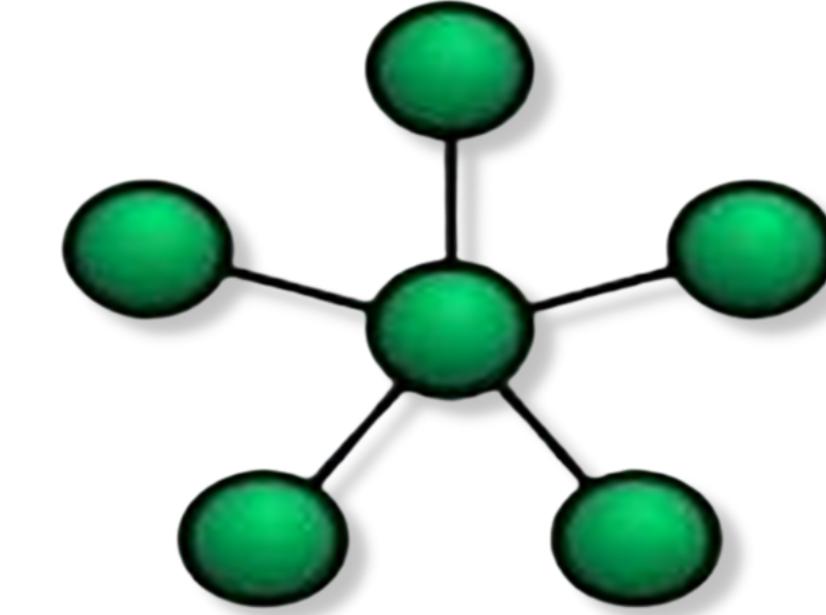
# STAR TOPOLOGY



## INFO:

- The star topology uses a separate cable for each work station as shown in fig. The cable connects the work station to a central device typically a HUB. The configuration provides a more reliable network that is easily expanded. With star there is no central point of failure in the cable . if there is a problem with the cable only the station connected to that cable is affected . to add more work stations simply connect another HUB.

# STAR TOPOLOGY



## ADVANTAGES:

- Easily expanded and modified
- Easy to troubleshoot
- Multiple cable types supported by hub

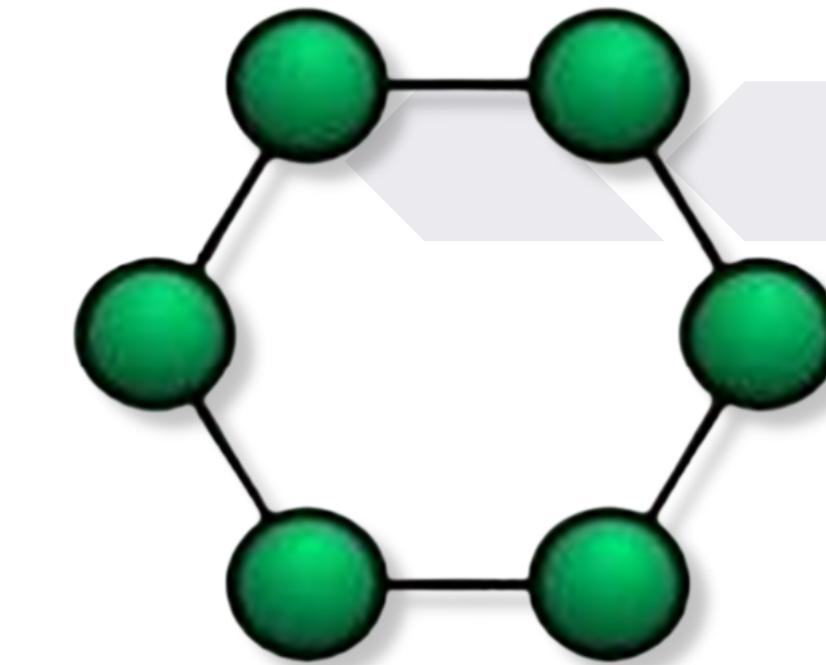
## DISADVANTAGES:

- If hub fails then entire network will fail
- Require more cables
- May require a device to rebroadcast signals across the network

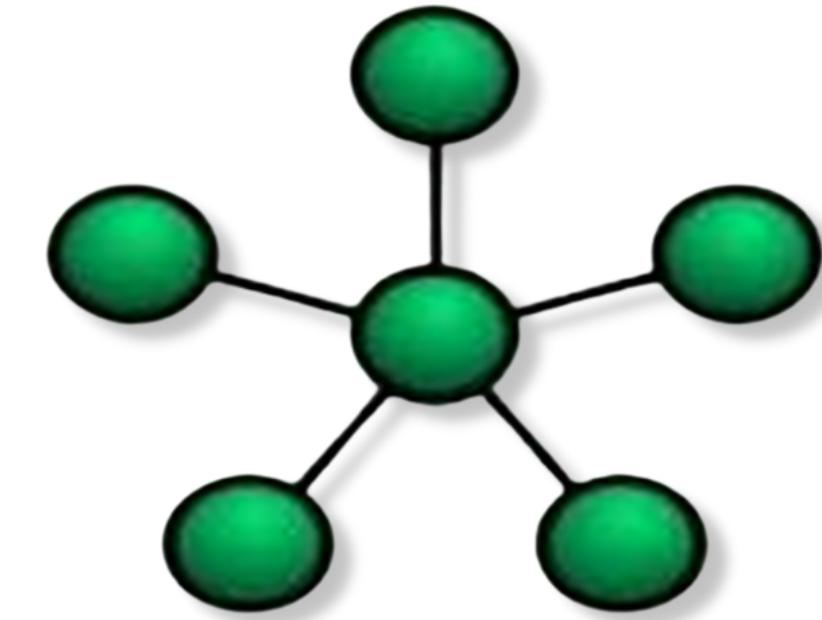
# RING TOPOLOGY

## INFO:

- A ring topology is a network configuration where device connections create a circular data path. Each networked device is connected to two others, like points on a circle. Together, devices in a ring topology are referred to as a ring network.
- In a ring network, packets of data travel from one device to the next until they reach their destination. Most ring topologies allow packets to travel only in one direction, called a unidirectional ring network. Others permit data to move in either direction, called bidirectional.



