

IG CS Topic 2.1-2.4 Data Transmission

Created by HardyWen

IG CS Topic 2.1-2.4 Data Transmission

Data Packets

Structure of a packet

Packet Switching

Packet Switching Method

Data Transmission Methods

Number of Bits

Directions

Universal Serial Bus (USB)

Data Packets

- data is **broken down** into **packets** to be **transmitted**
 - a packet is **a small unit of data**

Structure of a packet

- a packet contains a **packet header**, a **payload** and a **trailer**

1. **Packet Header**

- a section of a packet that contains information about the content of the packet and its destination, which can be broken down into:

1. **Destination address**

- normally an IP address
- states where the packet is to be sent

2. **Packet number**

- the **order** of the packet in the data
- the packets of data may not have all been sent in the correct order
 - hence in destination, when the device has received all the packets, it will rearrange the packet based on the packet numbers to show the data correctly

3. **Originators address**

- normally an IP address
- states where the data has been originally sent
- not used often
 - but can be used to track illegal activities or ask the device to resend the packet when an error occurs

2. **Payload**

- the **actual data** from the file that you are sending

3. **Trailer**

- known as the **footer**
- contains 1) a **marker** indicating that it is the end of the packet
and 2) the data for **error detection**

Packet Switching

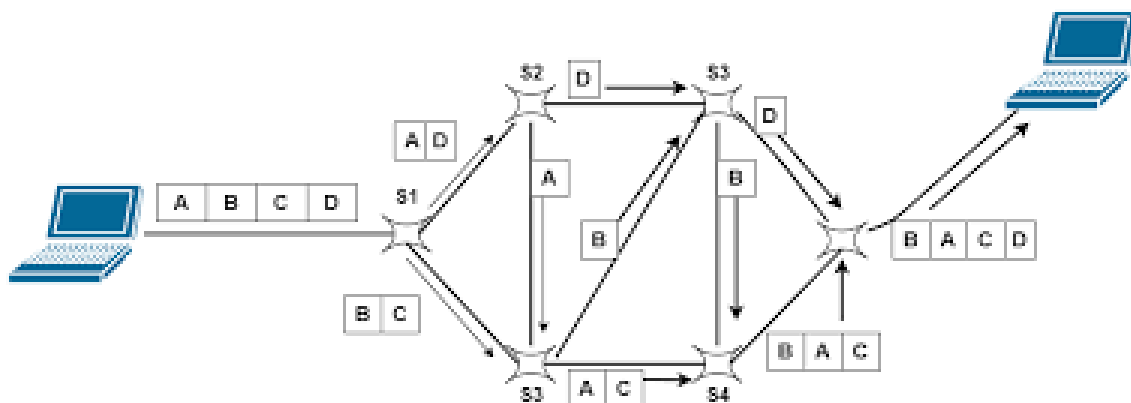
- a method of transmitting data packets across a network
- each data takes an **individual pathway**

Advantages	Disadvantages
No need to tie up a single communications line	Packets can be lost and need to be re-sent
Possible to overcome failed, busy or faulty lines by re-routing	Doesn't work well with real-time streaming
A high data transmission rate is possible	Delay at the destination while waiting for all of the packets to arrive and then reassemble them in the correct order

Packet Switching Method

explain how packet switching works.

1. Data is broken down into **packets**
2. Each packet could take a **different route**
3. A **router** controls the route a packet takes
 - the routing selection depends on the **number of packets** at each router
4. Packets may arrive **out of order**
5. Once the last packet has arrived, packets are **reordered**



Data Transmission Methods

- there are multiple ways data can be transmitted

Number of Bits

- remember to refer to bit in your answer...

1. Serial data transmission

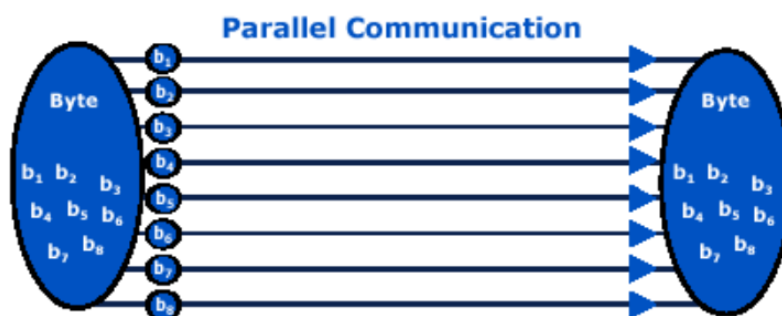
- **one bit** of data is sent at a time over **a single wire**
- used in **long-distance transmission** and transmission that requires the data to be **accurate**
 - example usage includes the **USB**



Advantages	Disadvantages
less chance of data being skewed because data arrives in order of sequence, one bit at a time	the transmission is slow as only one bit is sent at a time
more accurate over a longer distance	start bit and end bit are required to tell the destination when the transmission has started or ended
cheaper to manufacture and buy as only one wire is used	

