

Networks

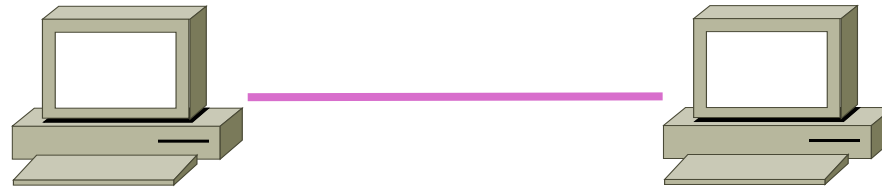
Introduction to Networking

What is a Network?

A **network** is a group of two or more computers or other electronic devices that are **interconnected for the purpose of exchanging data and sharing resources.**

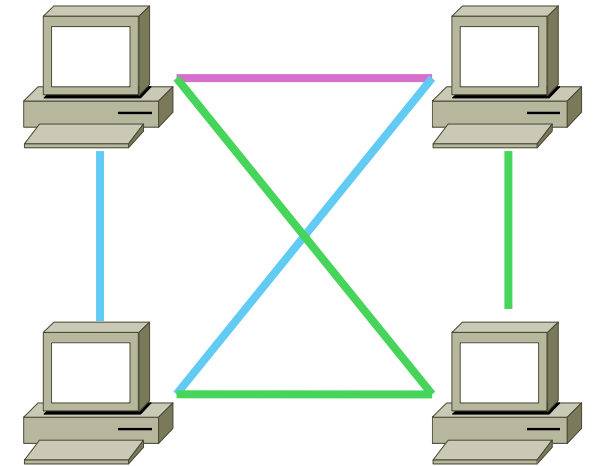
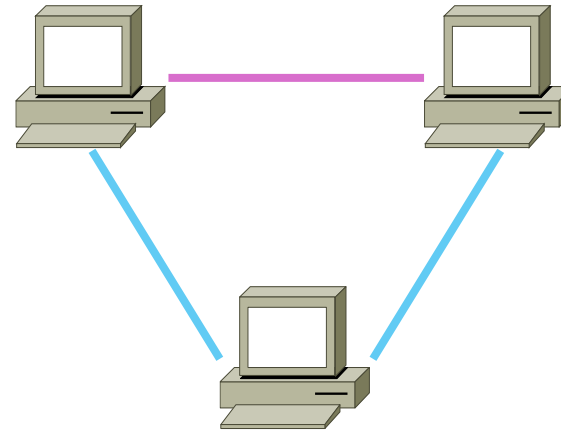
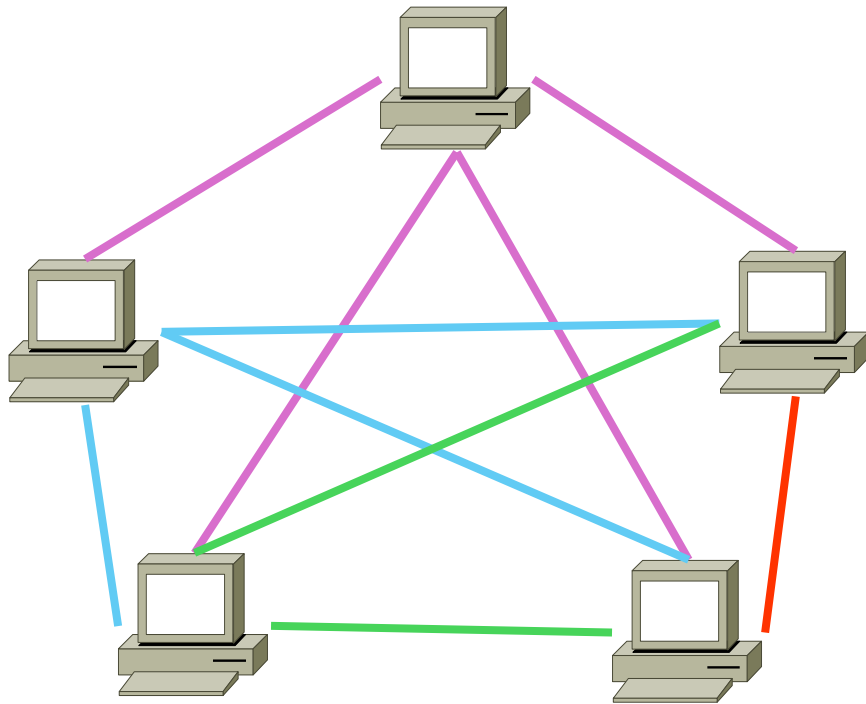
In the Beginning

Two Computers could be interconnected by a single cable.



In the Beginning

What about adding another computer?
It would be needed to add cards and cables.
Was it possible?



LAN

Local Area Network

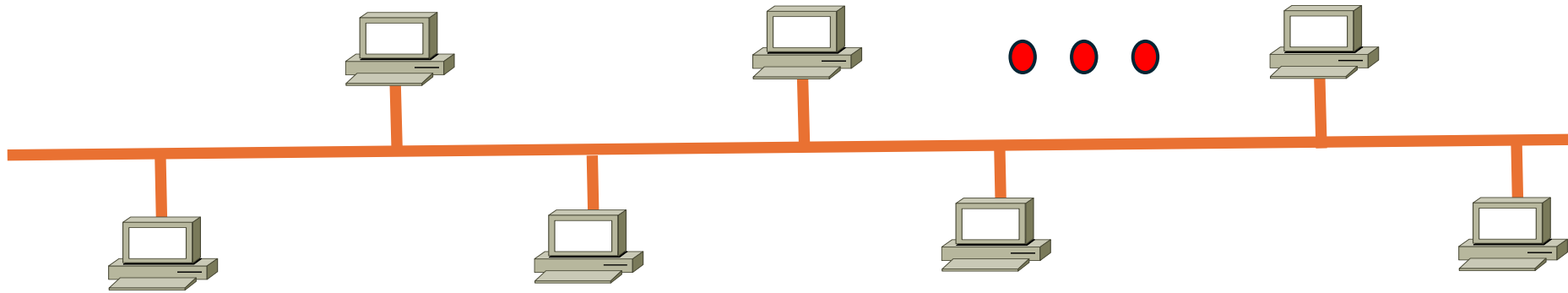
Local Area Network

A **Local Area Network (LAN)** is a group of devices within a limited extension area.

- A LAN works in Layer 2 (Data Link) of the OSI Model.
- PDUs in OSI's Second Layer are known as **FRAMES**.
- Currently the most common type of LAN is the Ethernet Network.

Ethernet LAN

An Ethernet Network can be defined as a bus with devices connected to it.



LAN switches are Ethernet Switches.



OSI Model

*Open System Interconnect
Reference Model*

Brief History

➤ **Early 80's**

Many network equipment manufacturers used their own proprietary methodology. Users had to buy all their networking equipment to the same vendor, so...

