

嵌入式網路程式設計

單元一：網路基本觀念

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單元學習目標與大綱

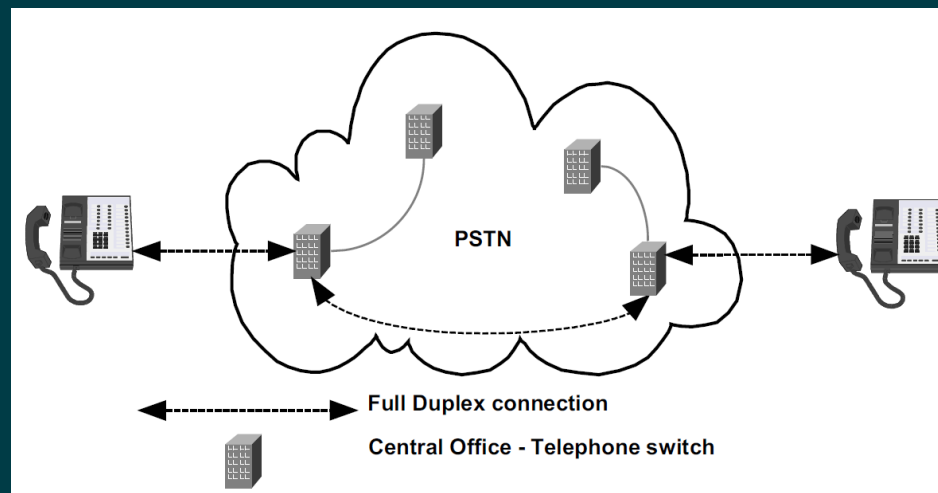
- Introduction to Networking
- OSI 7-Layer Model
- TCP/IP Protocol Stacks

Part 1

Introduction to networking

Introduction to Networking

- 電話網路
 - Public Switched Telephone Network (PSTN)
 - Circuit-Switched Network
 - Network resources are **dedicated** for the duration of the service (the length of a phone call)

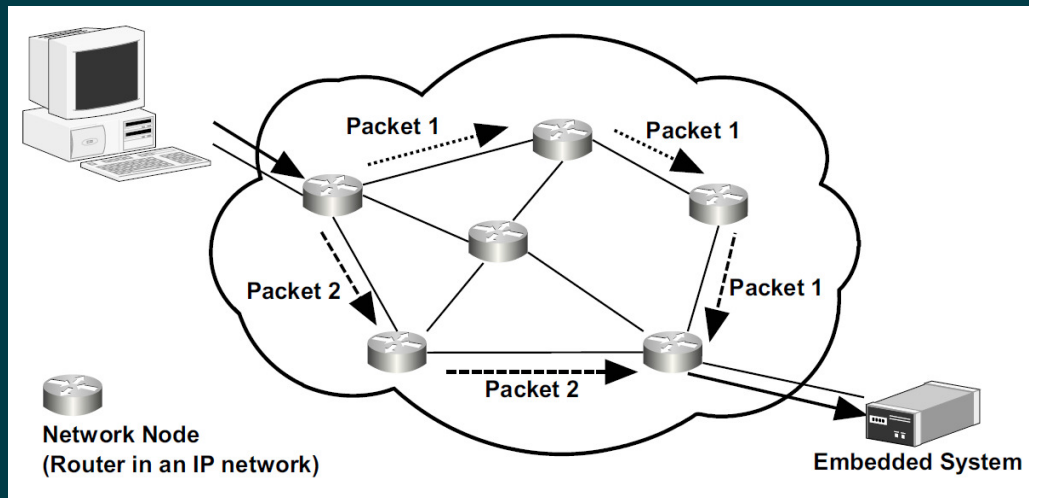


Terminology

- **Source** v.s. **destination**
- **client** v.s. **server**
- **Connection oriented** v.s. **connectionless**
- **Reliable** v.s. **non-reliable**
- **Packet switch** v.s. **circuit switch**
- **Packet, datagram**

Packet switched network

- When data is transfer
 - **Data** is chopped into small entities called **packets**
 - Network resources are **used only** when a packet is transferred between a source and destination
 - Network resources **are shared** by all communications
 - **Improve network utilization**



Characteristics of packet-switching

- Networks transfer packets using **store-and-forward**
- Packets have a **maximum length**
- Long message are broken into **multiple packets** (i.e. **fragmentation**)
- Source and destination address are stored **in every packet**

