Computer Networks II

Lecture No. 2

"OSI and TCP/IP Models"

DR. Lecturer . Taqwa.F.Hassan

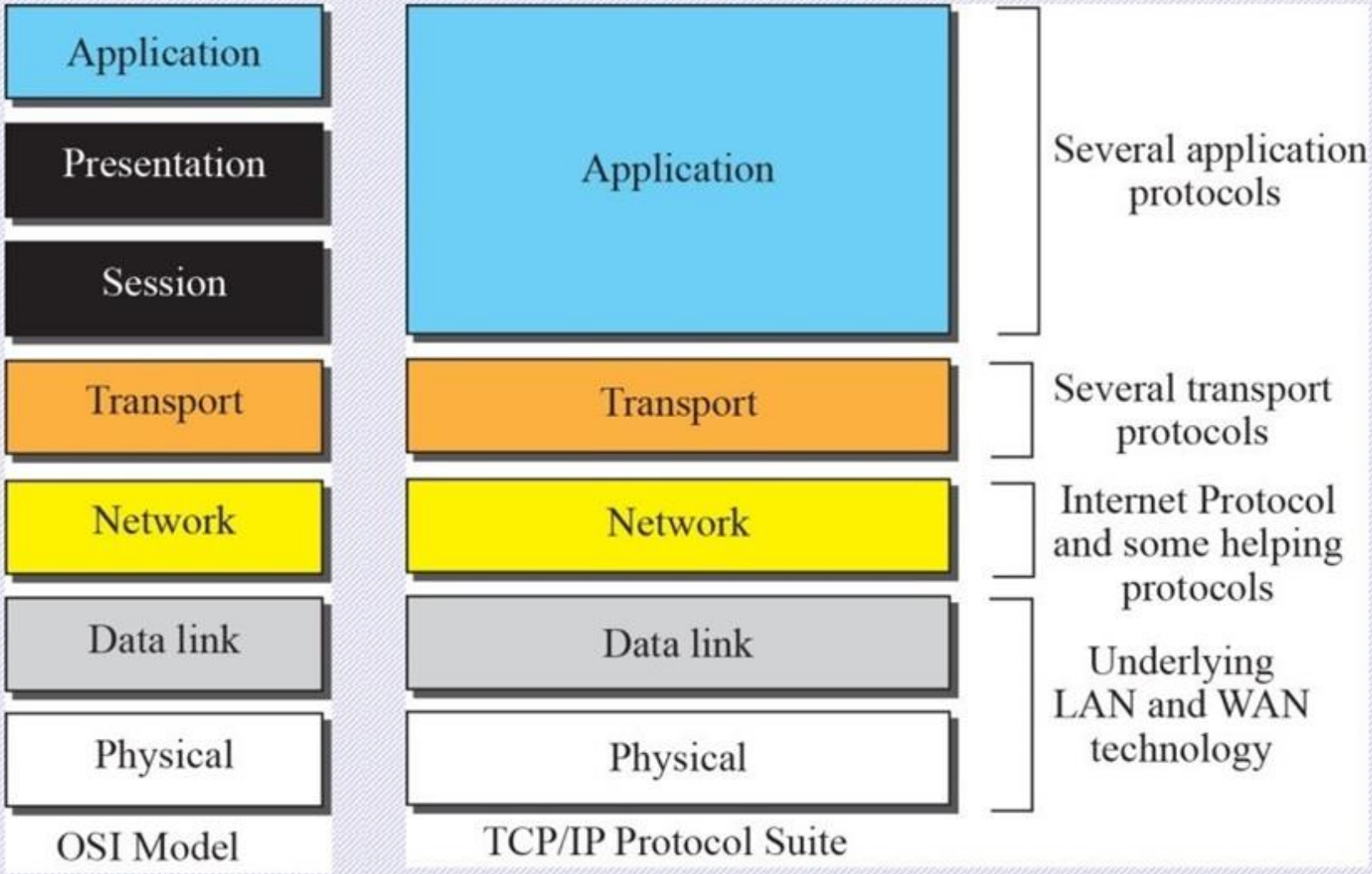
4th Year/ 1st semester

Computer Department - College of Engineering

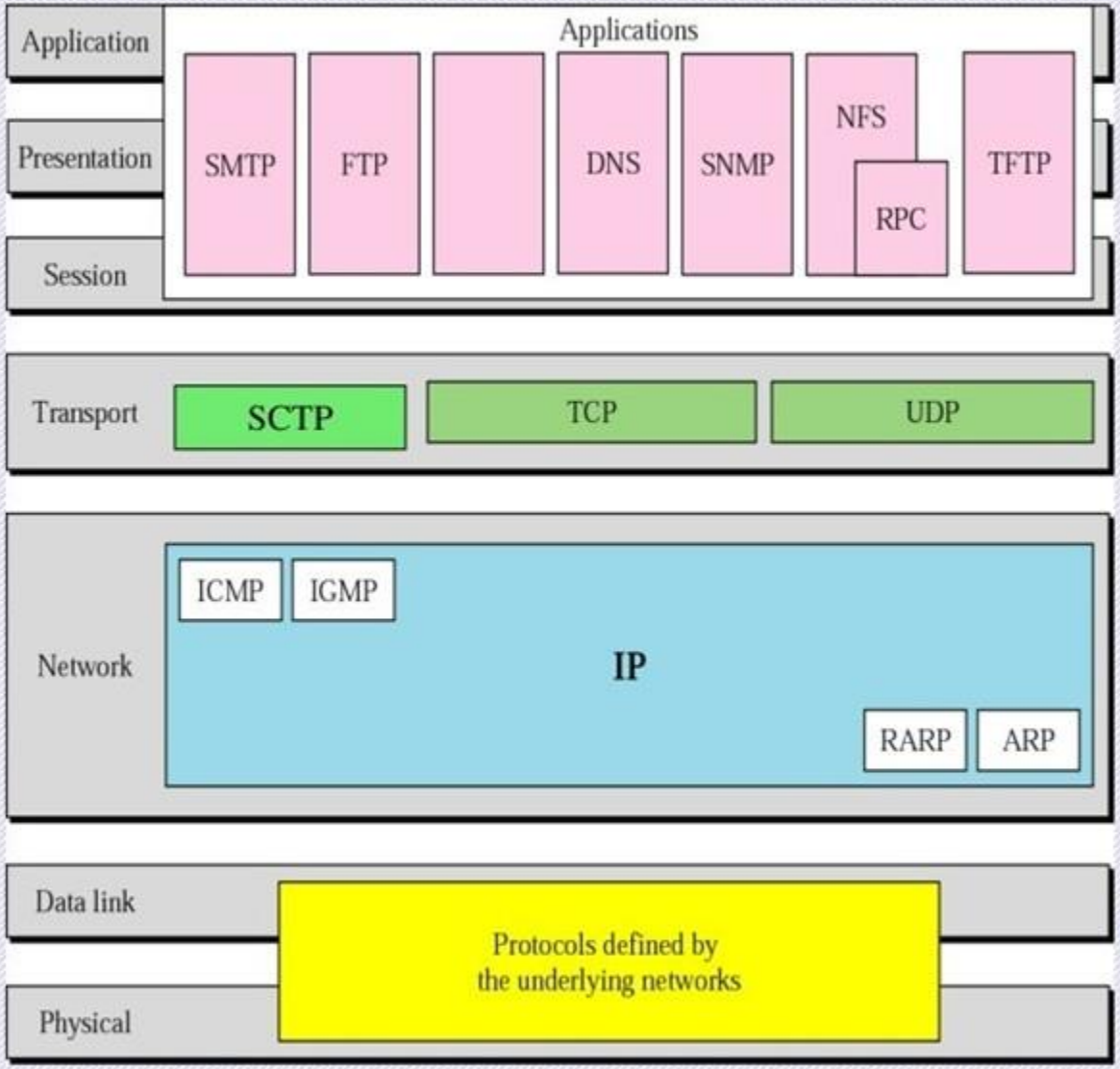
University of Diyala

2022-2023

How TCP/IP maps to OSI ??



TCP/IP Model



Explain Suite and Stack Concept