➤ **1984**

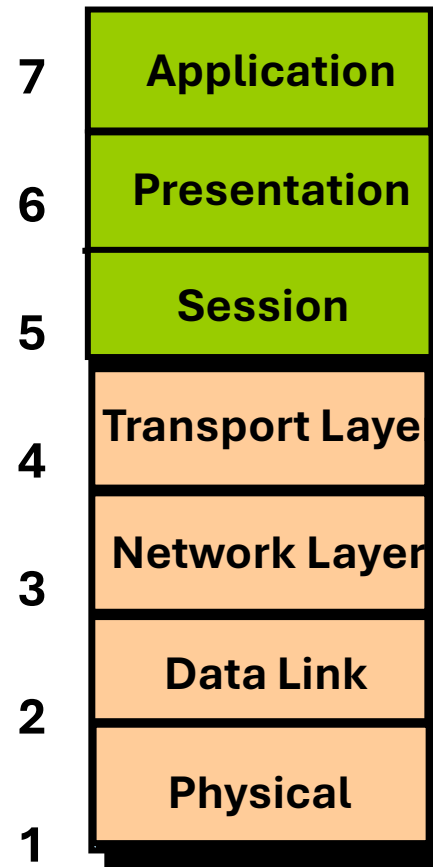
International Standardization Organization (ISO) created The **Open System Interconnect (OSI)** reference model

Purpose

OSI is a seven layer reference model designed to

Provide a simplified and standardized system to design and implement
Multivendor networks

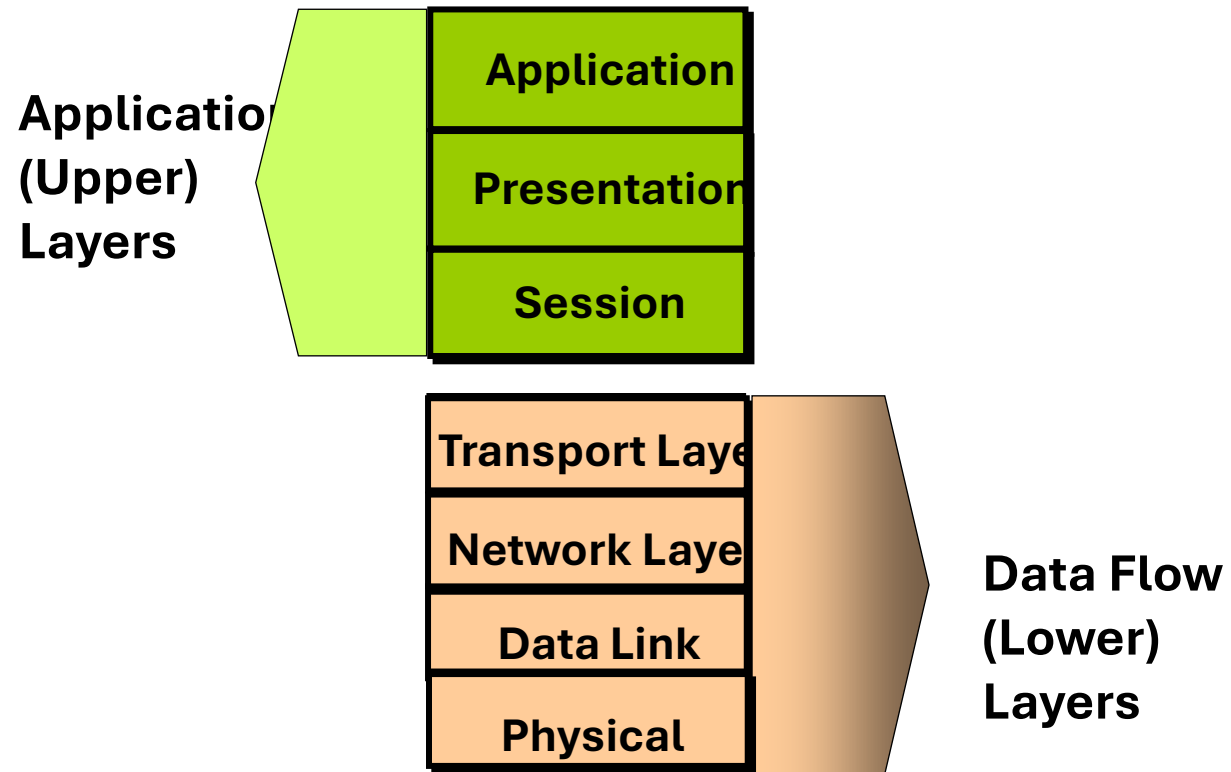
The Seven Layer Model



Benefits of Using a Standardized Model

1. Reduces systems complexity
2. Standard Interfaces for compatibility
3. Modular engineering to specialize design and development
4. Interoperable technology
5. Accelerates evolution. Keeping changes in one area from impacting other areas.
6. Facilitates learning.

OSI Model Review



Role of Application Layers



EXAMPLES

Telnet

HTTP

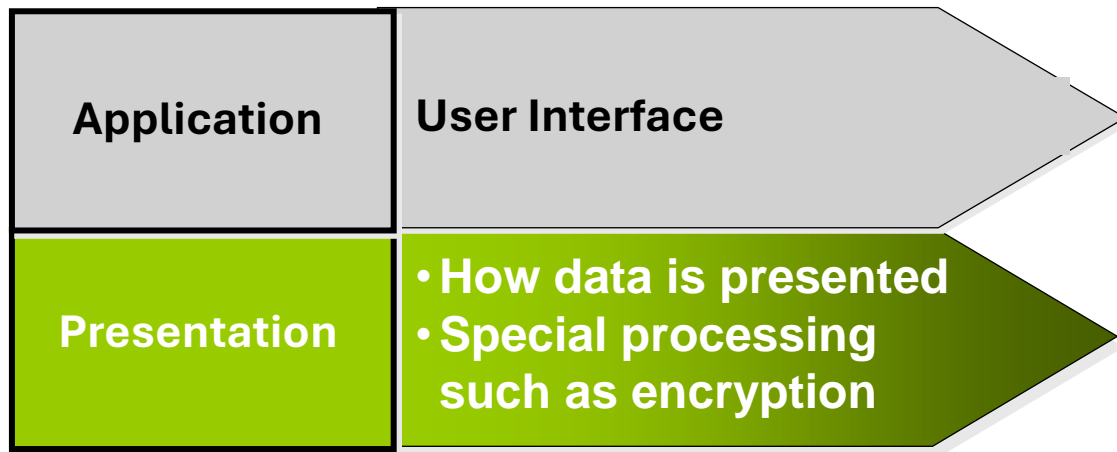
E-mail

SNMP

Application Layer:

Supports the communication component of an application. Not all applications need it.