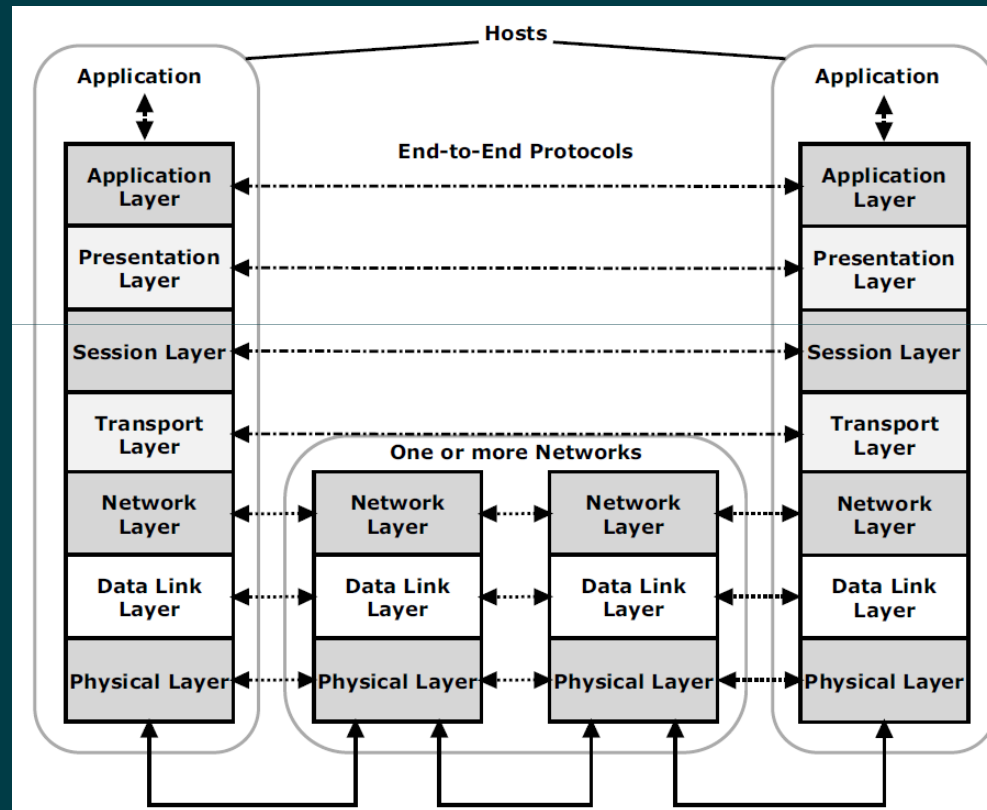
Store-and-forward operation in each packet switch

- **Store** each arriving packet
- **Reads the destination address** in the packet
- **Consults a routing table** to determine the next hop
- **Forwards** the packet