Protocols for different underlying technologies – this is key

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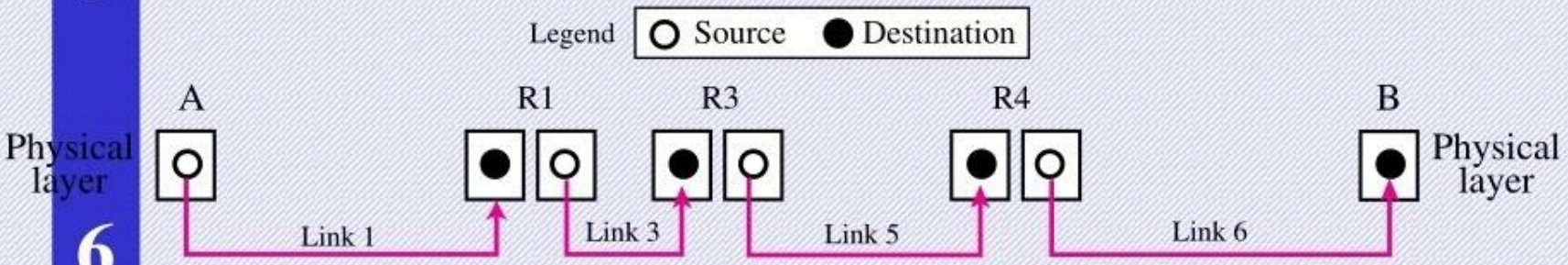
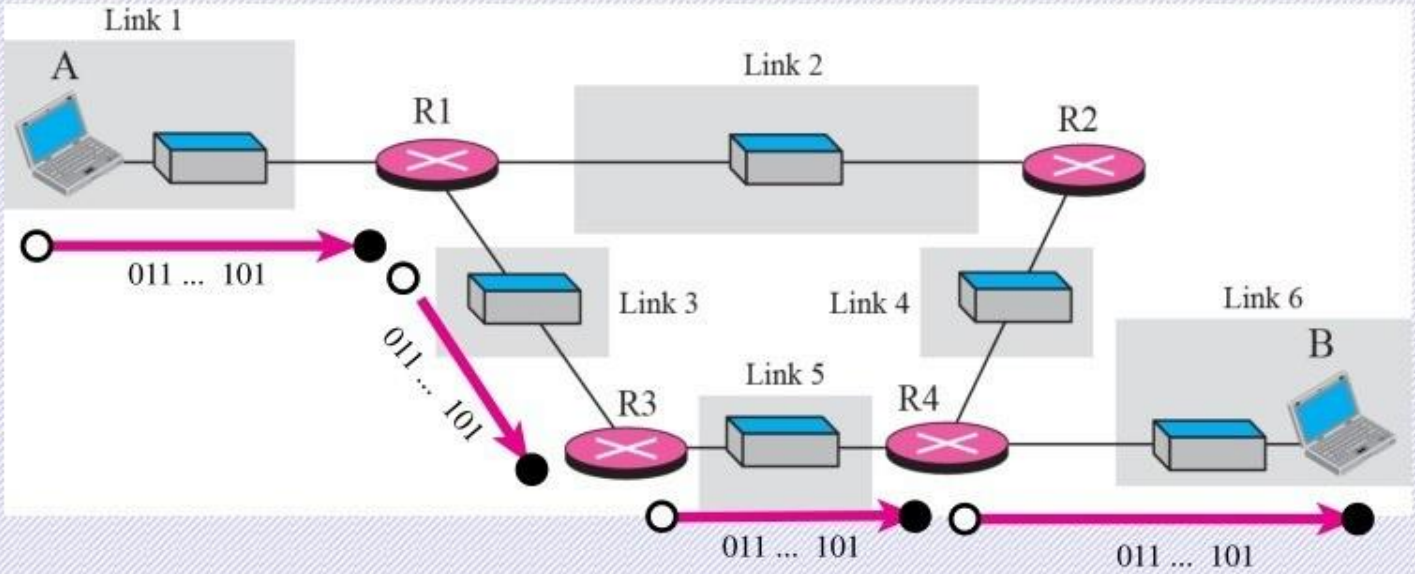
Explain communications at the physical layer





Signal to bits translation and vice versa (note: digital data is different from digital signal)