Role of Application Layers



EXAMPLES

Data: ASCII, EBCDIC

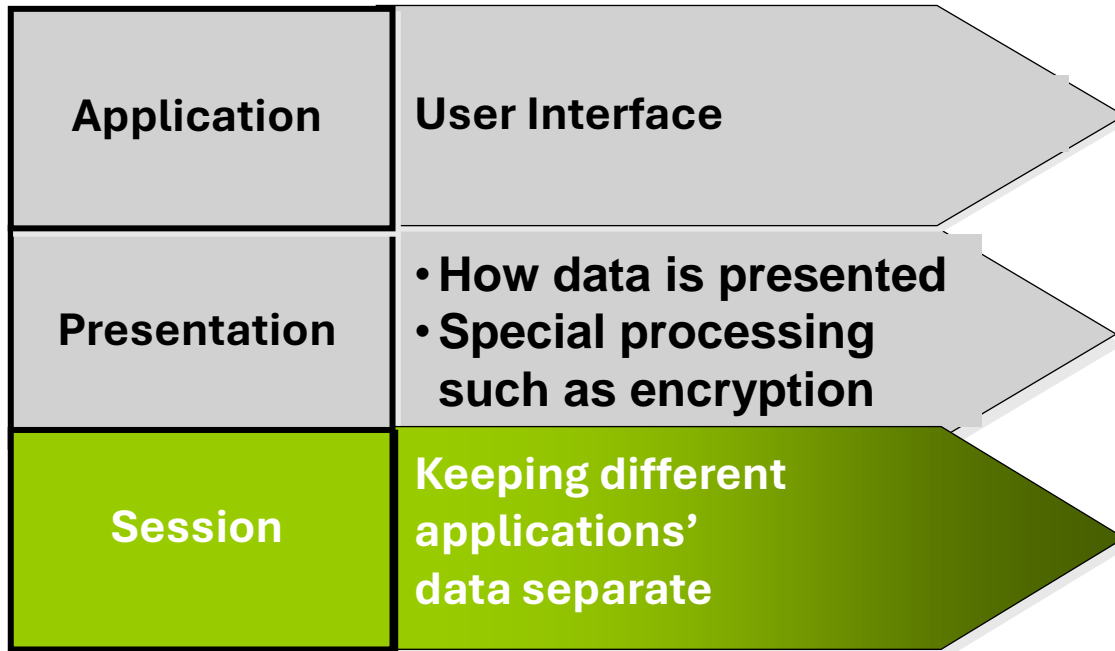
Multimedia: MPEG, MIDI, Quick time

Imaging: JPEG, TIFF, GIFF, PICT

Presentation layer:

- Concerns to data encoding, formatting, translation between codes and data structure used by programs.
- Negotiates data transfer syntax for applications.
- Special processing such as encryption .

Role of Application Layers



Examples:

NFS, SQL, RPC

Operating System

Application Access Scheduling

Role of Data Flow Layers

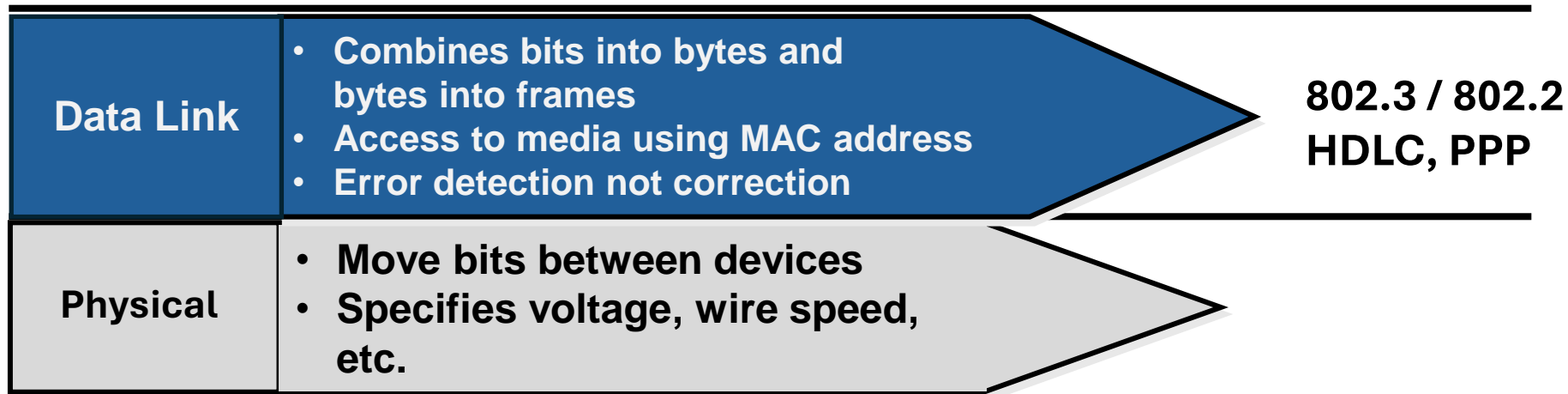
Physical

- Move bits between devices
- Specifies voltage, wire speed, etc.

Examples:

V.35, E1, T1, SONET, SDH

Role of Data Flow Layers



Role of Data Flow Layers

Network	Provide logical addressing which routers use for path determination	IP, IPX, Apple Talk
Data Link	<ul style="list-style-type: none">• Combines bits into bytes and bytes into frames• Access to media using MAC address• Error detection not correction	802.3 / 802.2 HDLC, PPP
Physical	<ul style="list-style-type: none">• Move bits between devices• Specifies voltage, wire speed, etc.	

Role of Data Flow Layers

Transport	<ul style="list-style-type: none">• Reliable or unreliable delivery• Error correction before retransmit	TCP / UDP
Network	Provide logical addressing which routers use for path determination	IP, IPX, Apple Talk
Data Link	<ul style="list-style-type: none">• Combines bits into bytes and bytes into frames• Access to media using MAC address• Error detection not correction	802.3 / 802.2 HDLC, PPP
Physical	<ul style="list-style-type: none">• Move bits between devices• Specifies voltage, wire speed, etc.	

Reliable and Unreliable Services

Connection-oriented means to pre-establish a path.

Exchanges acknowledgment and sequence numbers to guarantee packet delivery

Most connection-oriented protocols have error recovery techniques

TCP, SPX and LLC2 are connection-oriented protocols and have error recovery.

FR is a connection-oriented protocol although it does not have error recovery.

Connectionless does not pre-establish a path

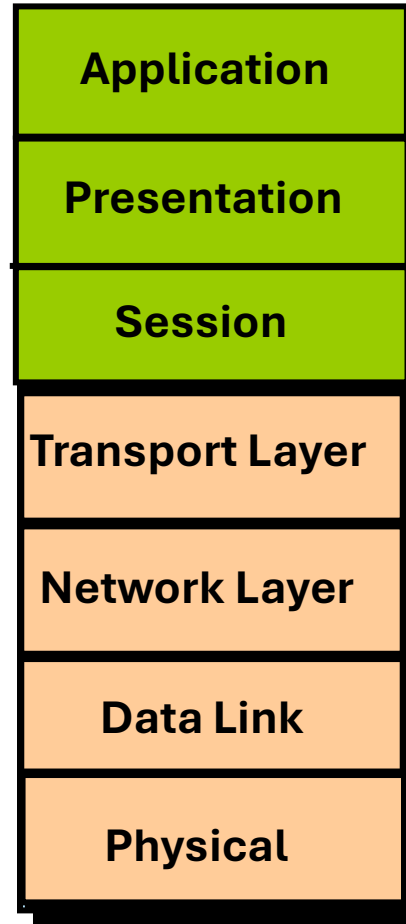
Imply shorter headers, less overhead, no slowing rates, no acknowledge.