# RING TOPOLOGY



## ADVANTAGES:

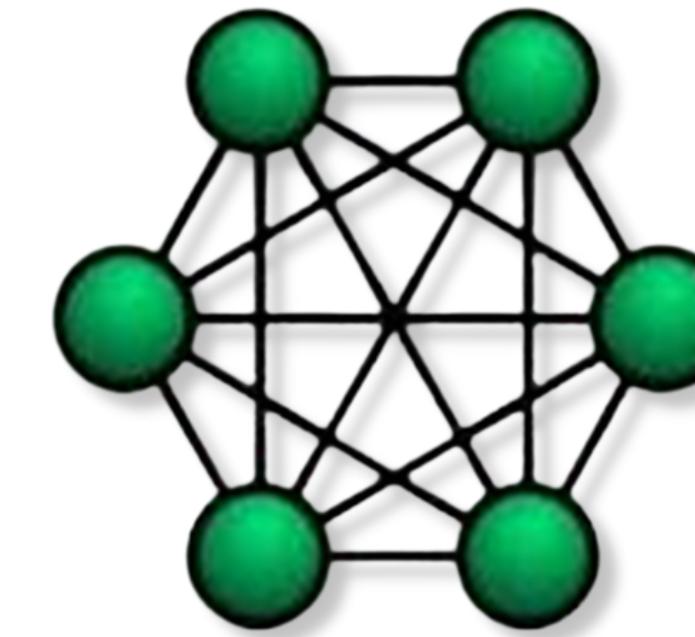
- It provides an orderly network in which every device has access to the token and can transmit.
- It performs well under a heavy load.

## DISADVANTAGES:

- Failure of one computer can affect the whole network .
- Difficult to troubleshoot.
- Change mode with adding or removing a device effect the entire network.

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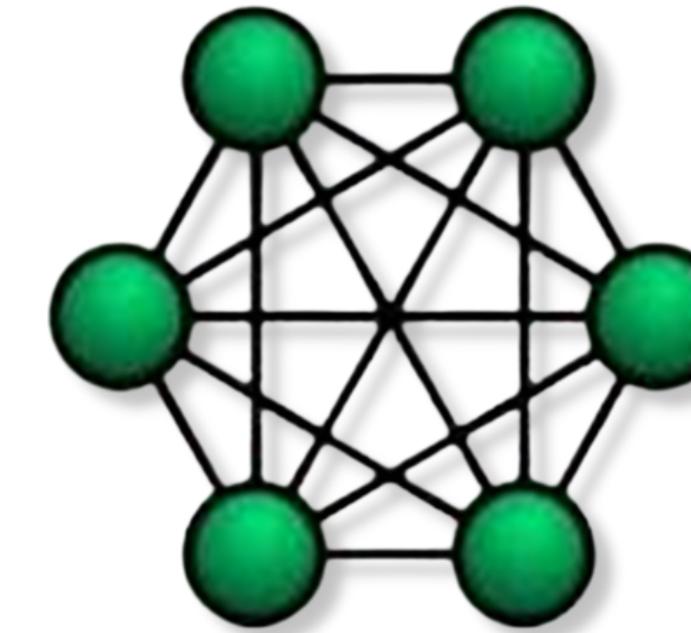
# MESH TOPOLOGY



## INFO:

- A mesh topology is a network setup where each computer and network device is interconnected with one another. This topology setup allows for most transmissions to be distributed even if one of the connections goes down. It is a topology commonly used for wireless networks. Below is a visual example of a simple computer setup on a network using a mesh topology.

# MESH TOPOLOGY



## ADVANTAGES:

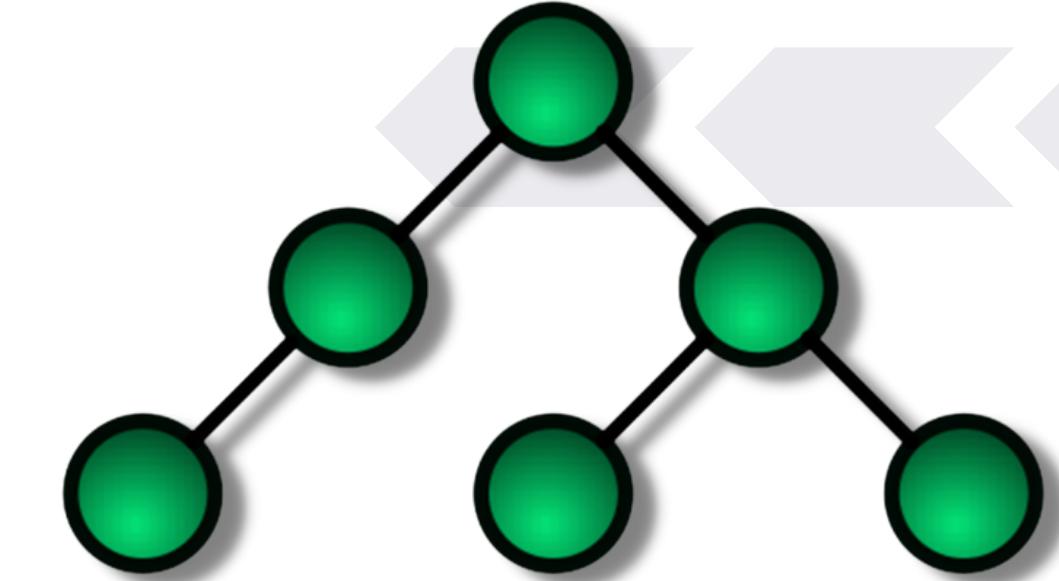
- Enhanced error tolerance provided by redundant links.
- Easy to troubleshoot.

## DISADVANTAGES:

- Difficult to install and maintain.
- Expensive.

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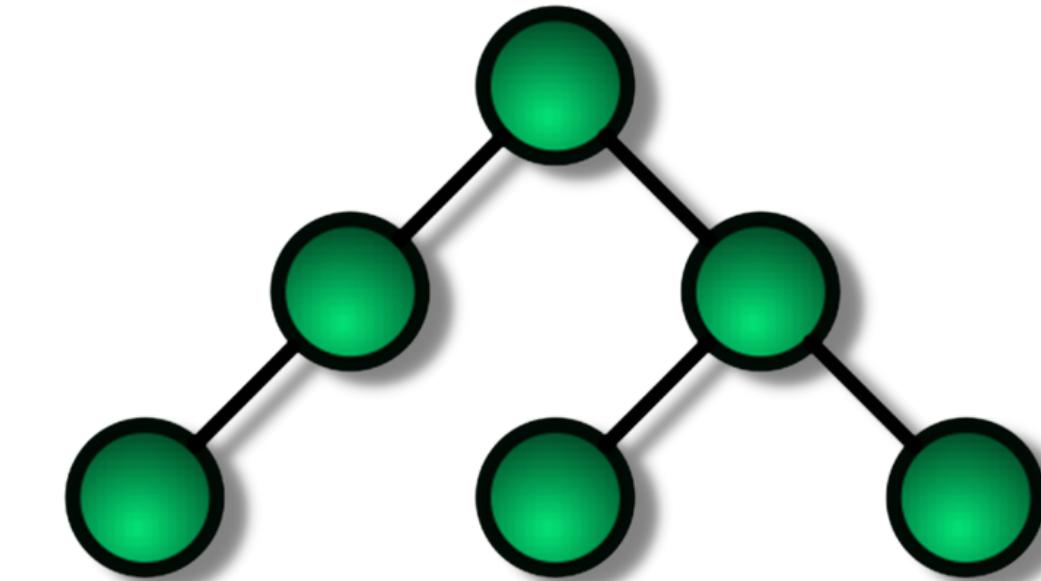
# TREE TOPOLOGY



## INFO:

- A tree topology is a special type of structure where many connected elements are arranged like the branches of a tree. For example, tree topologies are frequently used to organize the computers in a corporate network, or the information in a database.
- In a tree topology, there can be only one connection between any two connected nodes. Because any two nodes can have only one mutual connection, tree topologies create a natural parent and child hierarchy.