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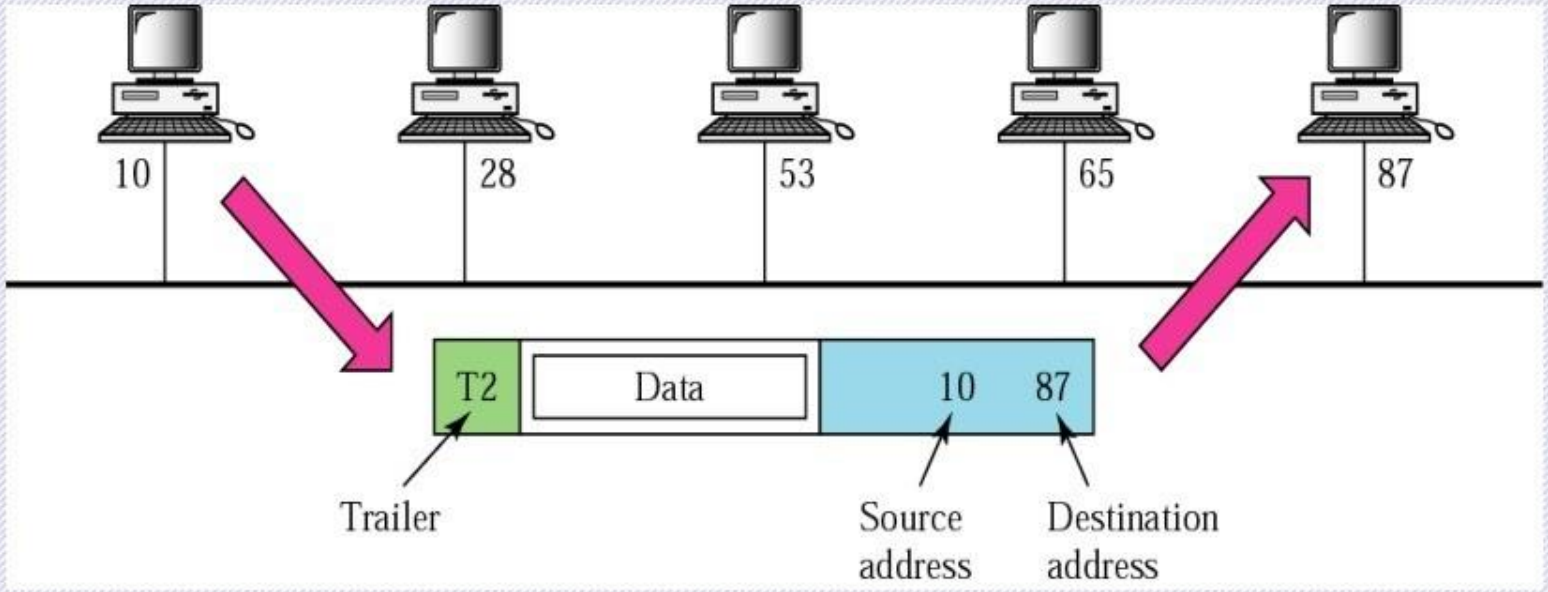
Physical addresses



- Physical address is also known as the link address
- Physical address can be different sizes (depend on the network)
- Unicast type physical addresses – single Rx
- Multicast type physical address – multiple Rxs
- Broadcast type physical address – all Rxs can pickup message

Physical Address Example

Most local area networks use a 48-bit (6 bytes) physical address written as 12 hexadecimal digits, with every 2 bytes separated by a hyphen as shown below:

07-01-02-01-2C-4B

A 6-byte (12 hexadecimal digits) physical address

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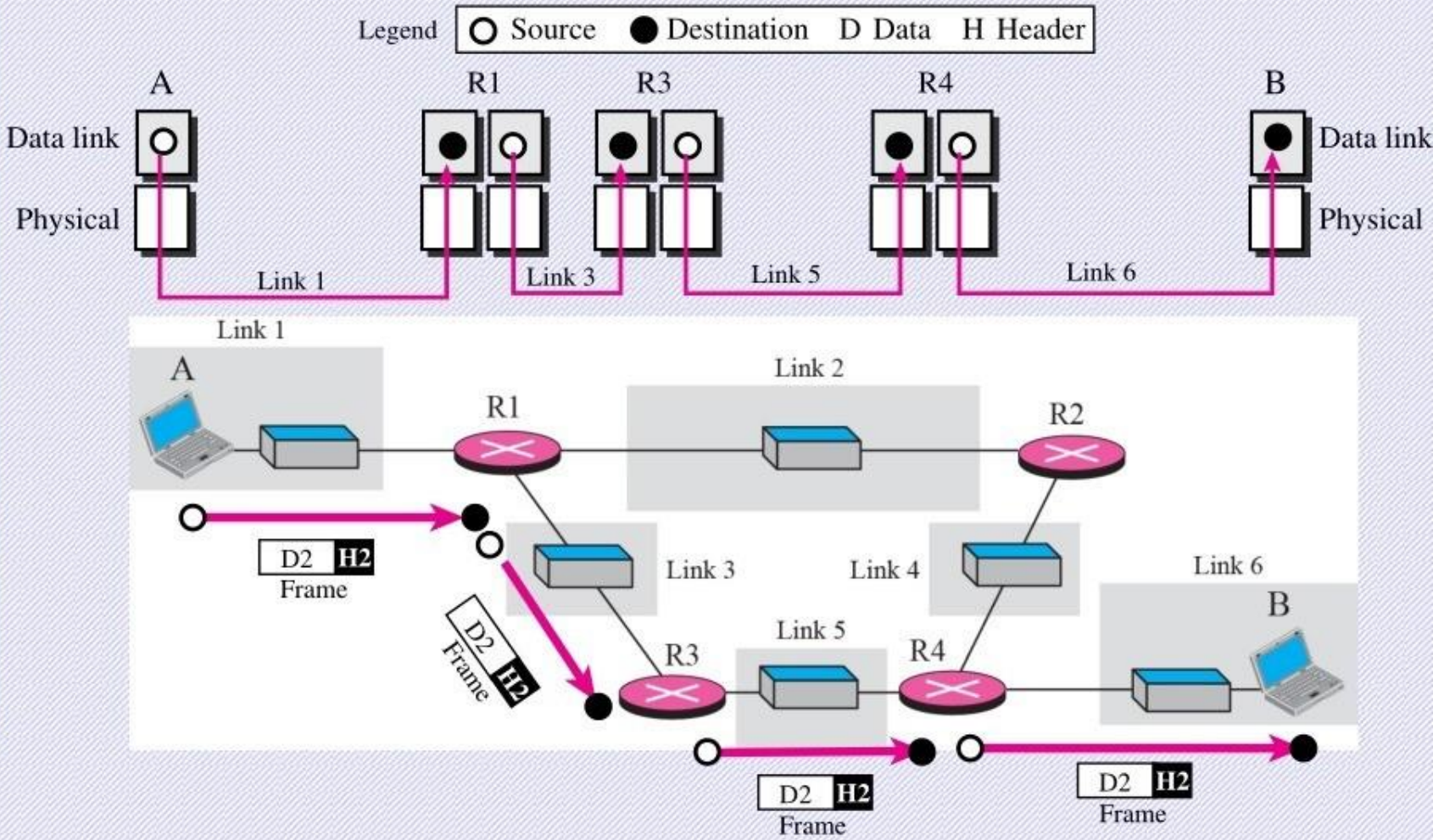
Explain communications at the data link layer