Part 2

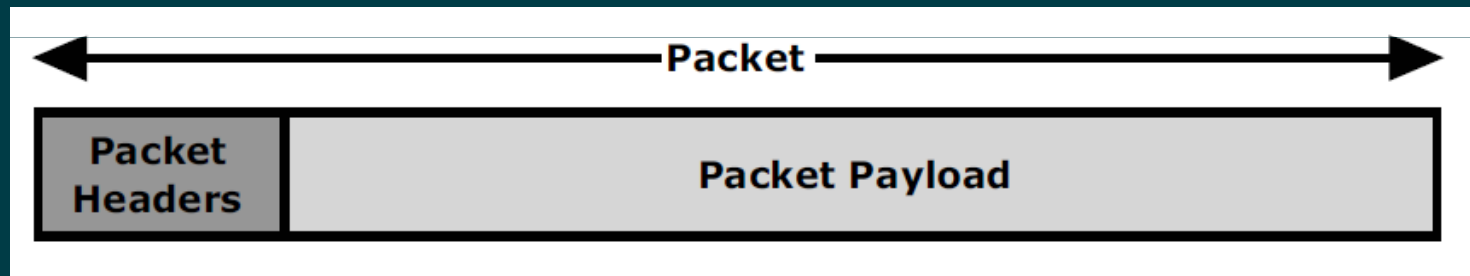
OSI 7-Layer Model

OSI 7-Layer Model



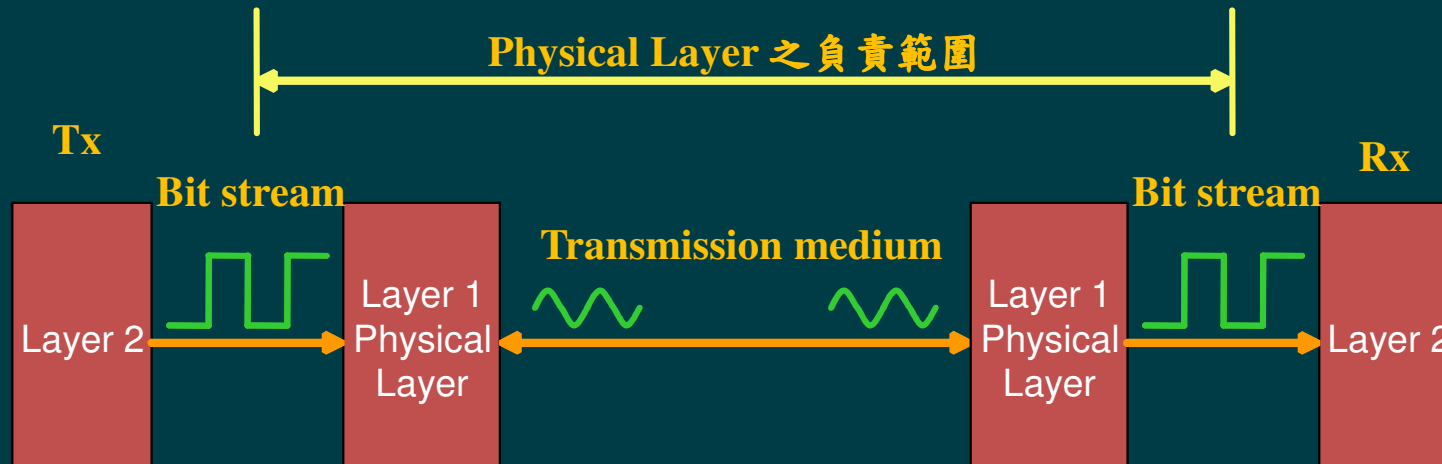
Packet encapsulation

- **Encapsulation** mechanism when data travels from one layer to the **next layer**



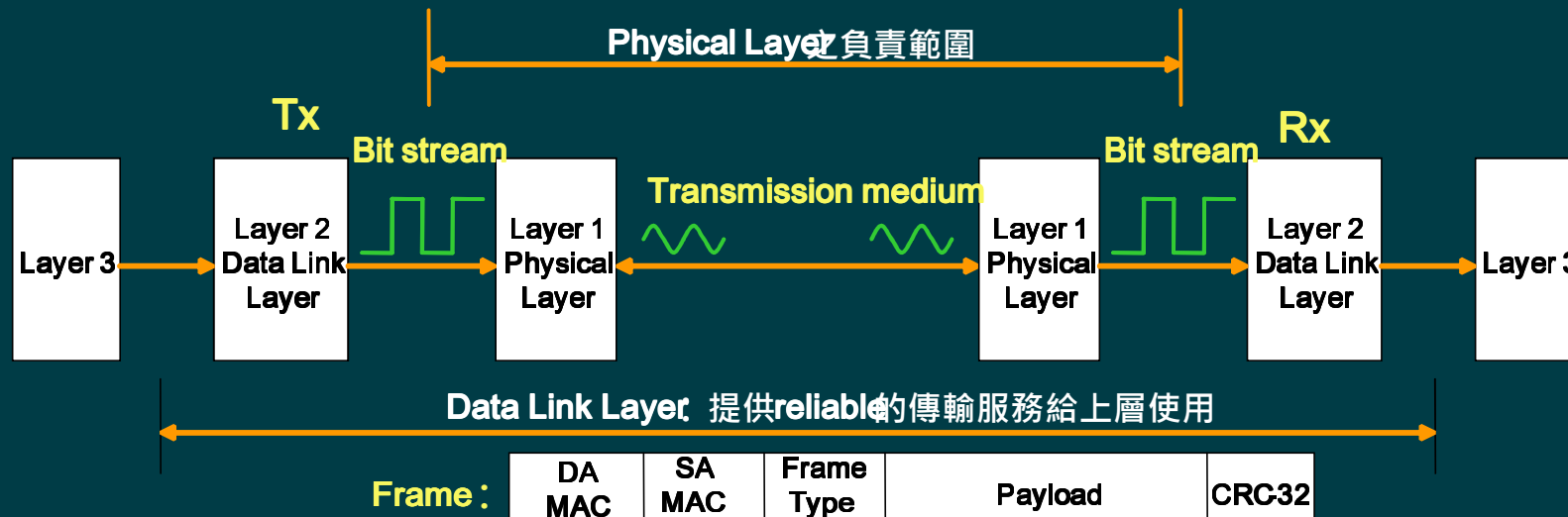
Physical Layer

- 負責網路之線路連結與資料傳輸工作
- 此層所看到的資訊僅為位元(bit)，即負責將一連串的位元(bit stream)經由實際的傳輸線路傳送給對方



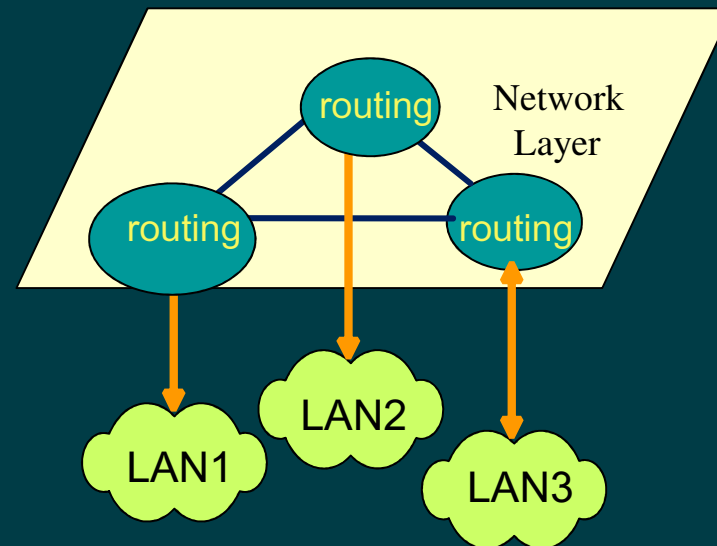
Data Link Layer

- **Point-to-Point Protocol**
- 確保一條連接線(或傳輸通道)上的**兩個端點間資料傳輸的正確性**
- 看到的資料已**非bit stream**，而是有意義的**frame**