# TREE TOPOLOGY



## ADVANTAGES:

- It is **scalable**. Secondary nodes allow more devices to be connected to a central node.
- Point to point connection of devices.
- Having different levels of the network makes it more manageable hence easier fault identification and isolation.

## DISADVANTAGES:

- Maintenance of the network may be an issue when the network spans a great area.
- Since it is a variation of bus topology, if the backbone fails, the entire network is crippled.

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# HYBRID TOPOLOGY

## INFO:

- A hybrid topology is a type of network topology that uses two or more differing network topologies. These topologies can include a mix of bus topology, mesh topology, ring topology, star topology, and tree topology.
- The choice to use a hybrid topology over a standard topology depends on the needs of a business, school, or the users. The number of computers, their location, and desired network performance are all factors in the decision.

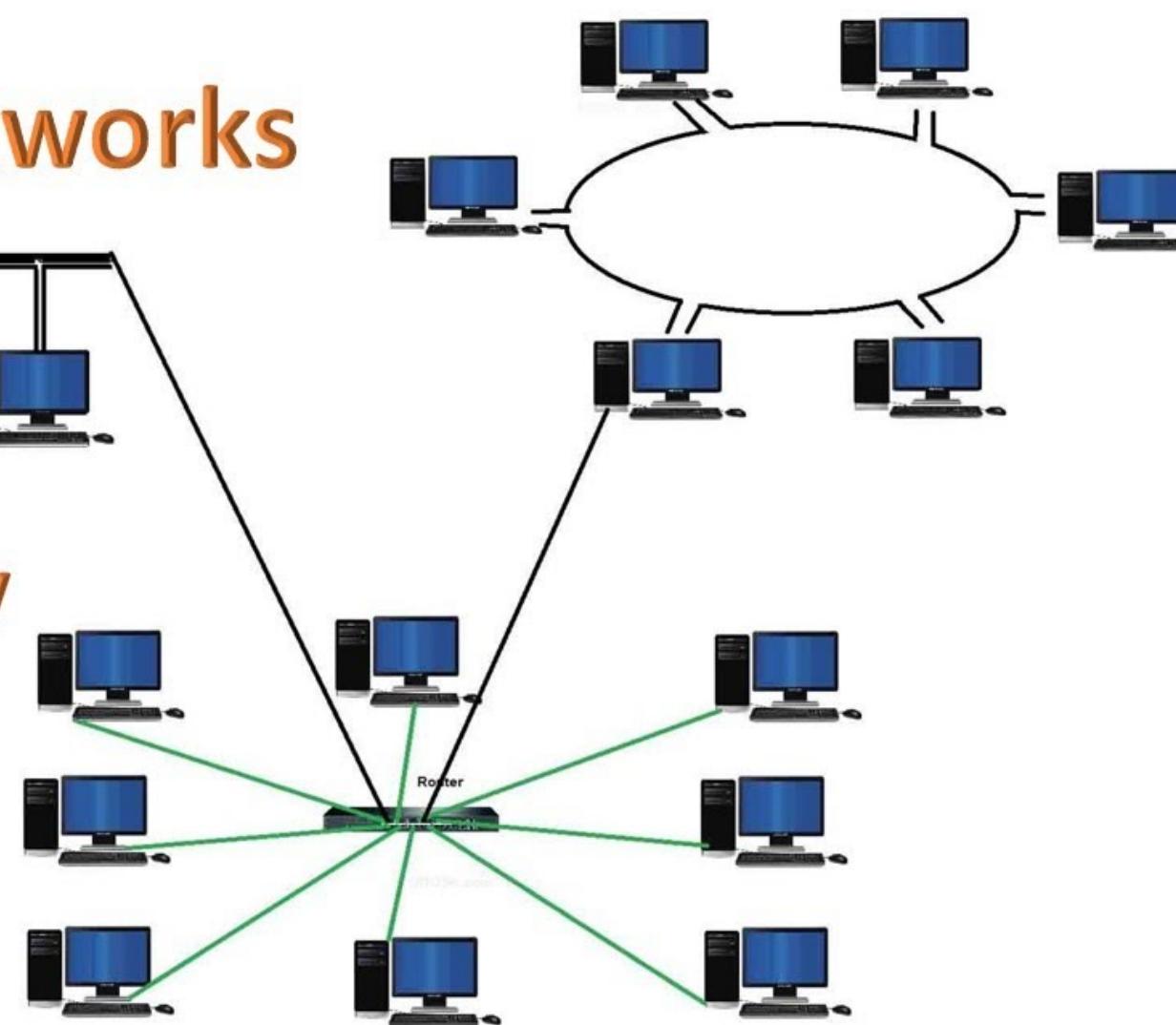
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# HYBRID TOPOLOGY