Connectionless protocols provide unreliable services, but data transfer is faster.

IP, UDP, LLC1, IPX, PPP are examples of this kind of protocols.

OSI Model Services

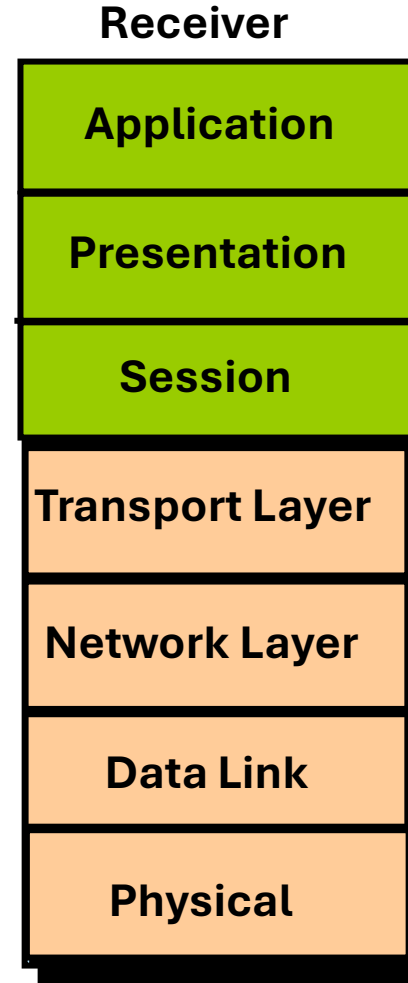
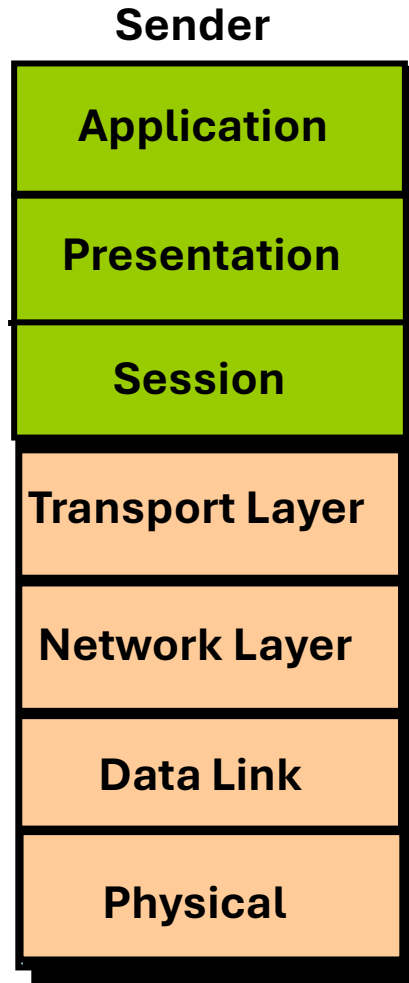
**Each layer serves
Its upper layer**



**And uses the
Services of
Its lower layer**

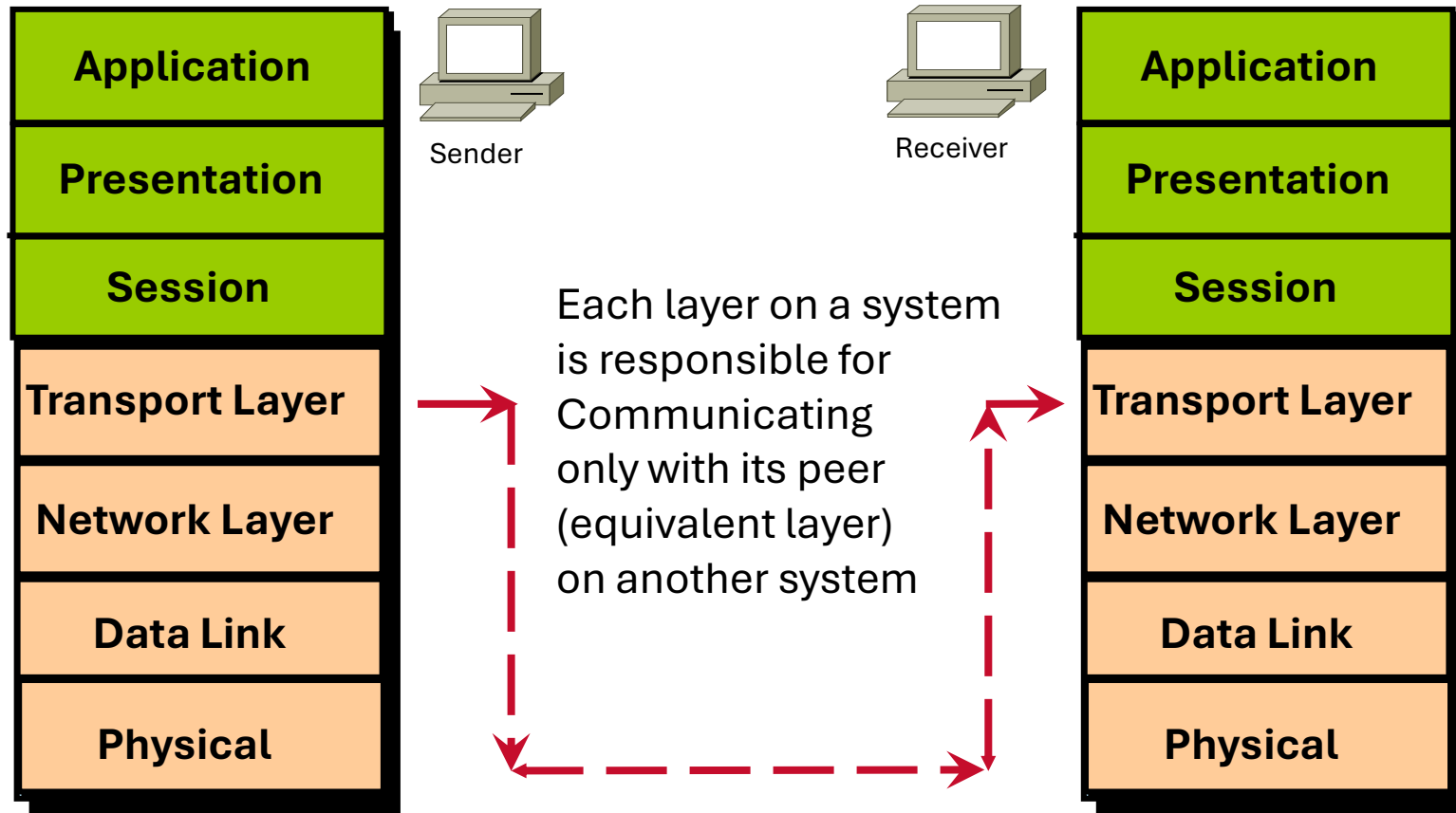
Data Flow

Data flows from the
Application layer
downward
To the physical layer
In the sending
system