2. Parallel data transmission

- **multiple bits** of data are sent at a time using **multiple wires**
- used in **short-distance** or **fast** transmissions
 - example usage includes **connecting a computer to a printer**
- it is often limited to **5 meters**



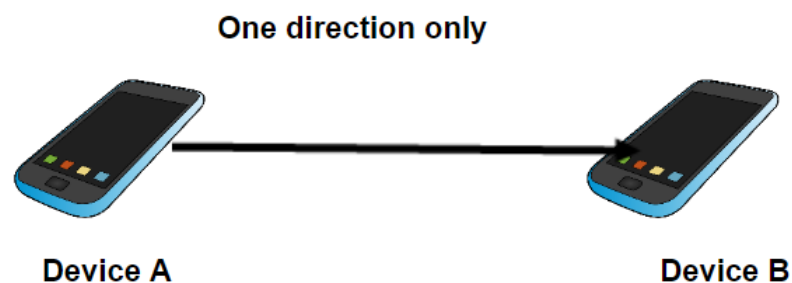
Advantages	Disadvantages
the transmission is fast as data is sent multiple bits at a time	high chance of data being skewed as packets do not arrive in the destination in order
match to underlying hardware - computers internally use parallel circuits	more chance of data interference over long distances, less accurate in transmission
	more expensive in purchasing

Directions

- the usages depend on the purpose

1. Simplex

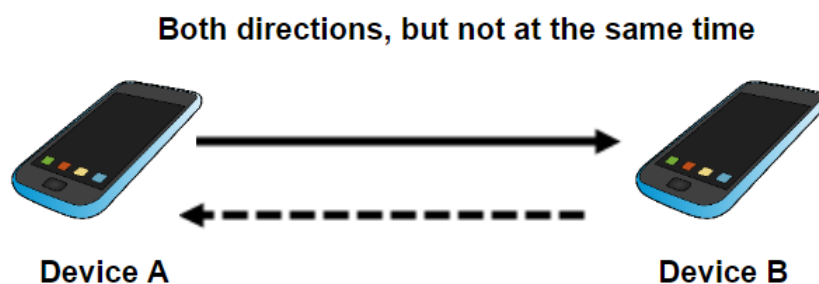
- data is transmitted in **one direction only**



- it has **no traffic issues** and the **full capacity** of the transmission line can be used
- however, two devices cannot communicate in simplex mode

2. Half-duplex

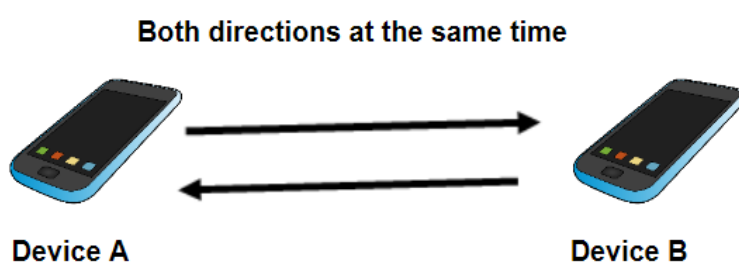
- data can be transmitted in **both directions**, but only **one direction** at a time



- data is **transmitted in both sides** and **troubleshooting** is easy
- however, there will be **delay** in half-duplex, making it **slow**

3. Full-duplex

- data is transmitted in **both directions**, at **the same time**



- data is transmitted at a **very fast** speed then the other methods and there is **no delay** in communication
- however, no proper **bandwidth utilization** as the same line is used for sending and receiving at the same time

Basis Of Compression	Simplex	Half Duplex	Full Duplex
Direction of Communication	Data transmitted only in one direction at a time	Signals can be transmitted on both side, but not at the same time	Signals can be transmitted on both sides at the same time.
Send / Receive	The sender only send data	The sender can be sent and receive but not at the same time	The sender can send and receive data at the same time
Performance	Worst performance	Better performance	Best performance
Example	Keyboard	Walkie-talkie	Telephone

- the transmission method combines a type of "number of bits" and a type of "directions"
 - e.g., half-duplex serial data transmission / simplex parallel data transmission

Universal Serial Bus (USB)

- **Universal Serial Bus** is an industry-standard that is used to transmit data
- A **USB** interface includes items such as **USB port** (USB 接口), **USB cable** (USB 线), **USB device** (USB 设备)
 - USB device includes **USB Memory stick** (U盘)
- USB uses **serial** data transmission that can be either **half-duplex** or **full-duplex**

Advantages	Disadvantages
impossible to connect a USB device incorrectly as the connector only fits one way	the length of the USB cable is limited normally to 5 meters
it is an industry standard so any devices you buy can connect to an USB	the transmission speed isn't as fast as other types of connections such as ethernet
supported by many operating systems	does not have an unlimited lifespan
faster transmission compared to wireless	
devices are automatically detected and configured when initially attached	

