Data transmission

IB Computer Science

Content developed by Dartford Grammar School
Computer Science Department
HL Topics 1-7, D1-4

1: System design
2: Computer Organisation
3: Networks
4: Computational thinking
5: Abstract data structures
6: Resource management
7: Control
D: OOP
# HL & SL 3 Overview

## Network fundamentals
- 3.1.1 Identify different types of networks
- 3.1.2 Outline the importance of standards in the construction of networks
- 3.1.3 Describe how communication over networks is broken down into different layers
- 3.1.4 Identify the technologies required to provide a VPN
- 3.1.5 Evaluate the use of a VPN

## Data transmission
- 3.1.6 Define the terms: protocol, data packet
- 3.1.7 Explain why protocols are necessary
- 3.1.8 Explain why the speed of data transmission across a network can vary
- 3.1.9 Explain why compression of data is often necessary when transmitting across a network
- 3.1.10 Outline the characteristics of different transmission media
- 3.1.11 Explain how data is transmitted by packet switching

## Wireless networking
- 3.1.12 Outline the advantages and disadvantages of wireless networks
- 3.1.13 Describe the hardware and software components of a wireless network
- 3.1.14 Describe the characteristics of wireless networks
- 3.1.15 Describe the different methods of network security
- 3.1.16 Evaluate the advantages and disadvantages of each method of network security
Topic 3.1.7

Explain why protocols are necessary
Summary

- Protocols are the **set of rules** computers follow when communicating across a network.
- Without them, **no information can be transmitted** as computers don't know how to interpret the signals coming through the network.
Essential functions of protocols

- Ensure data integrity
- Manage flow control
- Prevent deadlock
- Manage congestion
- Perform error checking
Data integrity

- Data integrity, in the context of networking, refers to the overall completeness, accuracy and consistency of data.
- Data integrity must be imposed when sending data through a network.

I sent you “A”. Did you get it?

Yip, I received “A”
Flow control

- Flow control is the mechanism that ensures the rate at which a sender is transmitting is in proportion with the receiver’s receiving capabilities.
- Flow control is utilized especially in cases where the sending device can send data much faster than the receiver can digest.
Deadlock

- A deadlock is a situation where **two nodes** or processes are trying to access the same node at exactly the same moment, causing **neither to be able to proceed**.
- It is then up to the relevant protocol to stop both, and re-queue them so that they can happen sequentially, letting traffic flow.
Congestion control

- Congestion refers to a **network state** where a node or link carries **so much data** that it may **deteriorate** network service quality, resulting in **queuing delay**, frame or **data packet loss** and the **blocking of new connections**.

- In modern networks, avoiding congestive collapse involves the application of network congestion avoidance techniques along with congestion control.

> I missed that last bit?
Error checking

- **Error checking or detection** refers to the techniques used to detect **noise** or **other impairments** introduced into data while it is transmitted from source to destination.

- Error detection often makes use of **parity bits**, bits at the end of a packet that are calculated to be either a 1 or 0.
Model Exam Question

18. A website allows members to place orders for products. A person may become a member by completing an online form with their details, including payment method, email address and password. To order from the site a member must enter a username and a password.

(a) Outline the use of verification and validation in the completion of the membership form. [2 marks]

(b) Outline the way in which encryption should be used in this system. [3 marks]

(c) Explain the role of protocols when a member accesses the site. [2 marks]