And flows upward in
The receiving system

Peer to Peer Communication



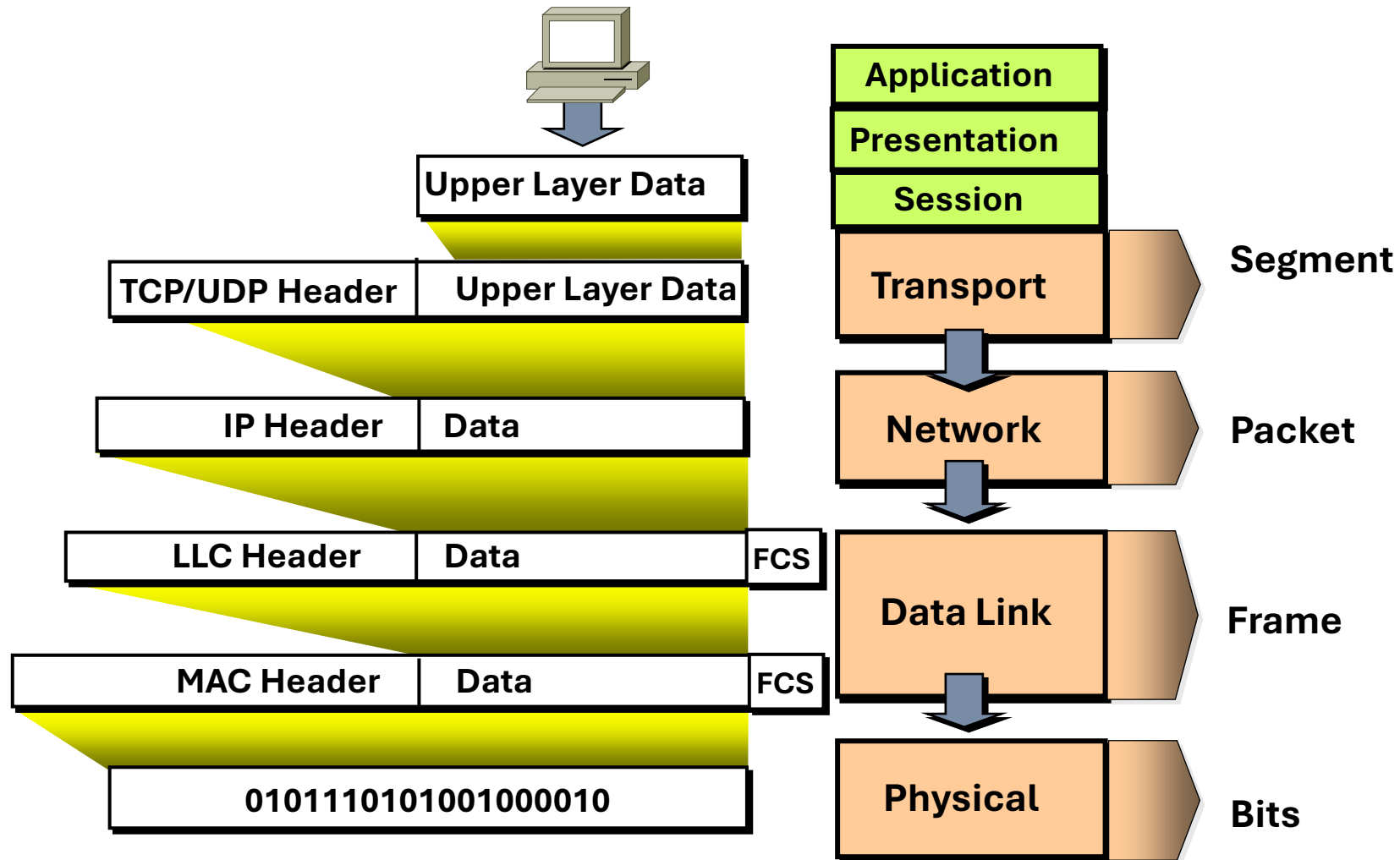
Data Encapsulation

When data flows from a upper to a lower layer, the lower layer adds Headers and trailers to the PDU it received from the upper layer
Then passes it to its own lower layer.

PDU (Protocol Data Unit):

A portion of data that flows between layers to be processed.

Data Encapsulation



De-encapsulating Data

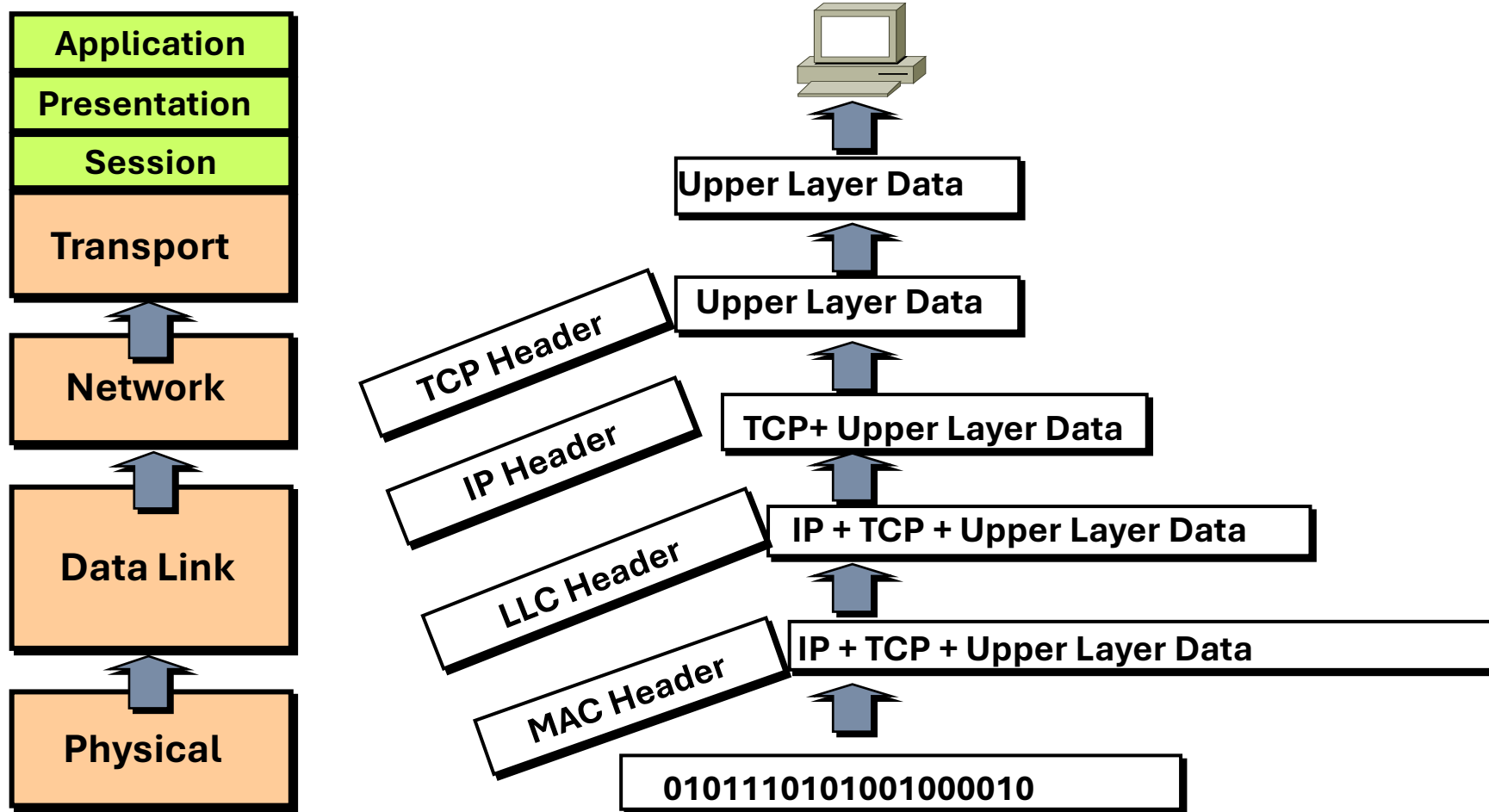
Encapsulation:

It is the process where a layer **adds headers and Trailers** to data before passing it to its lower layer

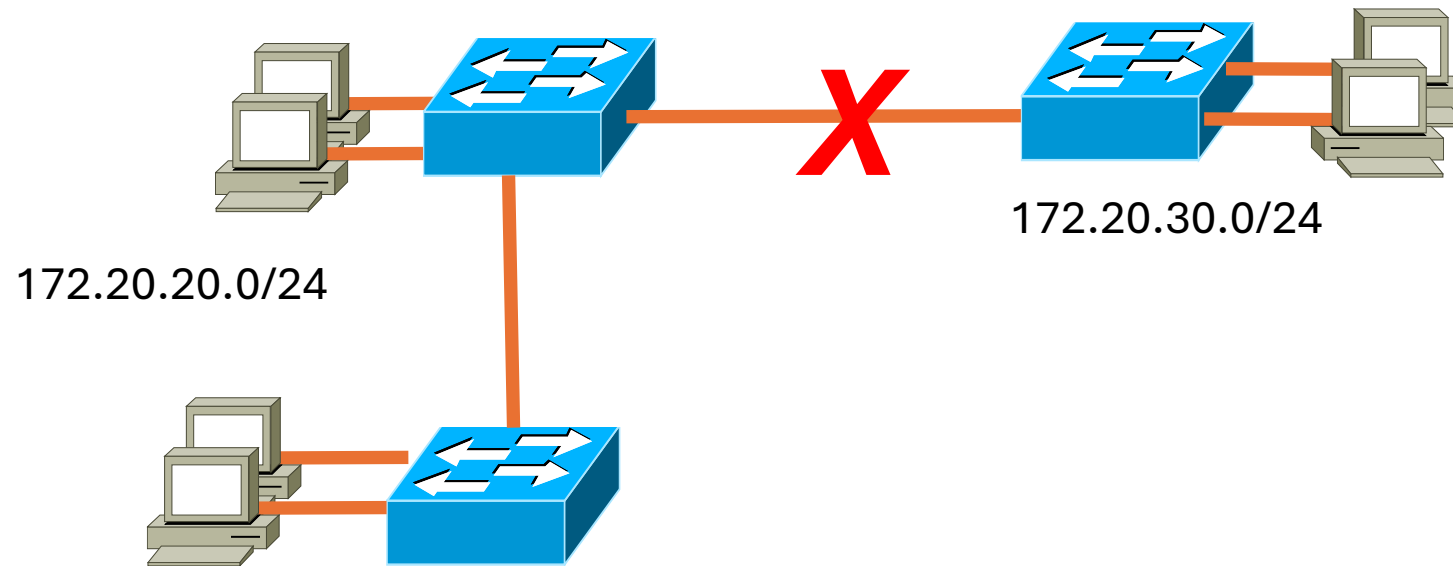
De-encapsulation:

It is the process where a layer **removes its own headers and Trailers** from a PDU before passing it to a upper layer.

