AQA Computer Science AS Level

3.9.1 Communication

Concise Notes

Specification:

3.9.1.1 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.

3.9.1.2 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