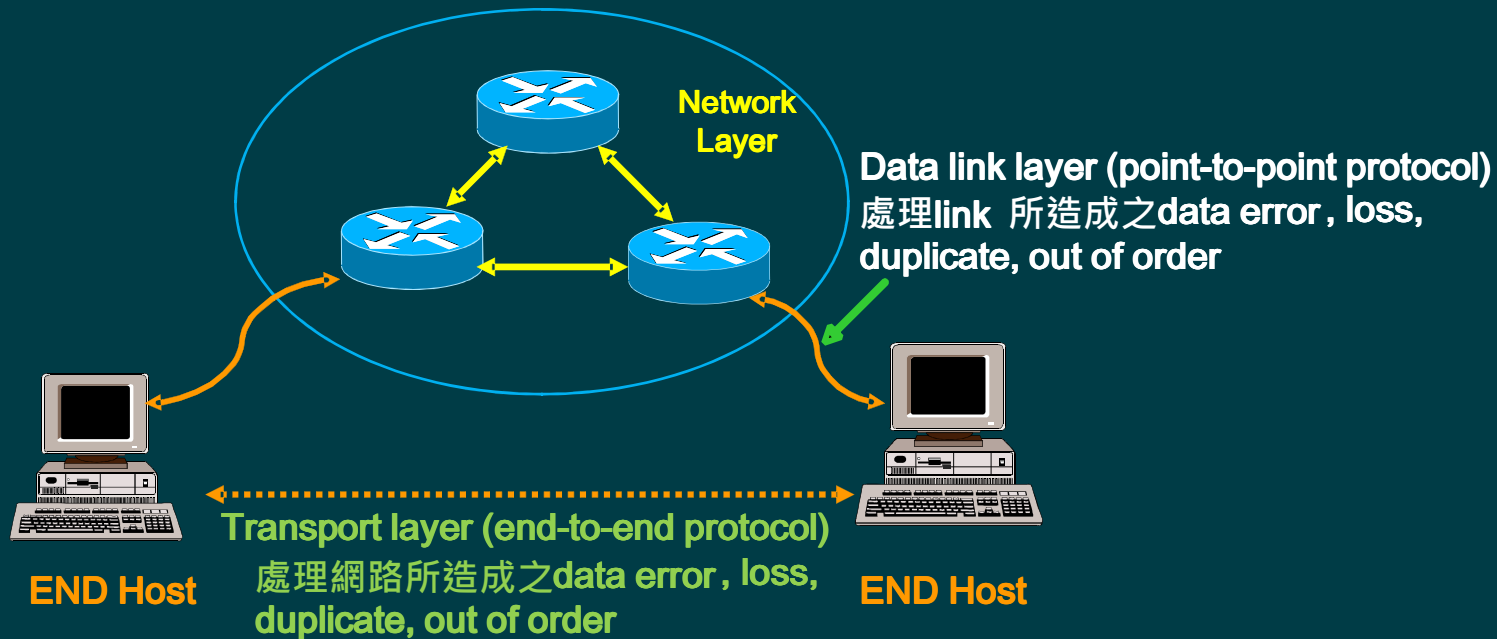
Network Layer

- 將資料由原始電腦(source host)繞路(routing)到目的地電腦
- 依據網路之涵蓋範圍, 可分為
 - LAN
 - MAN
 - WAN



Transport Layer

- 負責的工作與資料鏈結層(layer 2)非常相似
- End-to-End protocol
 - 解決error, loss, out of order and duplicate problem



- **Session Layer**

- 負責提供服務來達成許多使用者之間對談(dialog)的組成、同步、以及管理使用者之間資料的傳送

- **Presentation Layer**

- 將資料以有意義的形式表達給網路之使用者。其工作可能包含資料的壓縮 (Compression) 及還原 (Expansion) , 資料的「加密」(Encryption)及「解密」(Decryption)。