Computer Networks



Hybrid Topology



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# **HYBRID TOPOLOGY**

## **(TWO MOST COMMON TYPES)**

### **Star-Ring Hybrid Topology**

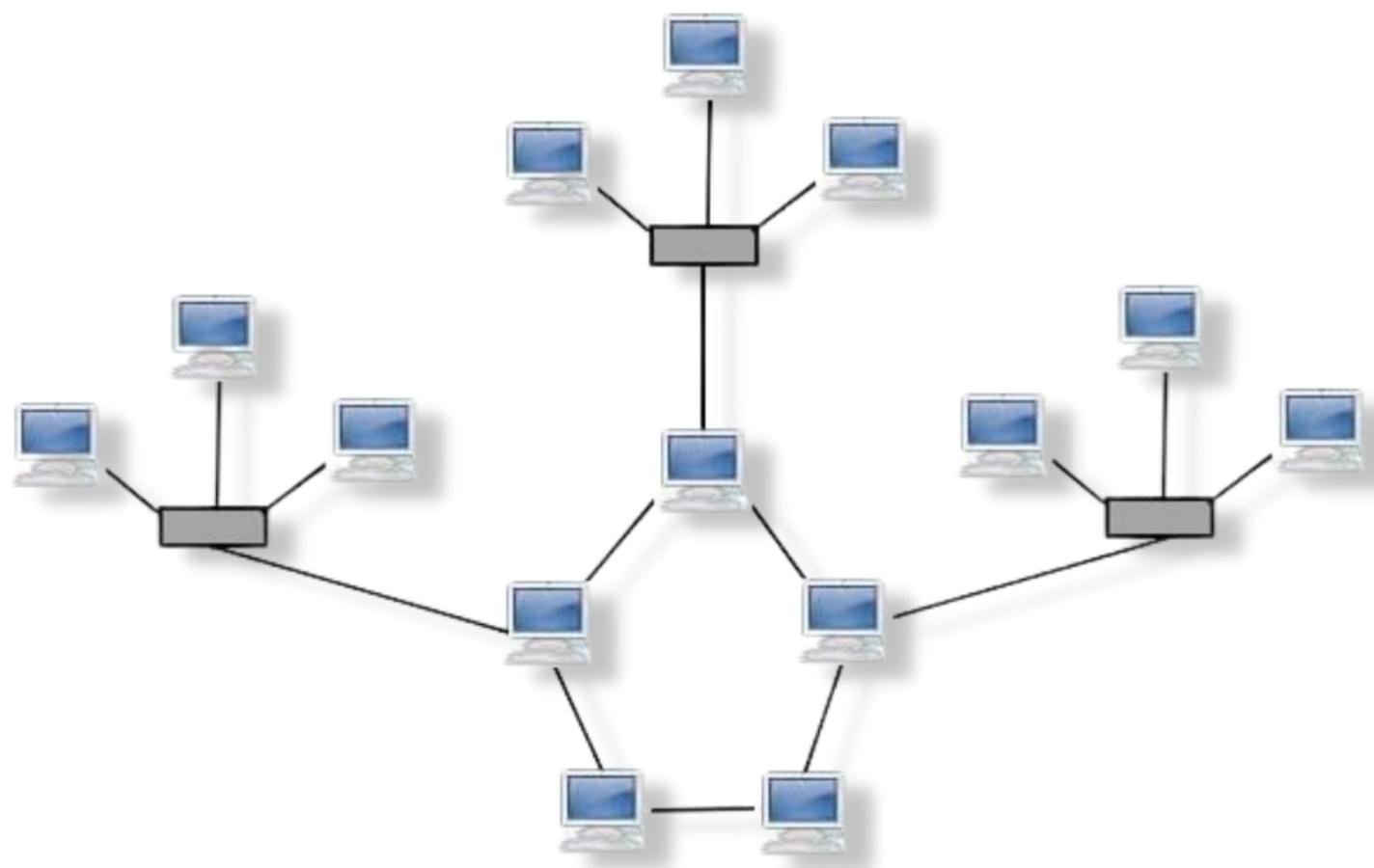
- A **star-ring hybrid topology** is a combination of the star topology and ring topology. Two or more star topologies are connected together through a ring topology.

### **Star-Bus Hybrid Topology**

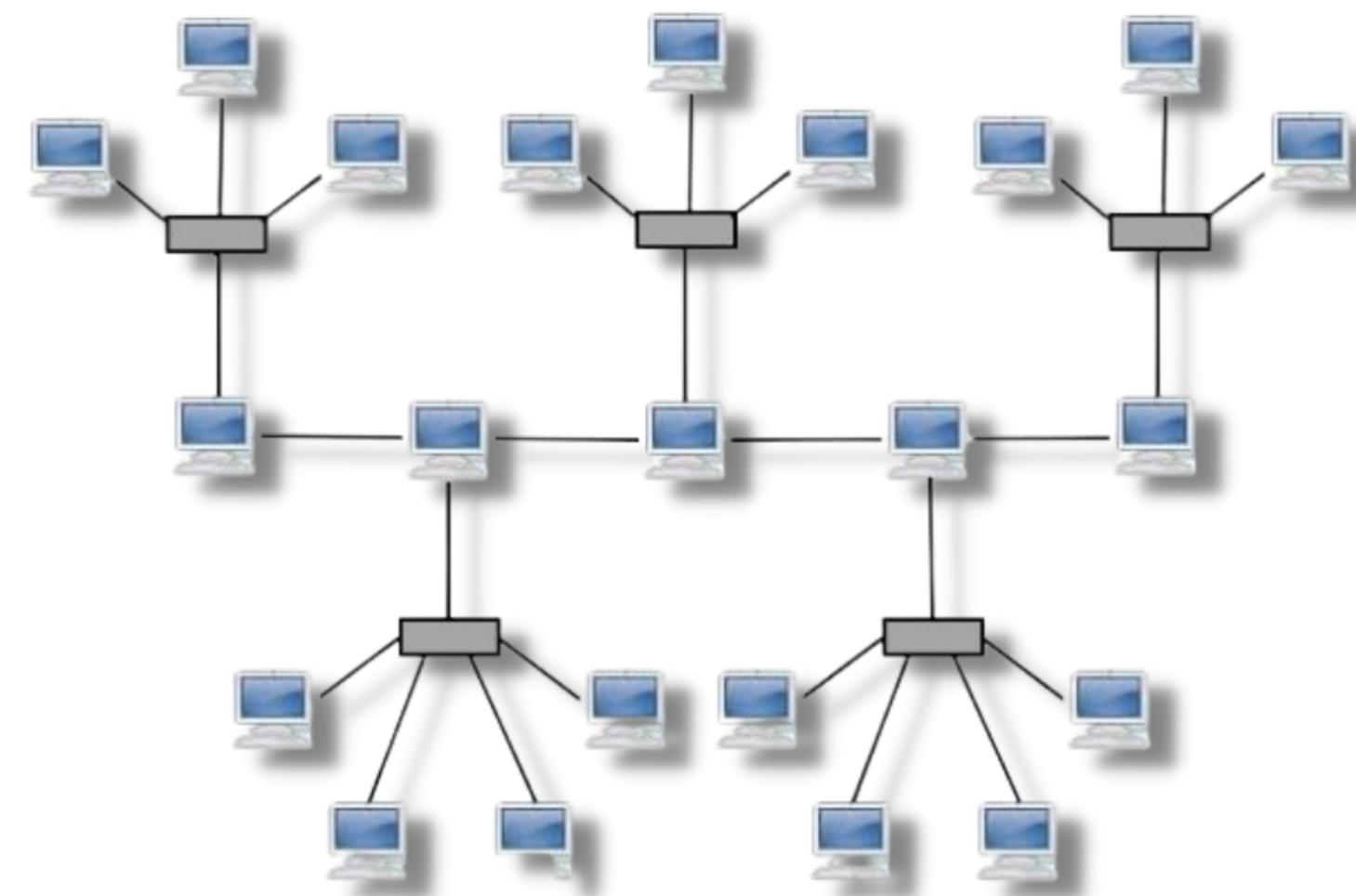
- A **star-bus hybrid topology** is a combination of the star topology and bus topology. Two or more star topologies are connected together through a bus topology.