Framing – encapsulation - decapsulation

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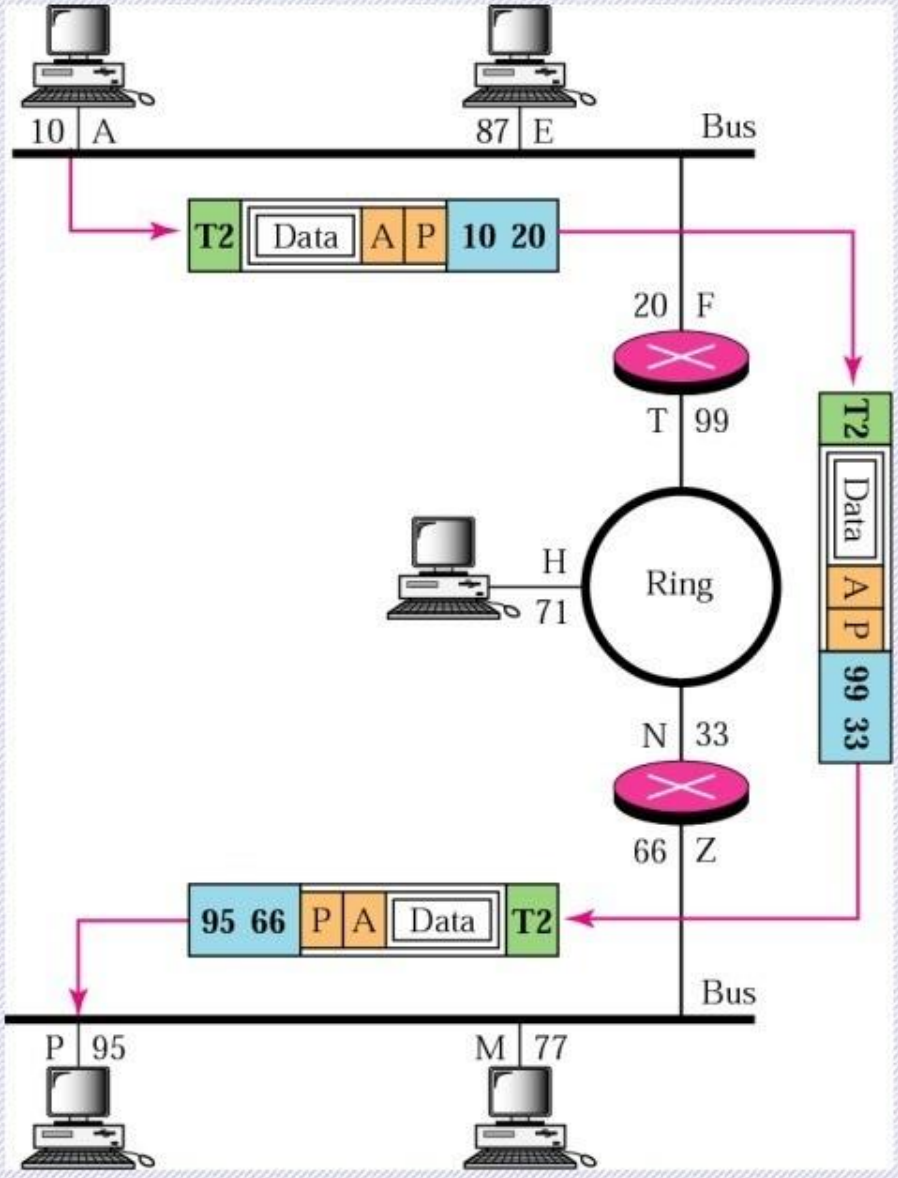
Explain communications at the network layer



IP Addresses can be either unicast, multicast or broadcast types

Going from network A physical address 10 to network P physical address 95.

Can't use the physical address because different networks

The network layer address contains the uniqueness we need from source to sink. Network layer address is A-P

Unit at this layer - **datagram**

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IP Address Example

An Internet address (in IPv4) is 32 bits in length, normally written as four decimal numbers (or 4 octal numbers), with each number representing 1 byte. How many bits is a byte ? A nibble ??

The numbers are separated by a dot. Below is an example of such an address. Call "dot notation"

132.24.75.9

Example of IPv6 Address (128 bits):

FDEC : BA98 : 7654 : 3210 : ADBF : BBFF : 2922 : FFFF

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ADDRESSING

We explained the physical address.

We explained the need for an Internetworking (IP) address or Logical address

Are the Physical and Logical addresses enough ?????