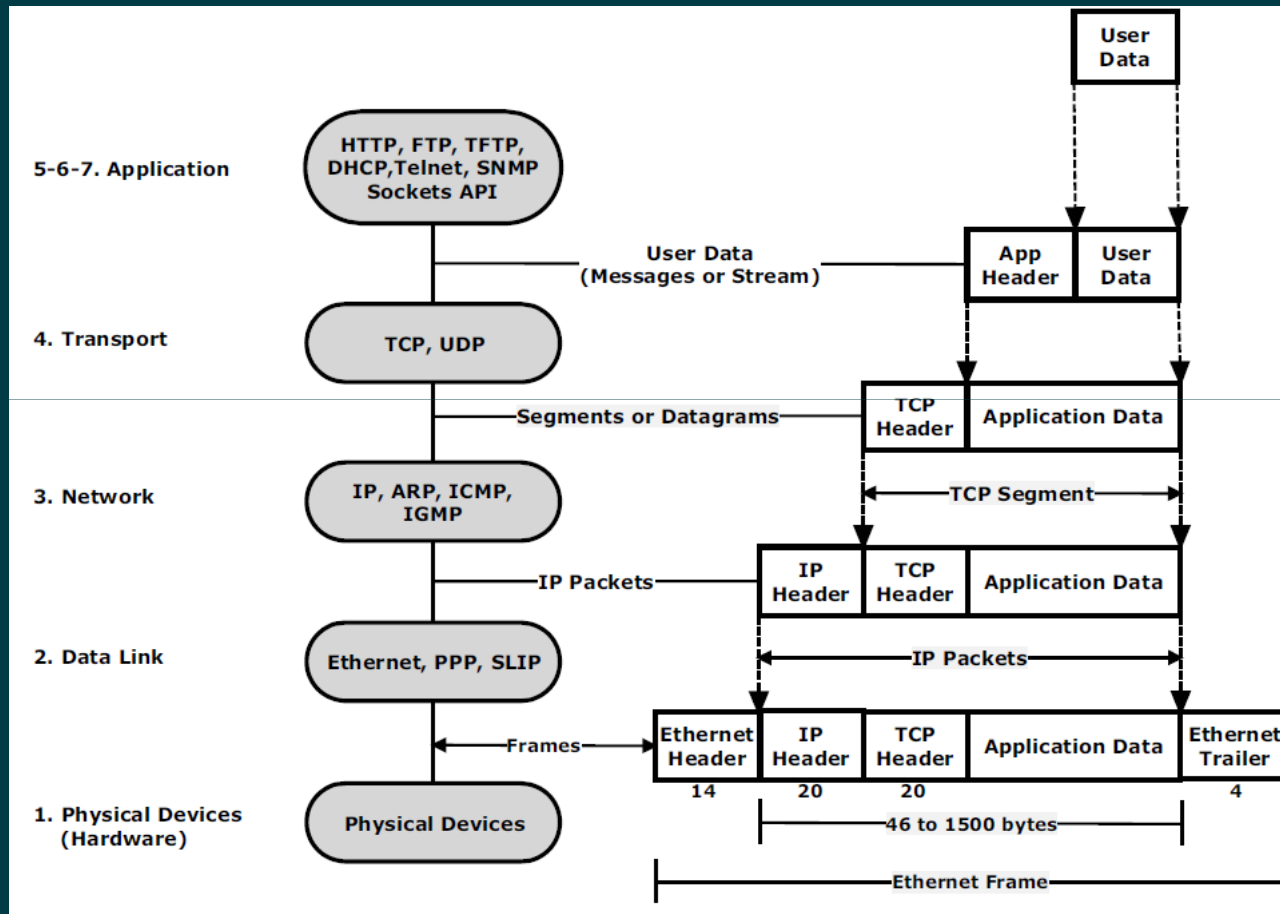
- **Application Layer**

- 提供各種服務給應用程式(application processes) , 使其能夠使用系統之連結功能來達到和其他應用程式交換資料的目的

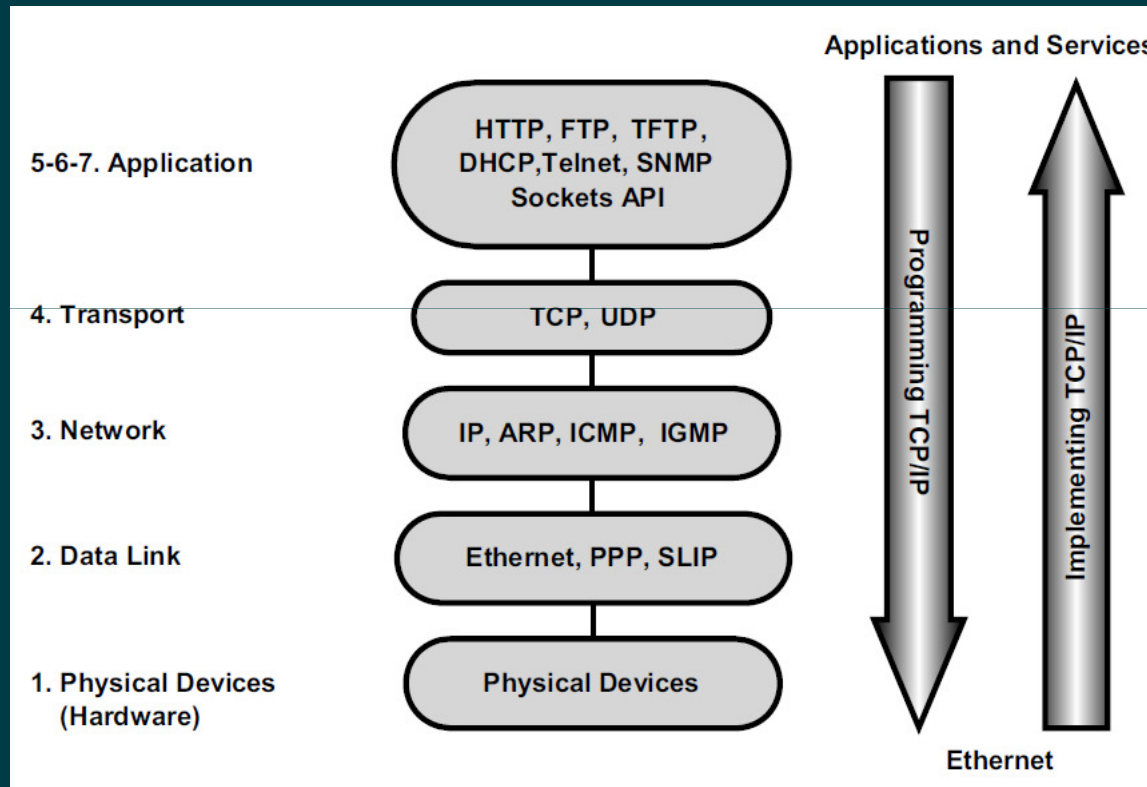
Part 3

TCP/IP Protocol Stacks

TCP/IP Layer Model