---

# **HYBRID TOPOLOGY (TWO MOST COMMON TYPES)**



**Star-Ring Hybrid Topology**



**Star-Bus Hybrid Topology**

---



# **NETWORK COMMANDS (WINDOWS)**



---



# **USEFUL WINDOWS NETWORKING COMMAND**

# ping COMMAND

## INFO:

- The ping command is one of the most often used networking utilities for detecting devices on a network and for troubleshooting network problems.
- When you ping a device you send that device a short message, which it then sends back (**the echo**).
- The general format is **ping hostname** or **ping IPaddress**.

- **ping www.google.com** or **ping 216.58.208.68**

# ipconfig COMMAND

## INFO:

- Another indispensable and frequently used utility that is used for finding network information about your local machine like IP addresses, DNS addresses etc
- **Basic Use: Finding Your IP Address and Default Gateway**

Type the command ipconfig at the prompt.

- The following is displayed:

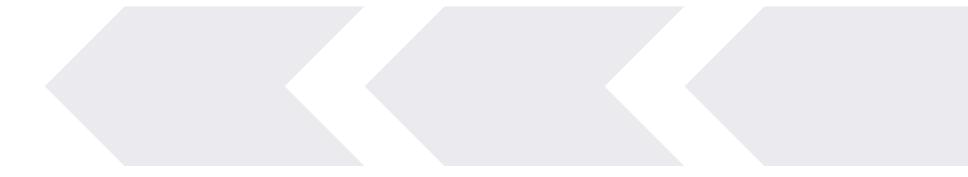
```
C:\>ipconfig
Windows 2000 IP Configuration

Ethernet adapter Local Area Connection 2:

      Connection-specific DNS Suffix  . : 
      IP Address . . . . . : 192.168.1.3
      Subnet Mask . . . . . : 255.255.255.0
      Default Gateway . . . . . : 192.168.1.1

C:\>
```

# ipconfig COMMAND



**Ip config** has a number of switches the most common are:

- **ipconfig /all** – displays more information about the network setup on your systems including the MAC address.
- **ipconfig /release** – release the current IP address
- **ipconfig /renew** – renew IP address
- **ipconfig /?** -shows help
- **ipconfig/flushdns** – flush the dns cache

# hostname COMMAND

## INFO:

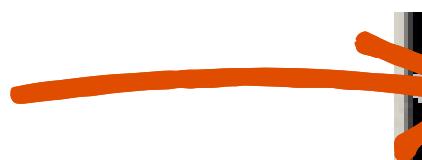
- A very simple command that displays the host name of your machine. This is much quicker than going to the control **panel>system** route.



# getmac COMMAND

## INFO:

- Another very simple command that shows the MAC address of your network interfaces



```
C:\>getmac
Physical Address      Transport Name
=====              =====
Disabled             Disconnected
Disabled             Disconnected
00-1F-1F-B7-C8-D2  \Device\Tcpip_<339DA12A-F1B4-4A88-
```

# arp COMMAND

## INFO:

- This is used for showing the address resolution cache. This command must be used with a command line switch arp -a is the most common.

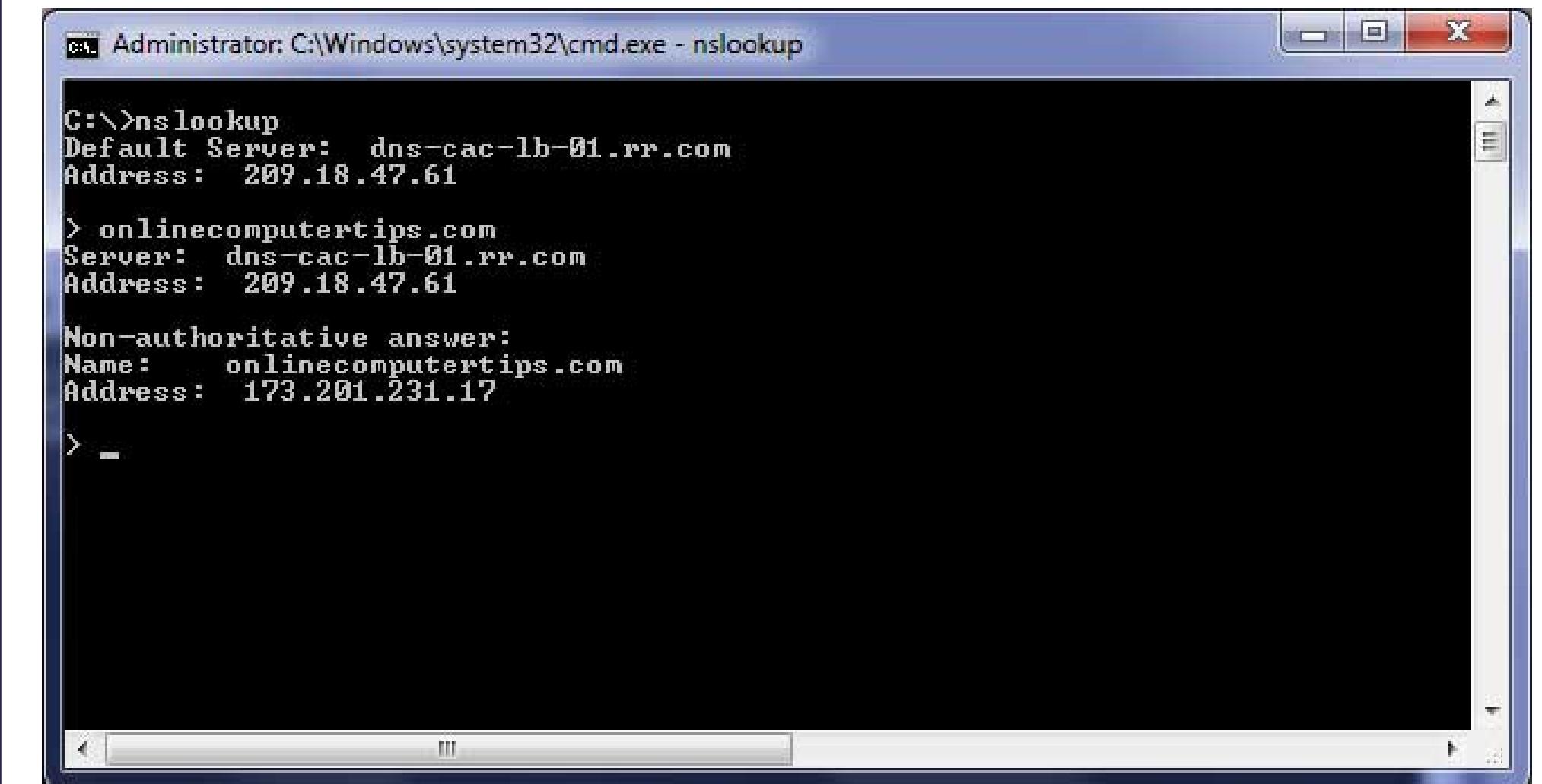


```
C:\>arp -a
Interface: 192.168.1.71 --- 0x10003
Internet Address      Physical Address      Type
 192.168.1.254        5c-dc-96-07-ff-d4  dynamic
C:\>
```