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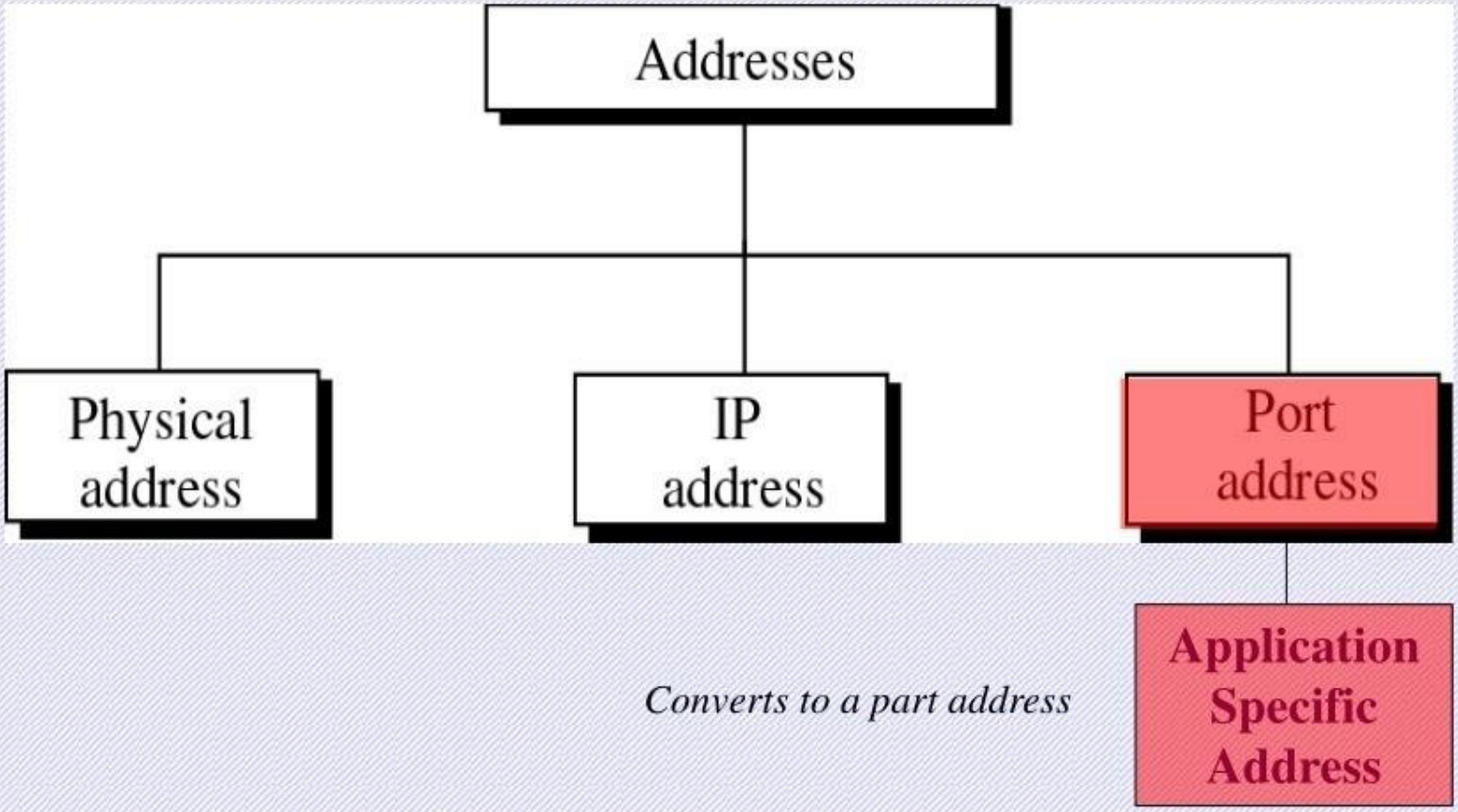
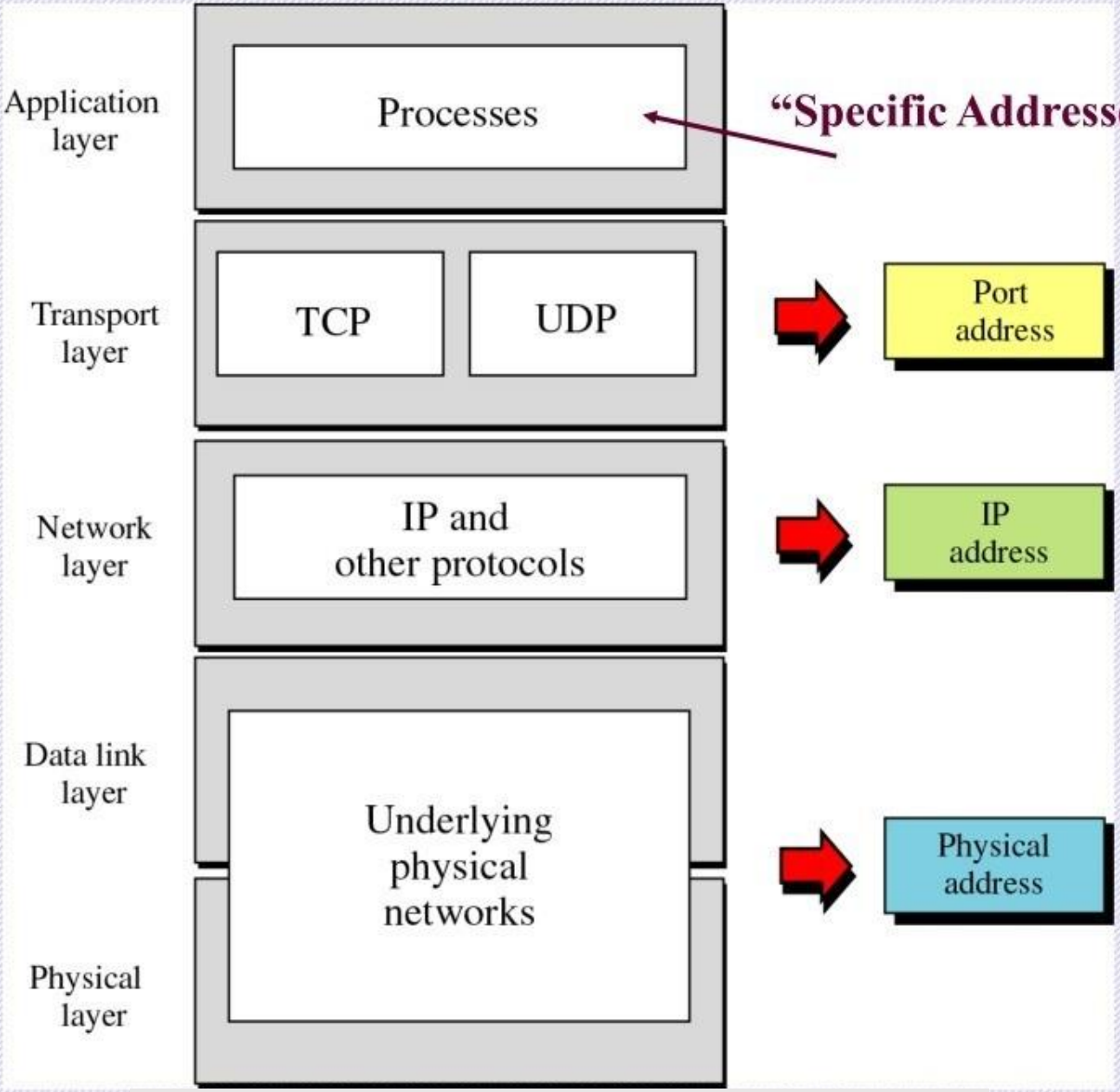
Addresses in TCP/IP