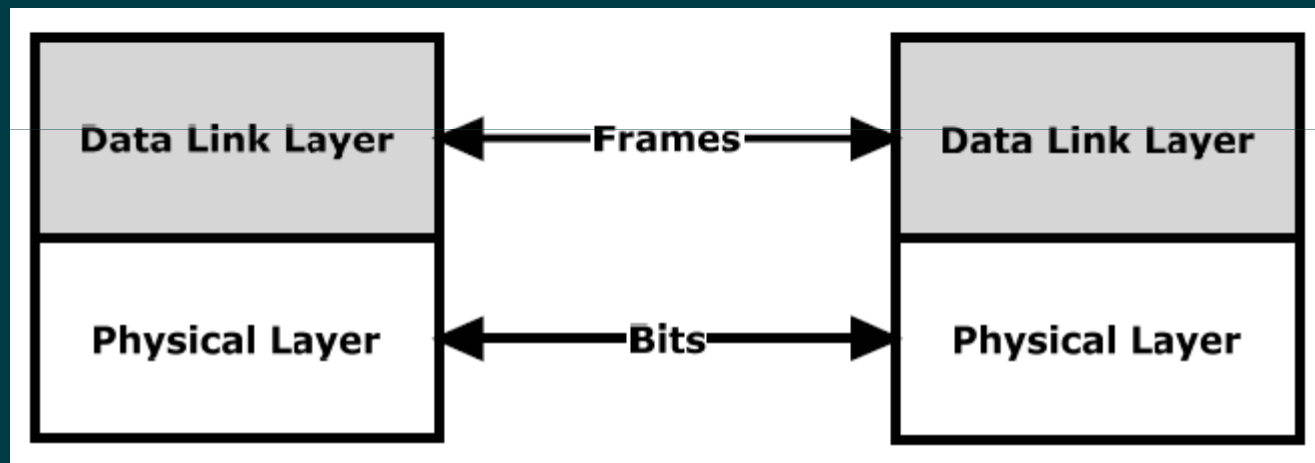
Internet Protocol Suit



Encapsulation Types

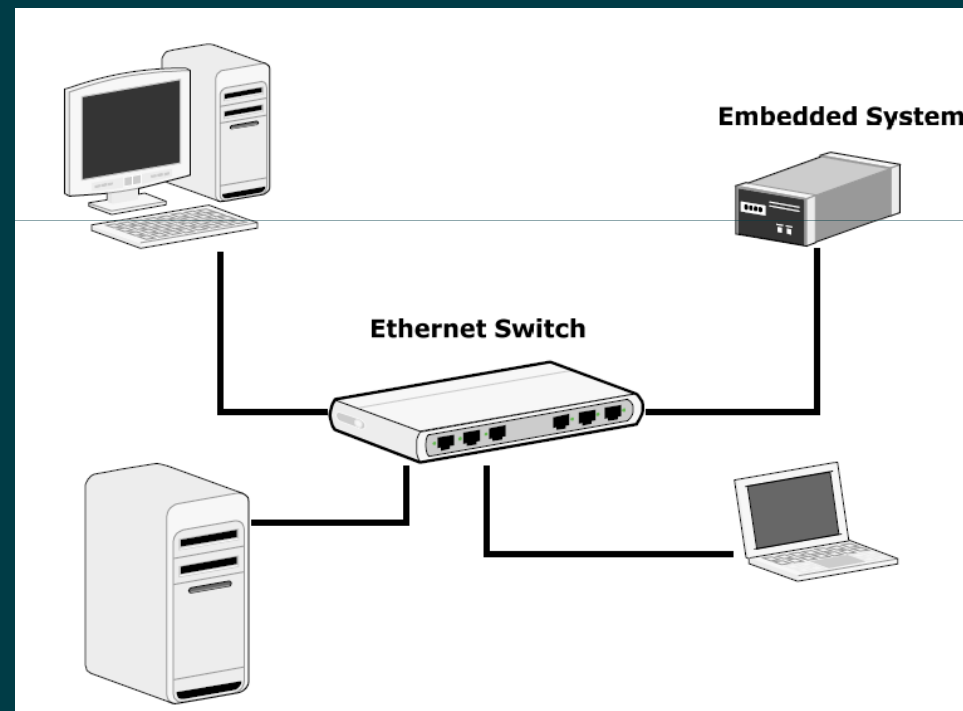
Layer Name	Layer Number	Encapsulation terminology
Data Link	2	Frame (Ethernet)