# nslookup COMMAND

## INFO:

- The main use of **nslookup** is for troubleshooting DNS related problems.
- Nslookup can be used in interactive and non-interactive mode.
- To use in interactive mode type nslookup at the command line and hit return.
- You should get an nslookup command prompt.



```
C:\>nslookup
Default Server: dns-cac-lb-01.rr.com
Address: 209.18.47.61

> onlinecomputertips.com
Server: dns-cac-lb-01.rr.com
Address: 209.18.47.61

Non-authoritative answer:
Name:  onlinecomputertips.com
Address: 173.201.231.17

>
```

# netstat COMMAND

## INFO:

- netstat provides statistics about all active connections so you can find out which computers or networks a PC is connected to. You can use the network tool for Windows, Linux, and macOS conveniently via the command line.
- Netstat – derived from the words network and statistics – is a program that's controlled via commands issued in the command line. It delivers basic statistics on all network activities and informs users on which ports and addresses the corresponding connections – TCP and UDP – are running and which ports are open for tasks.

Active Connections					
Proto	Local Address	Foreign Address	State	PID	
TCP	0.0.0.0:135	0.0.0.0:0	LISTENING	680	
TCP	0.0.0.0:445	0.0.0.0:0	LISTENING	4	
TCP	0.0.0.0:3389	0.0.0.0:0	LISTENING	1128	
TCP	0.0.0.0:49152	0.0.0.0:0	LISTENING	348	
TCP	0.0.0.0:49153	0.0.0.0:0	LISTENING	772	
TCP	0.0.0.0:49154	0.0.0.0:0	LISTENING	896	
TCP	0.0.0.0:49155	0.0.0.0:0	LISTENING	432	
TCP	0.0.0.0:49156	0.0.0.0:0	LISTENING	448	
TCP	10.0.2.15:139	0.0.0.0:0	LISTENING	4	
TCP	[::]:135	[::]:0	LISTENING	680	
TCP	[::]:445	[::]:0	LISTENING	4	
TCP	[::]:3389	[::]:0	LISTENING	1128	
TCP	[::]:49152	[::]:0	LISTENING	348	
TCP	[::]:49153	[::]:0	LISTENING	772	
TCP	[::]:49154	[::]:0	LISTENING	896	
TCP	[::]:49155	[::]:0	LISTENING	432	
TCP	[::]:49156	[::]:0	LISTENING	448	
UDP	0.0.0.0:5355	*:*		1128	

# taskkill COMMAND

## INFO:

- The taskkill command allows a user running any version of Microsoft Windows from XP on to "kill" a task from a Windows command line by PID (process id) or image name. This command is similar to end tasking a program in Windows.

The screenshot shows a Windows Command Prompt window titled "Administrator: Command Prompt". It displays a list of running processes from the tasklist command. The process "notepad.exe" is highlighted with a red box and a red arrow points to its PID (11916). The command C:\Windows\system32>Taskkill /IM notepad.exe /F is entered at the prompt, followed by three lines of output indicating success in terminating multiple instances of notepad.exe with PIDs 11916, 7304, and 13028.

Process Name	Type	PID	Size
svchost.exe	Services	11316	7,120 K
backgroundTaskHost.exe	Console	1344	12,892 K
RuntimeBroker.exe	Console	7560	11,152 K
SkypeApp.exe	Console	8720	2,12,976 K
svchost.exe	Services	10676	16,340 K
notepad.exe	Console	11916	13,184 K
backgroundTaskHost.exe	Console	6856	22,476 K
backgroundTaskHost.exe	Console	7716	20,004 K
cmd.exe	Console	11132	3,928 K
conhost.exe	Console	10628	18,220 K
tasklist.exe	Console	1956	8,300 K

```
C:\Windows\system32>Taskkill /IM notepad.exe /F
SUCCESS: The process "notepad.exe" with PID 11916 has been terminated.
SUCCESS: The process "notepad.exe" with PID 7304 has been terminated.
SUCCESS: The process "notepad.exe" with PID 13028 has been terminated.

C:\Windows\system32>
```

# THEORETICAL FRAMEWORK



## Overview

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## Proponents

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# LAYER 7



## LAYER 7: APPLICATION LAYER

- **Identifying communication partners**
  - Determines the identity and availability of communication partners for an application with data to transmit.
- **Determining resource availability**
  - Decide whether sufficient network or the requested communication exist.
- **Synchronizing communication**
  - All communication between applications requires cooperation that is managed by the application layer.

## LAYERING CAN BE HARMFUL?

- In the data networking context structured layering implies that the functions of each layer are carried out completely before the protocol data unit is passed to the next layer.
- This means that the optimization of each layer has to be done separately.
- Such ordering constraints are in conflict with efficient implementation of data manipulation functions.

WHY  
LAYERING  
CONSIDERED  
HARMFUL?

## LAYERING CAN BE HARMFUL?

- As a result of inter-layer dependencies, increased layering can quickly lead to violation of the Simplicity Principle.
- Industry experience has taught us that increased layering frequently increases complexity and hence leads to increases in OPEX(Operating Expense營運成本), as is predicted by the Simplicity Principle.
- It is always possible to agglutinate multiple separate problems into a single complex interdependent solution. In most cases this is a bad idea.

