

# **AQA Computer Science A-Level**

## **4.9.1 Communication**

### **Concise Notes**



## **Specification:**

### **4.9.1.1 Communication methods:**

Define serial and parallel transmission methods and discuss the advantages of serial over parallel transmission.

Define and compare synchronous and asynchronous data transmission.

Describe the purpose of start and stop bits in asynchronous data transmission.

### **4.9.1.2 Communication basics:**

Define:

- baud rate
- bit rate
- bandwidth
- latency
- protocol

Differentiate between baud rate and bit rate.

Understand the relationship between bit rate and bandwidth.



## Communication basics

### Symbol

- A **particular pattern of bits** represented by a signal

### Baud rate

- The **number of signal changes** in the medium **per second**
- 1 Baud (or 1Bd) = 1 symbol change per second

### Bit rate

- The **number of bits that are transmitted** over the medium **per second**
- Often measured in **bits per second** (bps)
- = Baud rate × № of bits per signal

### Bandwidth

- The **range of frequencies** that a communication medium is capable of transmitting
- Expressed in **Hertz**
- Higher bandwidth results in a **higher bit rate**

### Latency

- The **difference in time** between an action being **initiated** and its **effect** being noticed
- Often measured in **milliseconds**
- Usually **increases** with distance

### Protocol

- A **set of rules** relating to communication between devices
- Allow devices made by **different manufacturers** in **opposite ends of the world** to communicate seamlessly



## Serial and parallel data transmission

### Serial data transmission

- Data is sent **one bit at a time** over one communication line
- Frequently used for transmitting data over **medium to long distances**
- USB connections are a common example of serial data transmission

### Parallel data transmission

- **Numerous parallel communication lines** send **multiple bits** between components **simultaneously**
- More lines = more data transferred simultaneously
- **More expensive** than serial transmission because of the use of multiple lines
- Most often used **over short distances**, **between parts of the processor** and **within RAM**

### Crosstalk

- Signals from the **tightly packed** communication lines can “**leak**” into others
- This can cause **data corruption**

### Skew

- Each of the lines will have **slightly different electrical properties**
- The time taken for one bit to be transferred will **differ slightly** from line to line
- Bits sent together may not be received together
- Worst over long distances
- Can lead to bits from different pulses **overlapping**, causing **corruption** of data

### The advantages of serial over parallel

- Serial data transmission **doesn't suffer from skew or crosstalk**
- It is therefore a **more reliable communication method**, especially over **long distances**.
- Serial mediums, which use **just one line**, are **cheaper** to install than parallel mediums which use more than one line



## Synchronous and asynchronous data transmission

### Synchronous transmission

- A **clock signal**, shared by both the sender and the receiver, times when signals are sent
- The signals, sent at **regular intervals**, will be received **in the same order** that they were sent
- Suitable for transmitting information in **real-time systems**
- Used within the busses of a computer's processor in the fetch-execute cycle

### Asynchronous transmission

- **Start and stop bits** are used to indicate the **duration of a transmission**
- The start bit can be **either a 0 or a 1** and the stop bit is **always the opposite** of the start bit
- The sender and receiver must use **the same Baud rate**
- The sender and receiver need only synchronise their clocks **for the duration of data transmission**