Network	3	Packet
Transport	4	TCP - Segment UDP - Datagram
Application	5-6-7	Data

Network Interface Card (NIC)



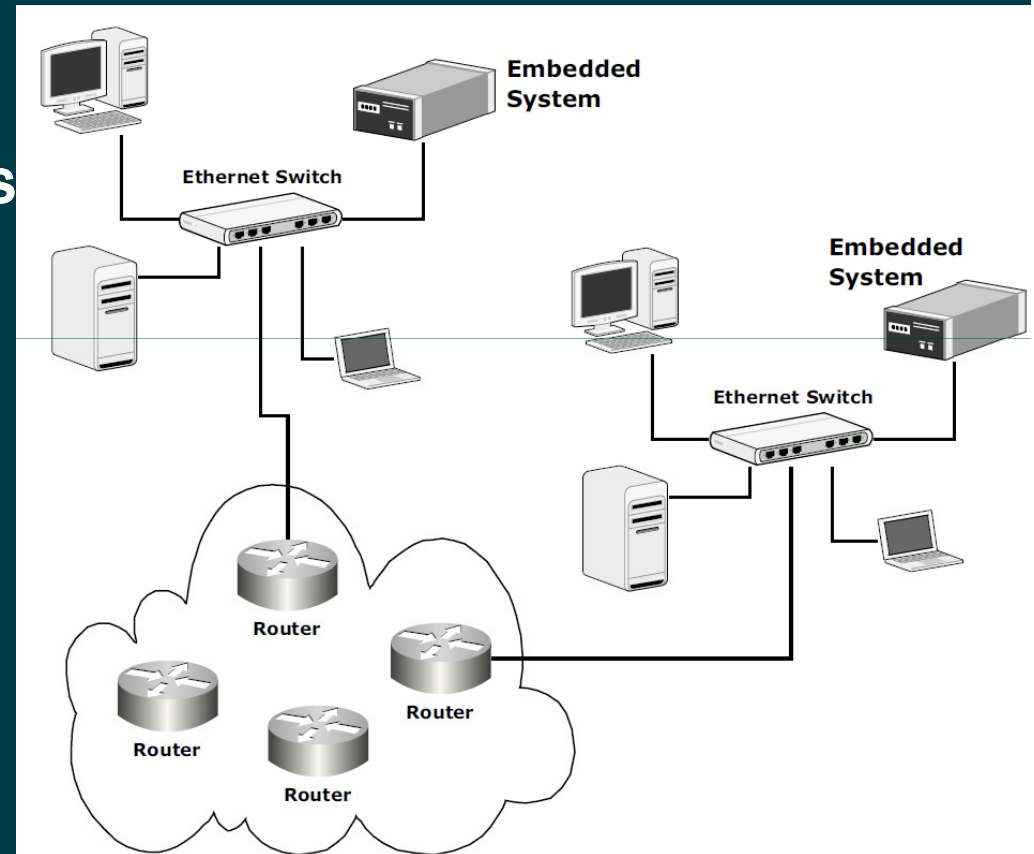
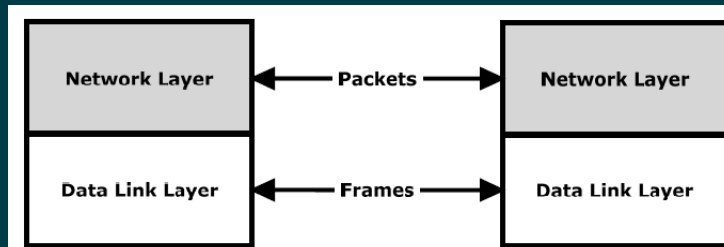
Layer 1+ Layer 2: Ethernet