Relation-ship between layers and addresses in TCP/IP

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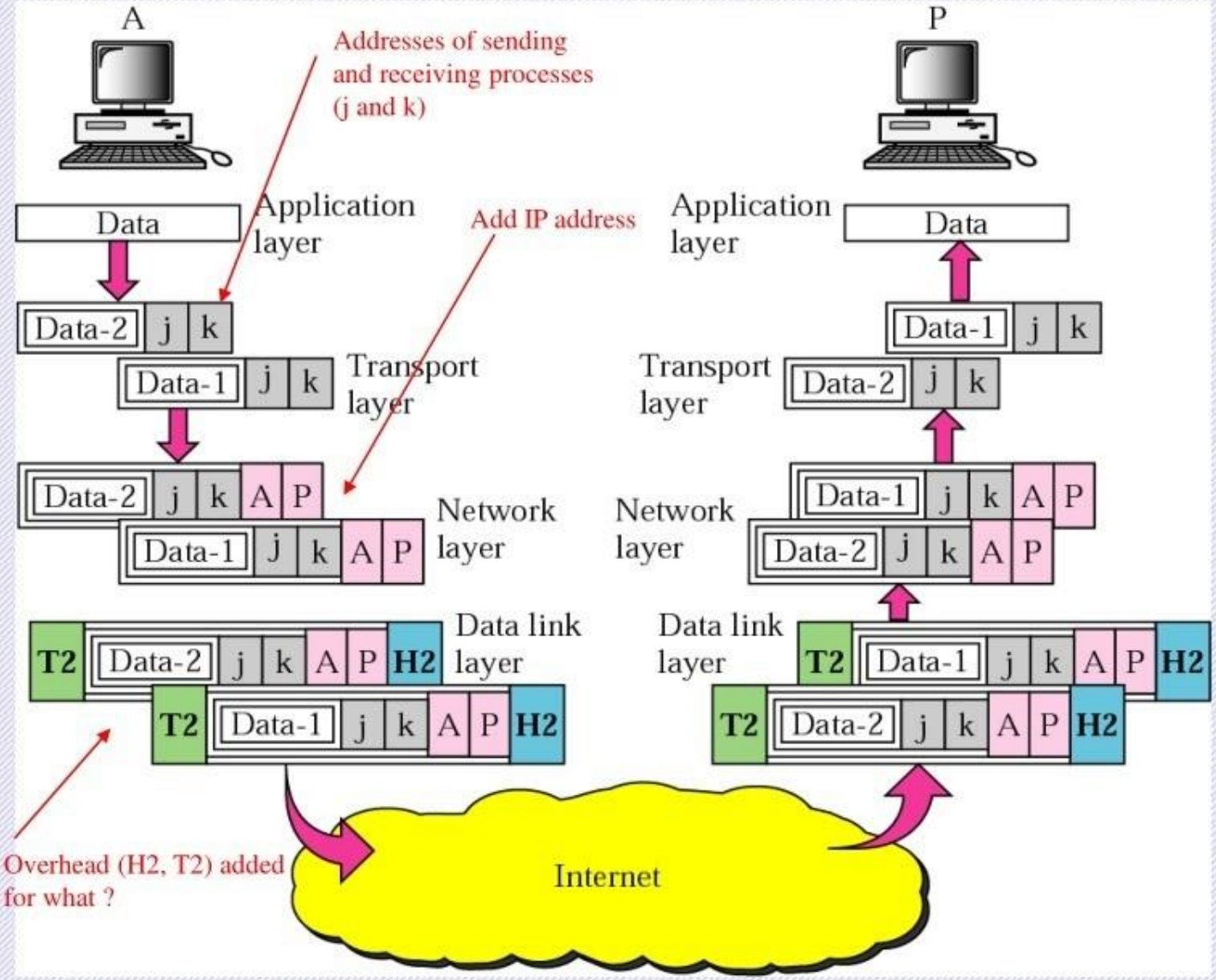
Port addresses



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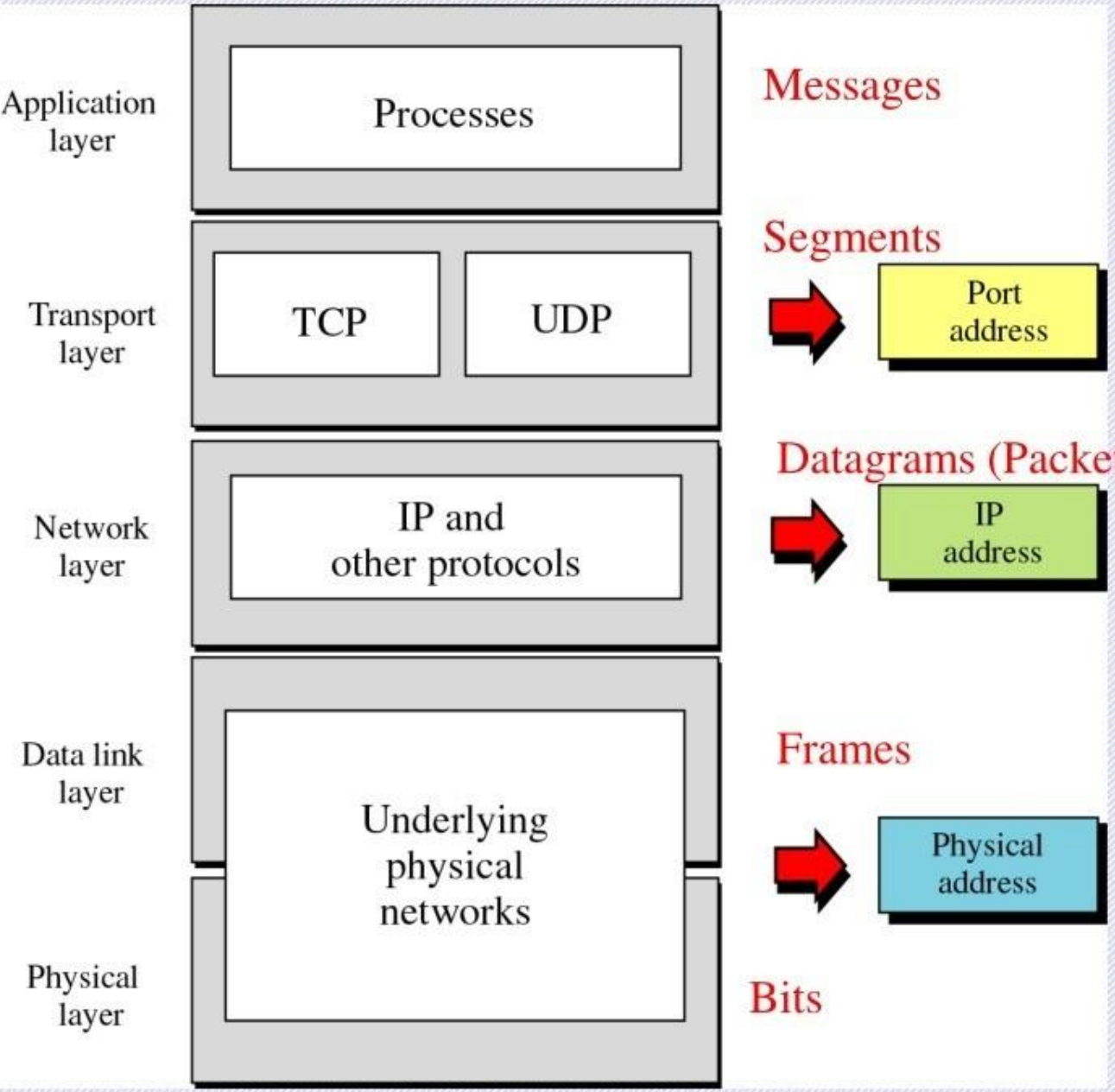
Port Address Example

port address is a 16-bit address represented by one decimal number as shown below.