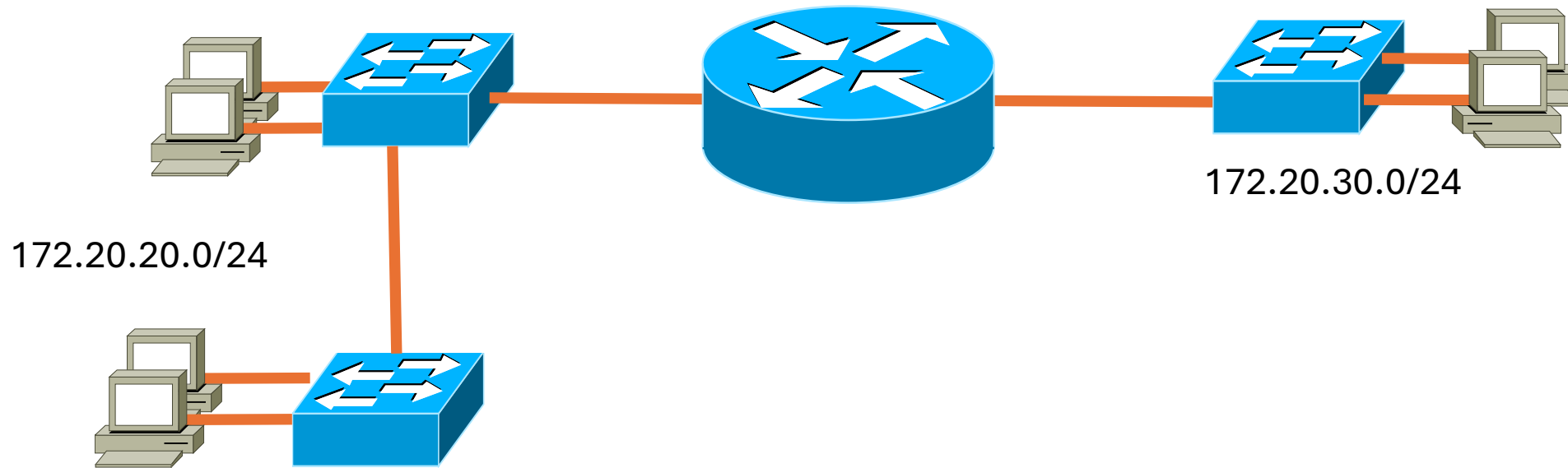
De-encapsulating Data



Communicating Networks

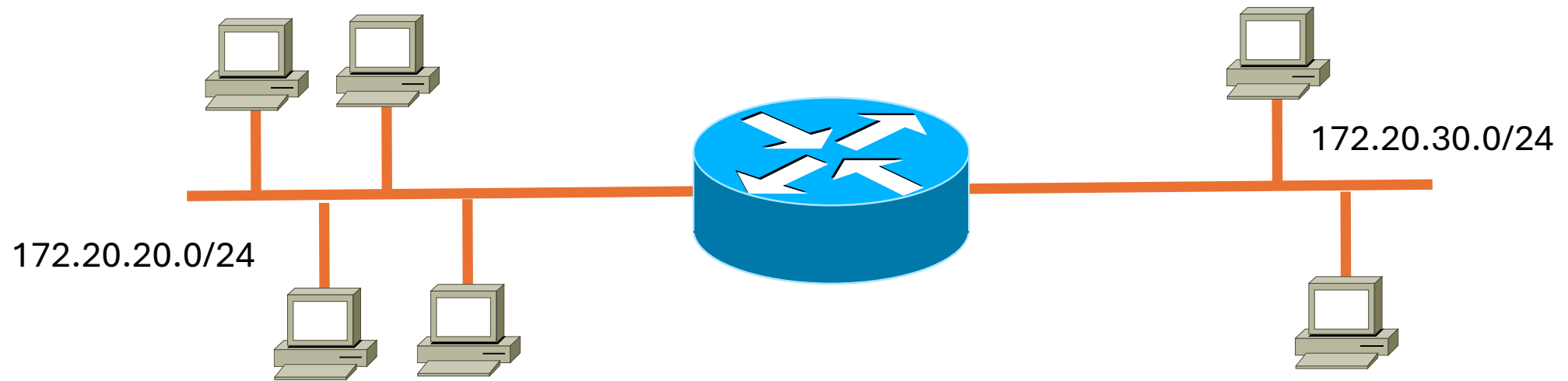


Communicating Networks

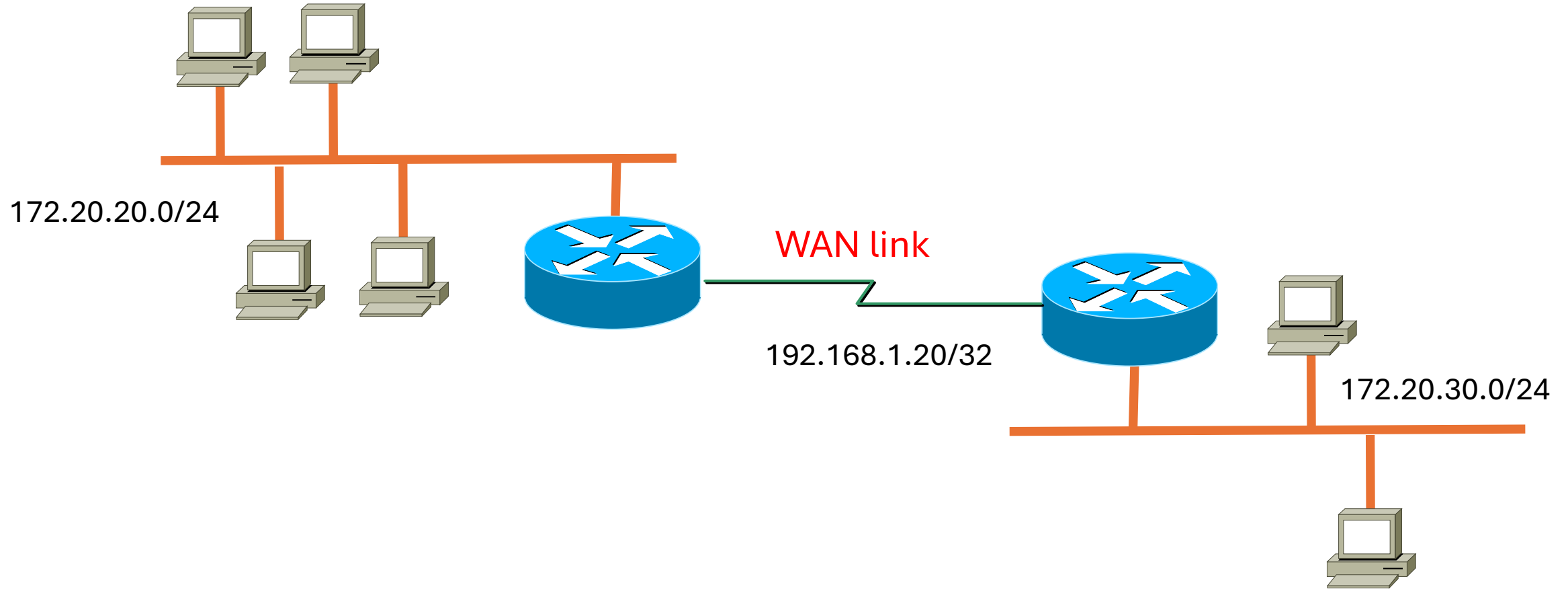


To communicate different networks a router is needed.