- NIC connects host to local area network

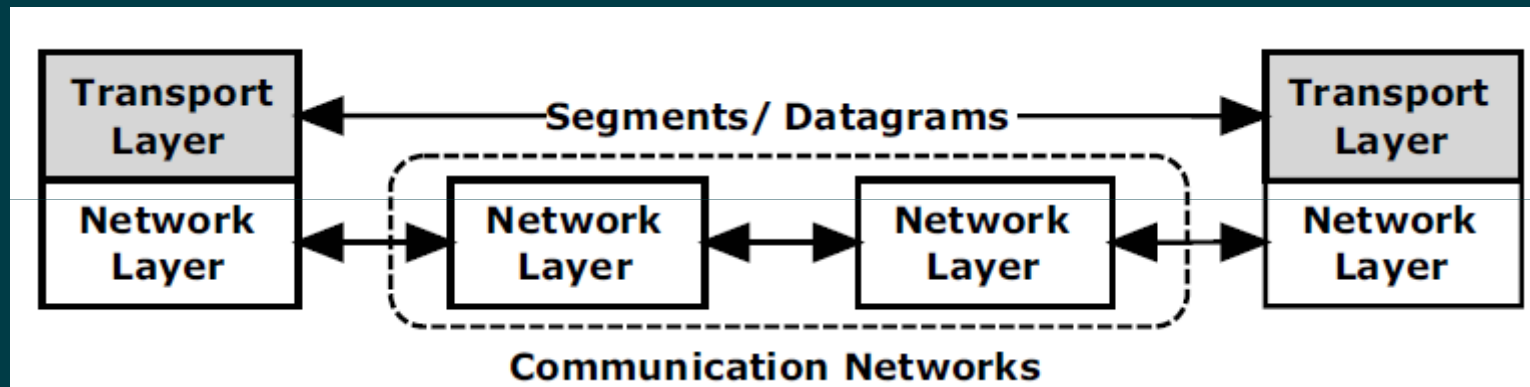


Layer 3 Network Layer: IP Protocol

- Internet
– a network of networks



Layer 4-Transport: TCP/UDP Protocol



Transmission Control Protocol (TCP)

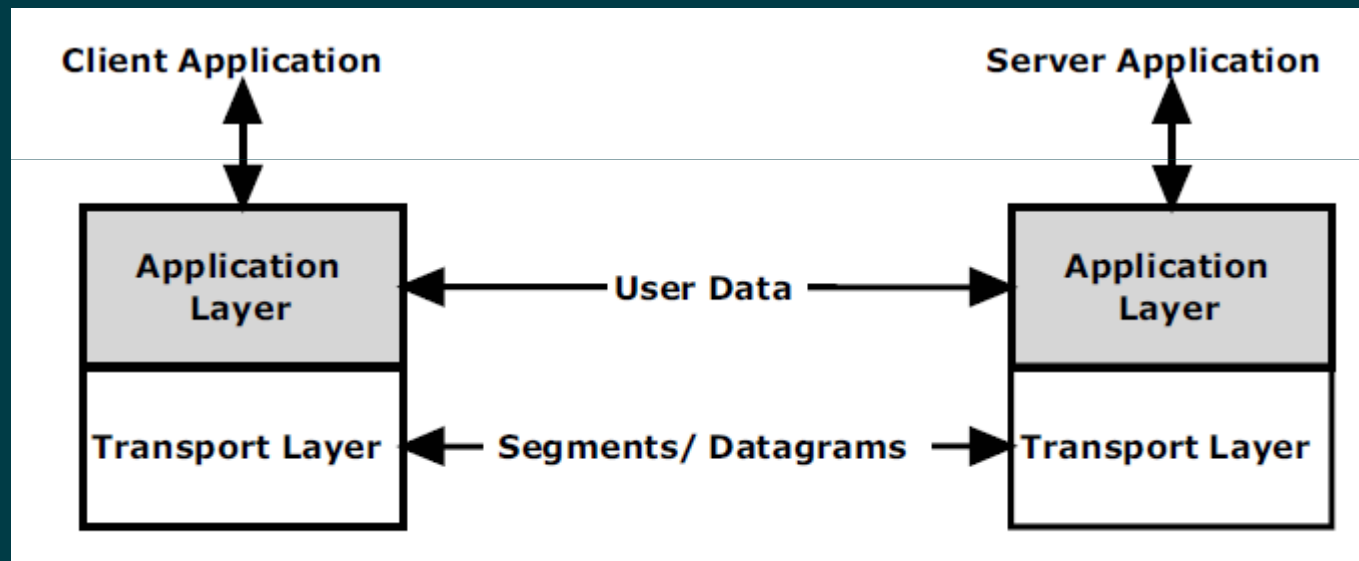
- **Reliable stream** transfer providing
 - Error recovery
 - Flow control
 - Packet sequencing

User Datagram Protocol (UDP)

- A **quick-and-simple single-block** transfer

Layer 5-6-7-The Application

- A quick-and-simple single-block transfer



Summary