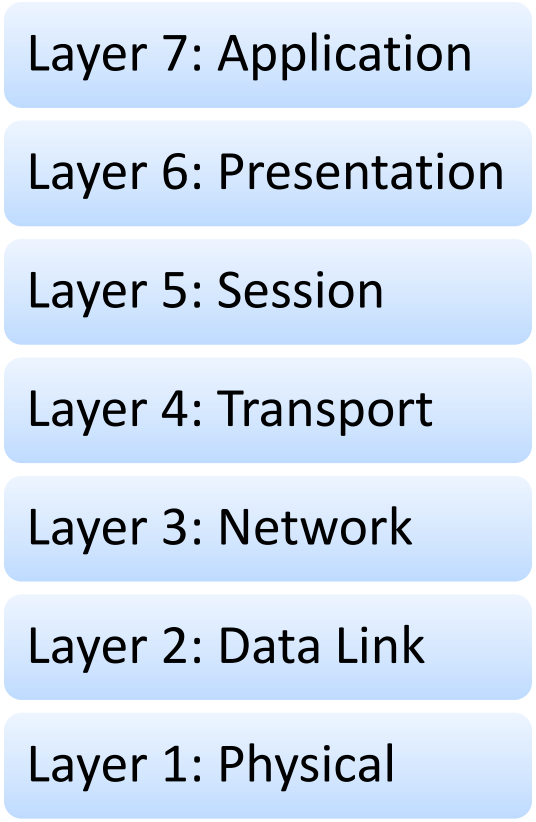
753 A 16-bit port address



Relation-ship between Layers, Addresses, and Units in TCP/IP

OSI Reference Model

- Open Systems Interconnection Reference Model
- Splits communication system into seven layers
- Each layer performs their task and passes the data to the next layer



1.Physical Layer

- This layer deals with the Hardware of network.
- Physical Layer Hardware
  - Cables , Connectors, Hubs, Repeaters.. Etc.
- Function :
  - Manages signaling to and from physical network connections
- Physical Layer Protocols & Standards
  - Ethernet (802.3), Token Ring(802.5) , Wi-Fi(802.11)

2.Data Link Layer

- This layer deals with MAC addresses of devices
- Responsible for Physical Addressing , Error correction & preparing the information for the media frames.
- Devices
  - Switches , Bridges , Wireless Access Points , NICs, etc.
- Data Link Layer Protocols & Standards
  - L2TP, PPP,SLIP etc….

3.Network Layer

- This layer deals with Packets (Data Bundles)
- Responsible for logical addressing and routing
- Devices
  - Routers, Layer 3 Switches, Firewalls.. Etc.
- Network Layer Protocols
  - ARP, IP, RIP, IGRP.. Etc.

4.Transport Layer

- This layer deals with Segments
- Breaks information into segments and is responsible for connection & connectionless communication
- Hardware
  - Proxy Server , Gateways , Firewall…etc.
- Transport Layer Protocols
  - TCP
  - UDP

5.Session Layer

- Responsible for establishing, managing & terminating user connections.
- Acknowledgements of data received during a session.
- Retransmission of data if it is not received by a device.
- Session Layer Protocols
  - RTP , SIP , Net BIOS.. etc.

6.Presentation Layer

- Allows hosts & applications to use a common language.

- Performs..
  - Data formatting
  - Encryption & Decryption for security
  - Compression & Expansion

- Examples
  - JPEG, MP3, MPEG…. Etc.

7.Application Layer

- This layer is what the user sees….

  (Loading an application such as web browser or email..)

- Provides Interface for users to communicate with applications.

- Examples
  - Email , Instant Messengers, Http , SMTP, Telnet, Ping… etc.

What is TCP/IP..?

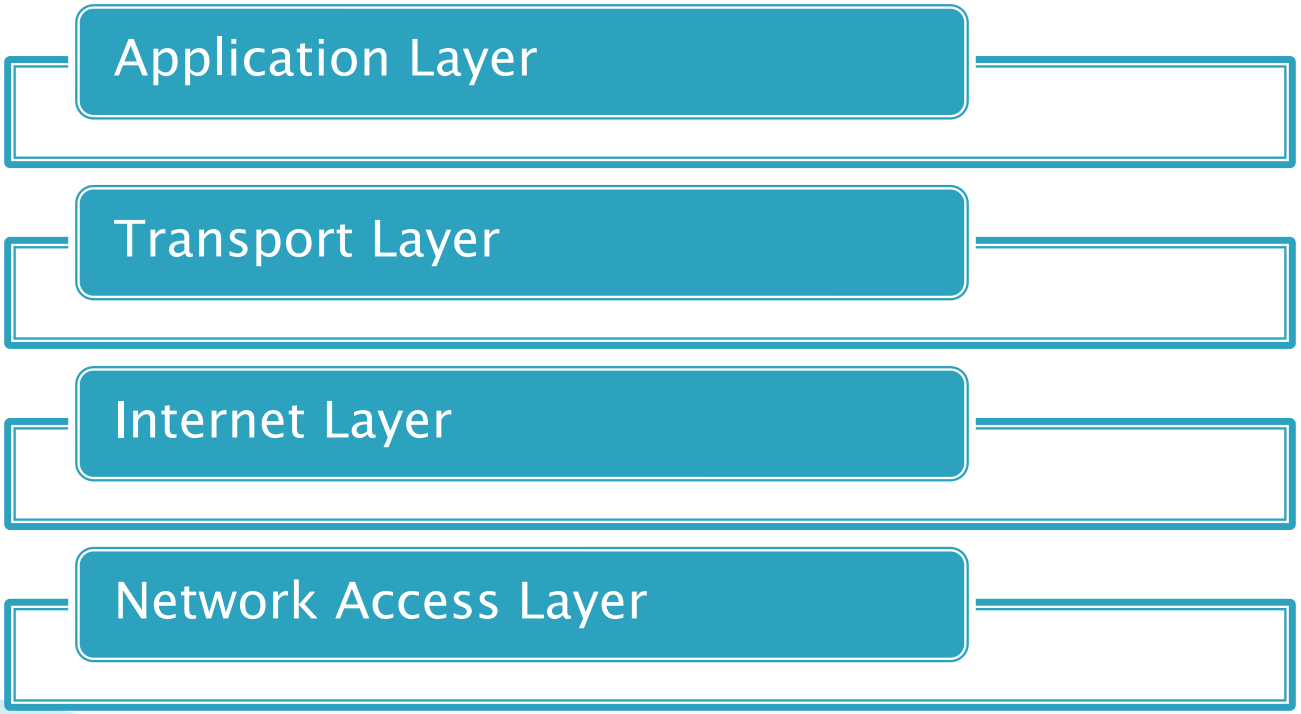
- TCP/IP is a set of protocols developed to allow cooperating computers to share resources across a network.
- TCP stands for Transmission Control Protocol
- They are Transport Layer & Network Layer protocols in OSI model.
- The most well known network that adopted TCP/IP is --> Internet. (The Biggest WAN)