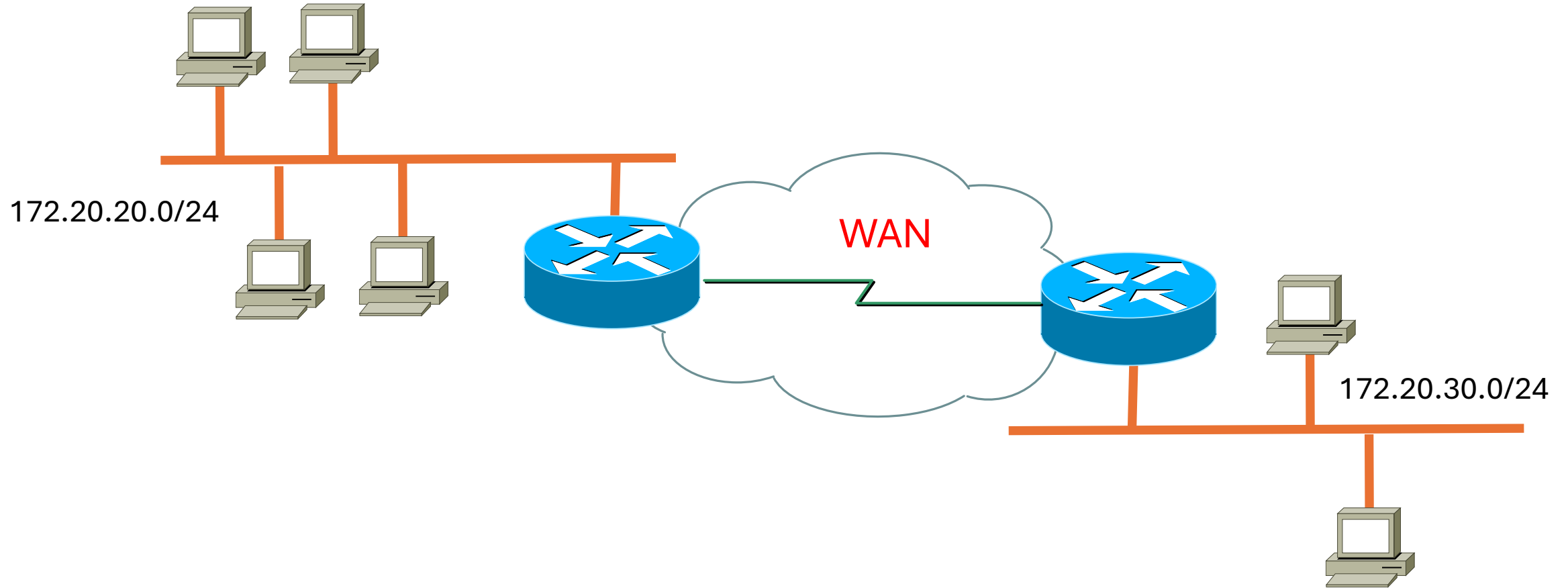
Communicating Networks



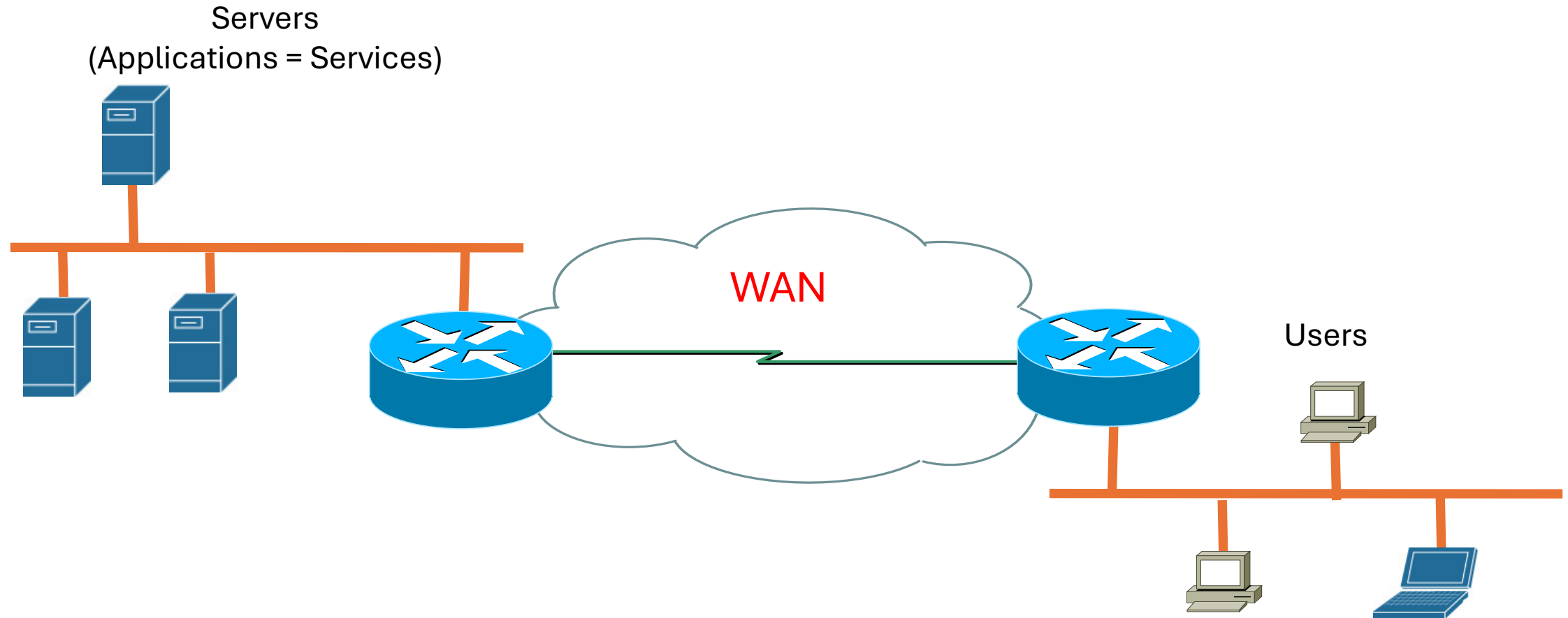
What about Distance?



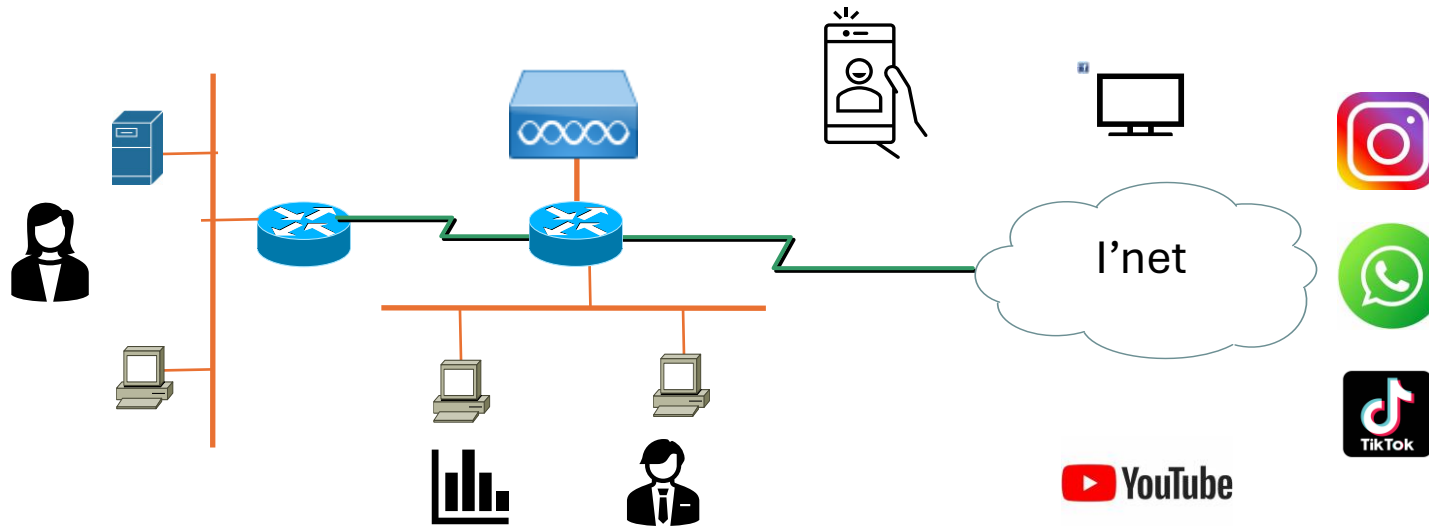
What about Distance?



What do We Connect in Networks?



What do We Connect in Networks?



Local Area Network

Video

<https://youtu.be/H7-NR3Q3BeI>

Hub, Bridge, Switch, Router - Network Devices - Networking Fundamentals
- Lesson 1b

References

- **Introduction to Cisco Router Configuration: Student Guide.**
Ciscopress. Chapters 1 and 2
- **Interconnecting Cisco Network Devices: Student Guide.**
Ciscopress. Chapter 2
- **CCNA: Cisco Certified Network Associate Study Guide (Exam 640-507).** Todd Lammle. Sybex. Chapter 2
- **Cisco CCNA Exam #640-507 Certification Guide.**
Wendell Odom. Ciscopress. Chapter 2

Thank You

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