## Objectives 01

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## Objectives 02

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# OBJECTIVES

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# HYPOTHESIS

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# METHODOLOGY

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## Quantitative

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## Qualitative

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# IMPLEMENTATION

## Phase 01

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## Phase 02

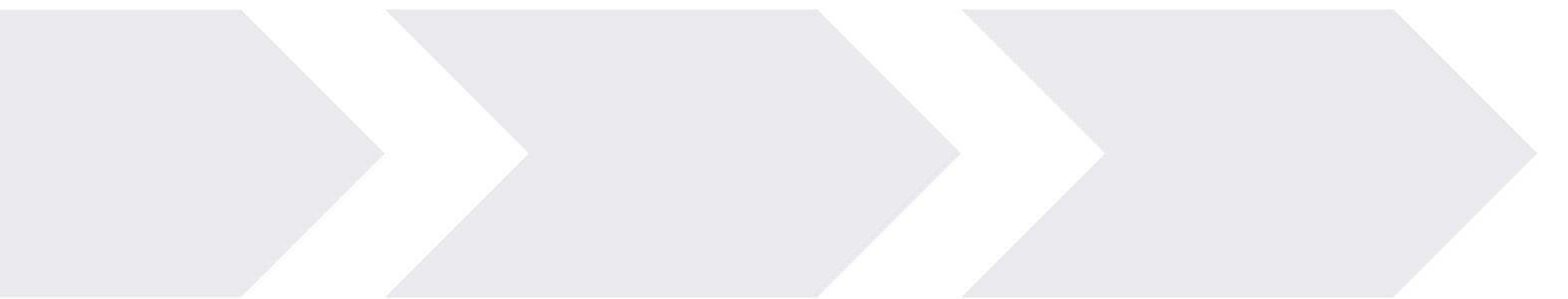
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## Phase 03

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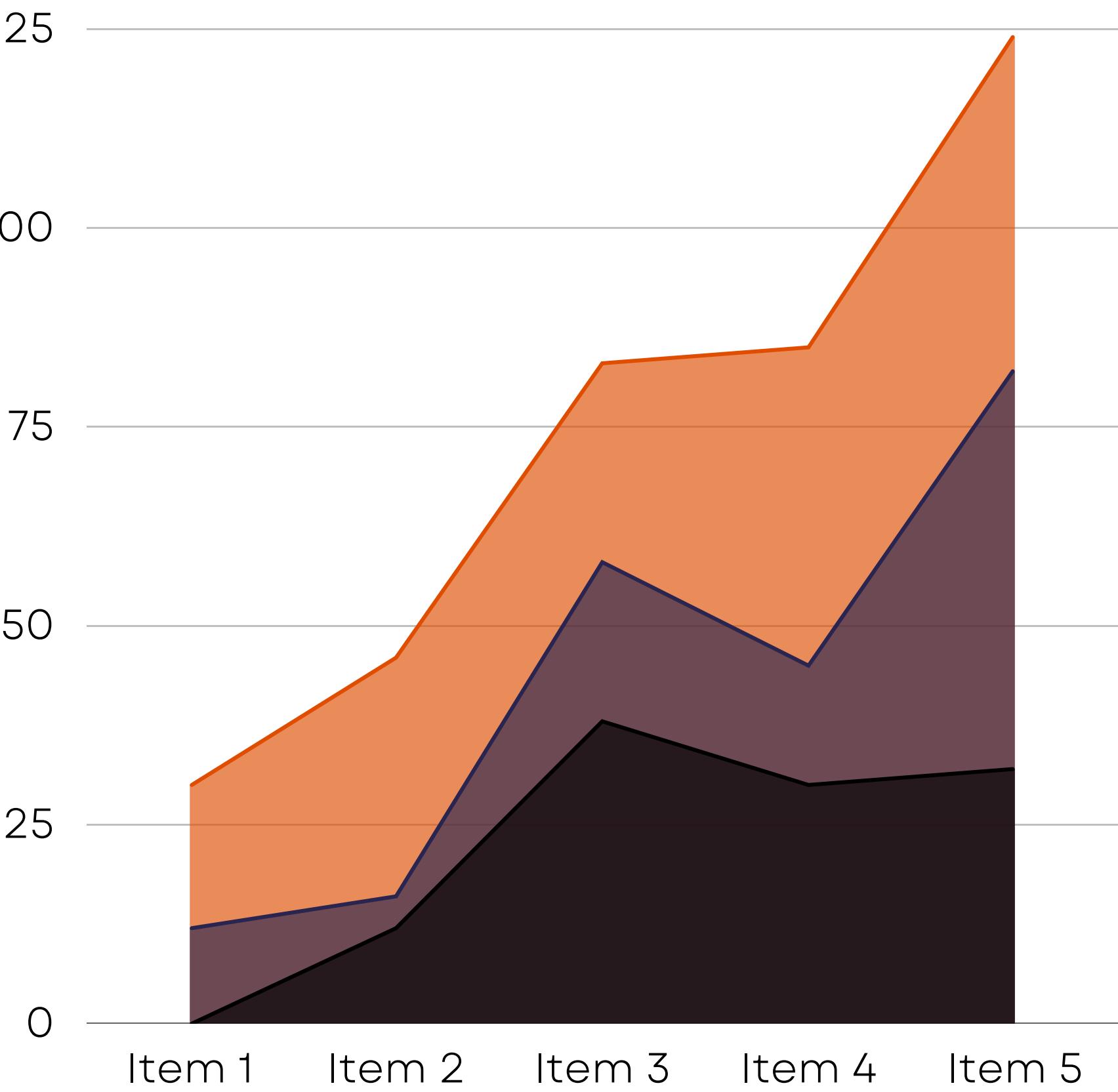
## Phase 04