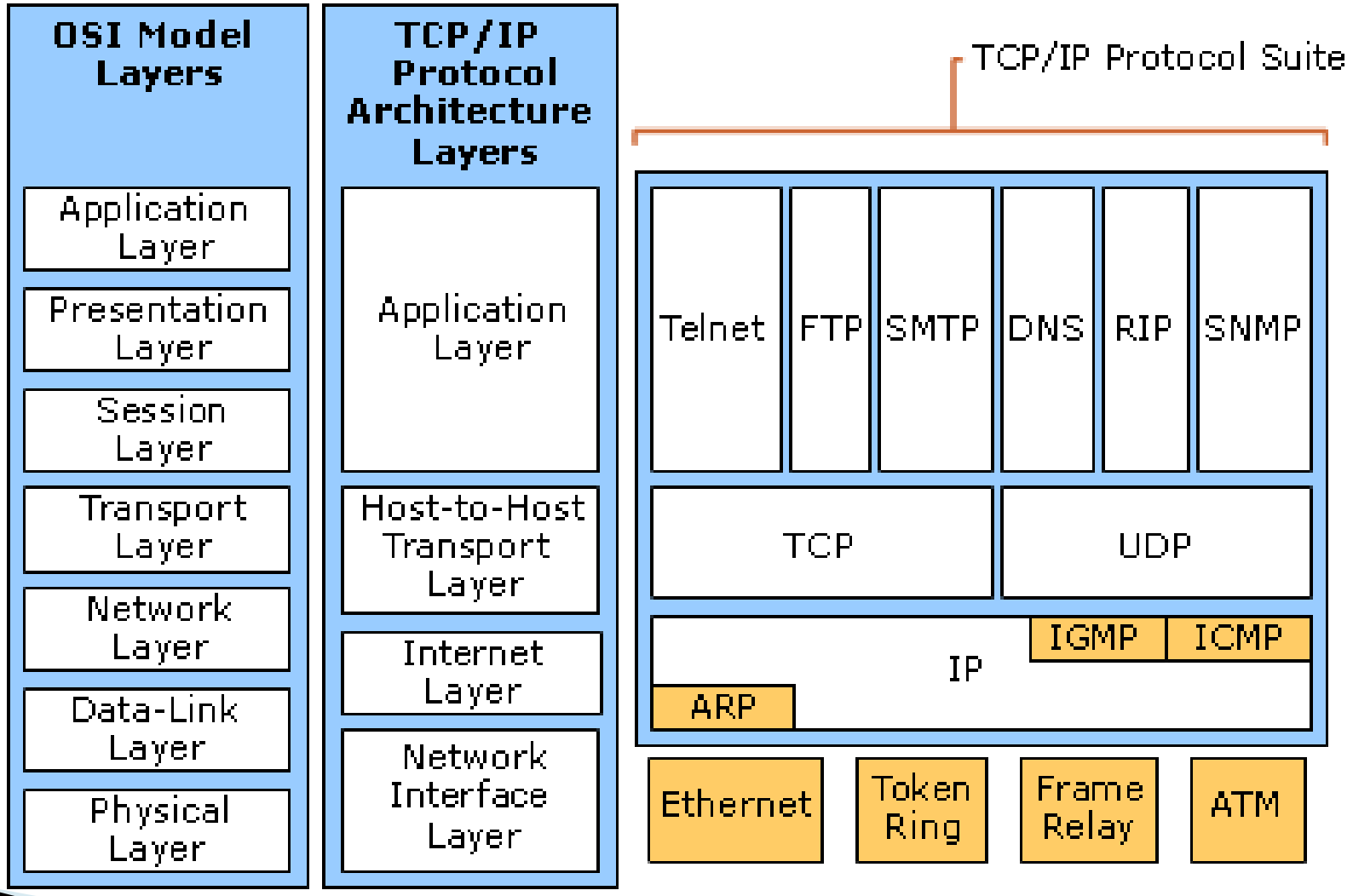
Why TCP/IP is so popular..?

- TCP/IP was developed very Early!
- Technologies were widely discussed in documents called "Request For Comments" (RFC) – free of charge
- Supported by UNIX Operating System

TCP/IP Model

- Because TCP/IP was developed earlier than the OSI 7 layer model, it doesn't have 7 layers but only 4 layers or 5.




OSI Model Layers
Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data-Link Layer
Physical Layer
TCP/IP Protocol Architecture Layers
Application Layer
Host-to-Host Transport Layer
Internet Layer
Network Interface Layer
TCP/IP Protocol Suite
Telnet
FTP
SMTP
DNS
RIP
SNMP
TCP
UDP
IGMP
ICMP
IP
ARP
Ethernet
Token Ring
Frame Relay
ATM

Application Layer…….

- Application layer protocols defined the rules when implementing specific network applications.

- Examples :
  - FTP – (File Transfer Protocol)
  - Telnet – (Remote Terminal Protocol)
  - SMTP – (Simple Mail Transfer Protocol)
  - HTTP – (Hyper Text Transfer Protocol)

Transport Layer…

- End to End data transfer……
- Examples :
  - TCP (Transmission Control Protocol)
    - Connection oriented (connection established before data exchanged)
    - Reliable delivery of data
  - UDP (User Datagram Protocol)
    - Connectionless service
    - Delivery is not guaranteed (unreliable)

Internet Layer (Network Layer)

- Internet layer protocols define the rules of how to find the routers for a packet to the destination.
- It only gives best effort delivery. (packets can be delayed, corrupted, lost or out of order)
- Examples :
  - IP – Internet Protocol (Provide packet delivery)
  - ARP – Address Resolution Protocol (Defined the procedure of network address / mac address translation)
  - ICMP – Internet Control Message Protocol (Defined the procedure of error message transfer)

Network Access Layer (Data Link and Physical Layer)

- Also known as Network Interface Layer…
- The Network Access Layer is the layer in the TCP/IP model at which data is transmitted and received across the physical network.
  - Mostly in hardware
  - A well known example is Ethernet
- Examples :
  - Ethernet
  - Token Ring
  - Frame Relay
  - ATM (Asynchronous Transfer Mode)

Thank you for listening