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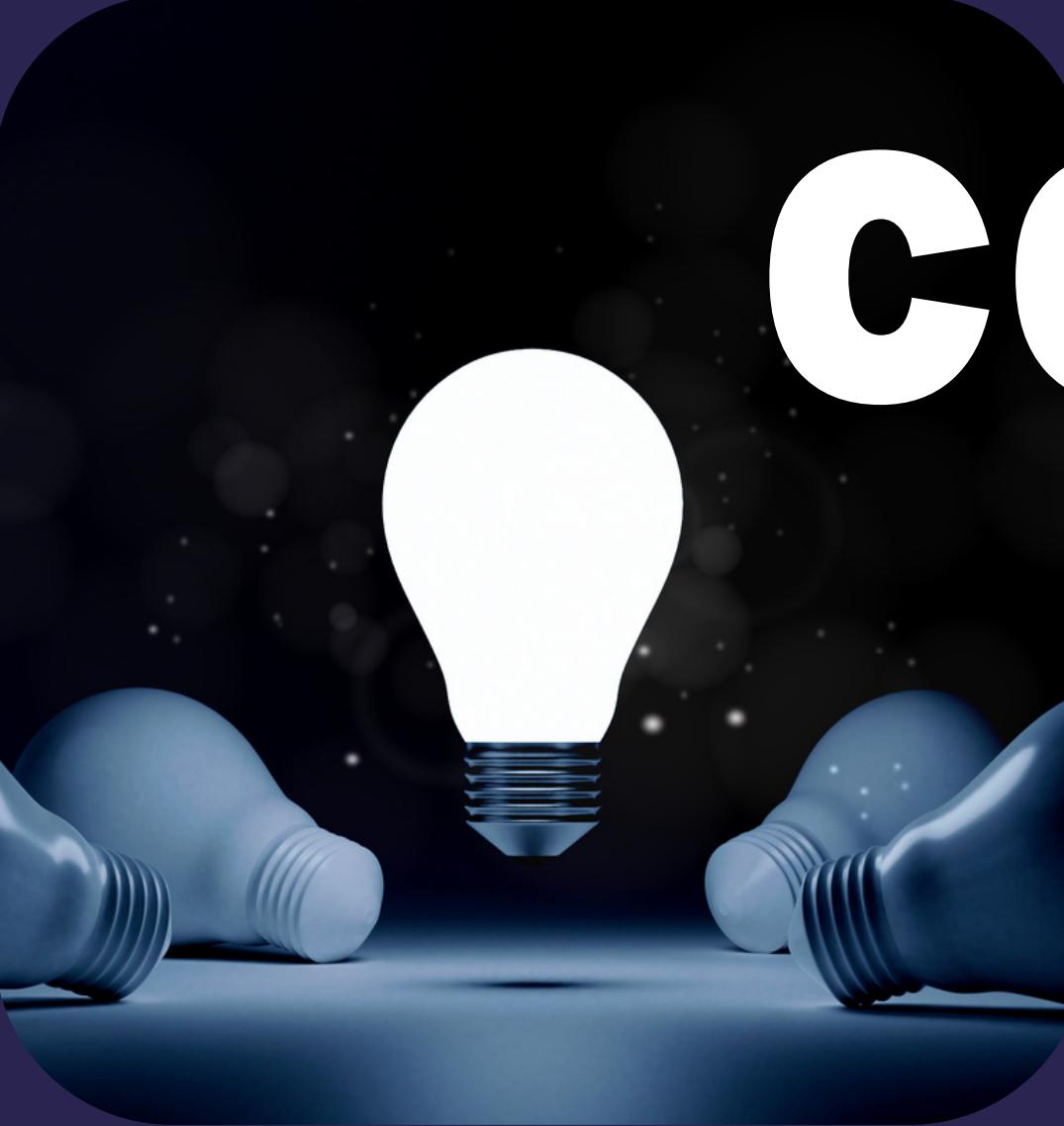


# RESULT

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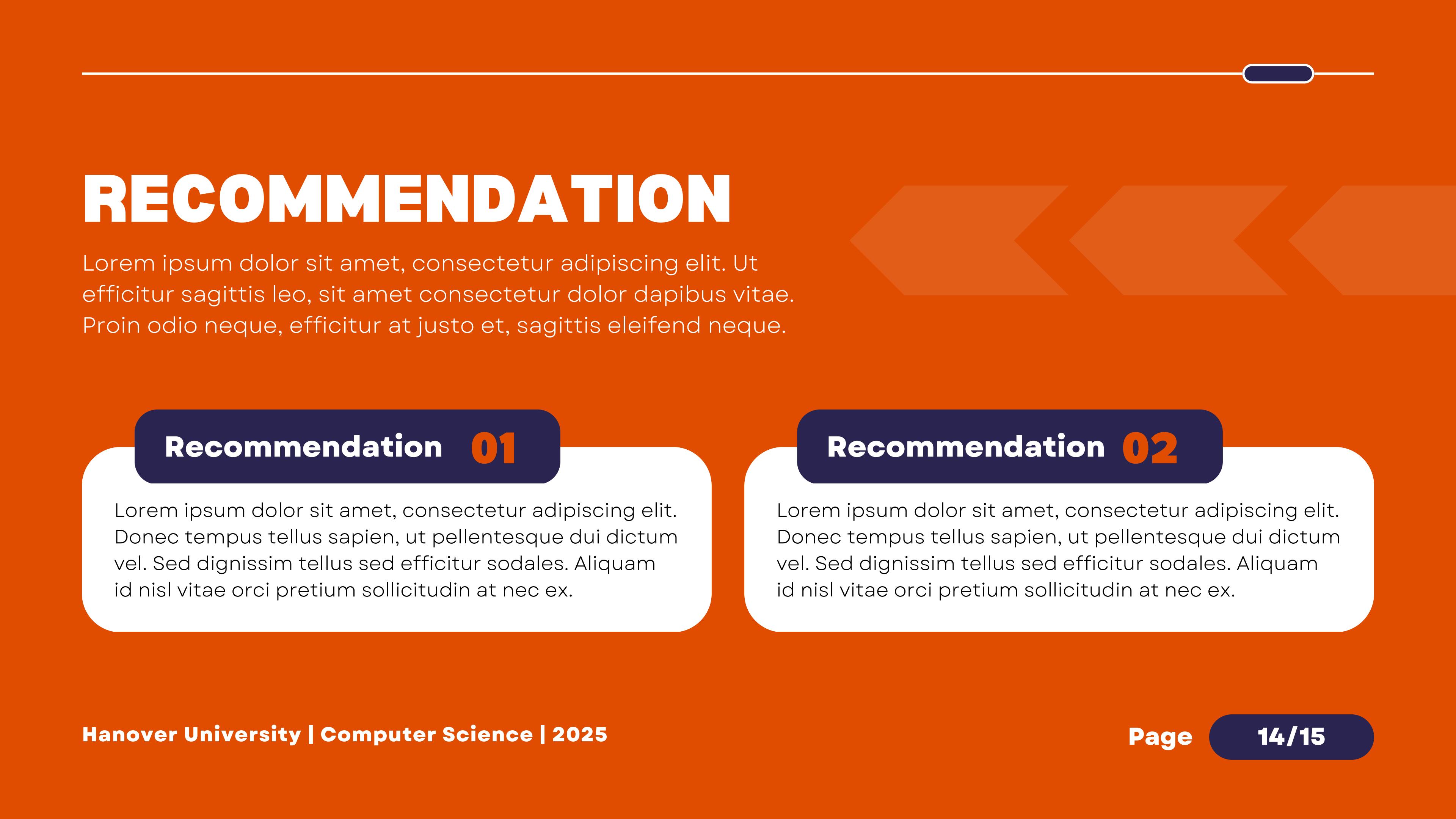
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# CONCLUSION

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# RECOMMENDATION

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## Recommendation 01

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## Recommendation 02

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# THANK YOU!

## THEESIS DEFENSE

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