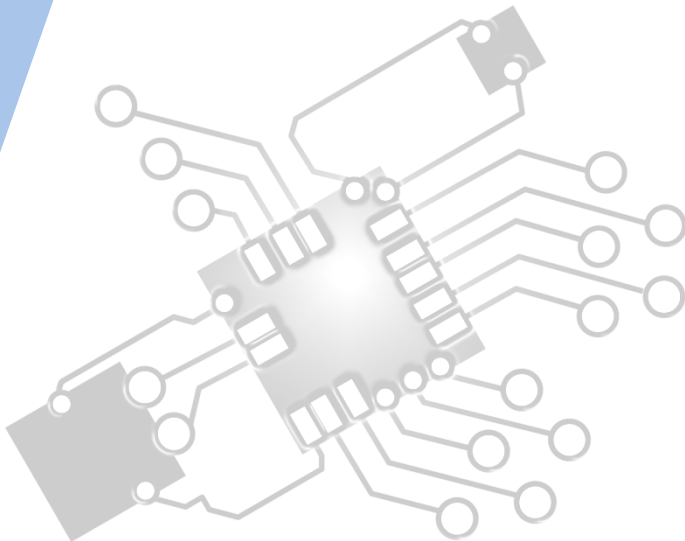# Data transmission

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

1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

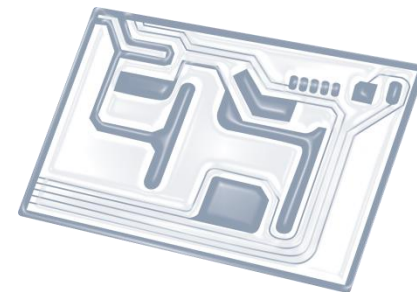5: Abstract data structures

6: Resource management
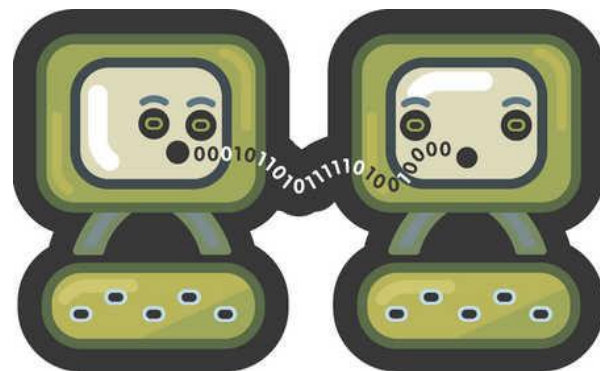
7: Control

D: OOP

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
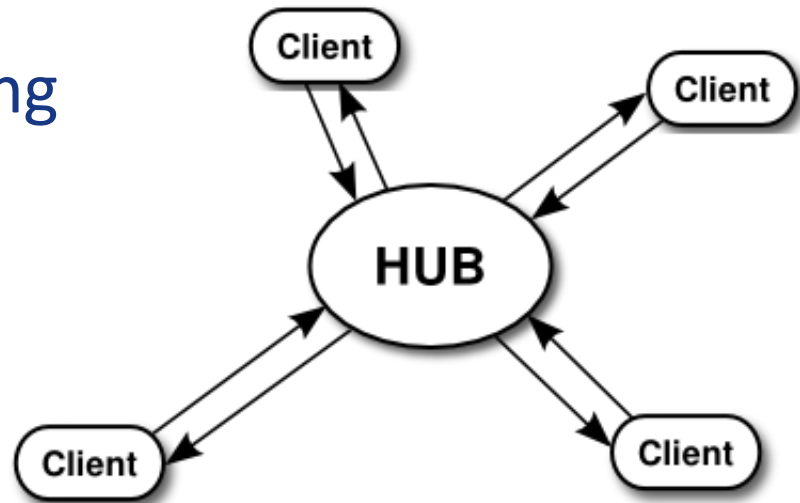
Data integrity

- 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?
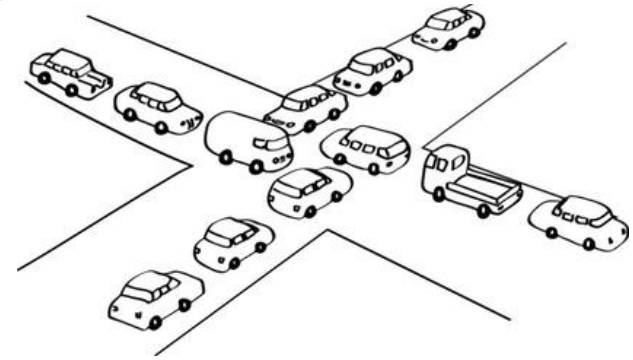
Yip, I received "A"

Node A

Node B
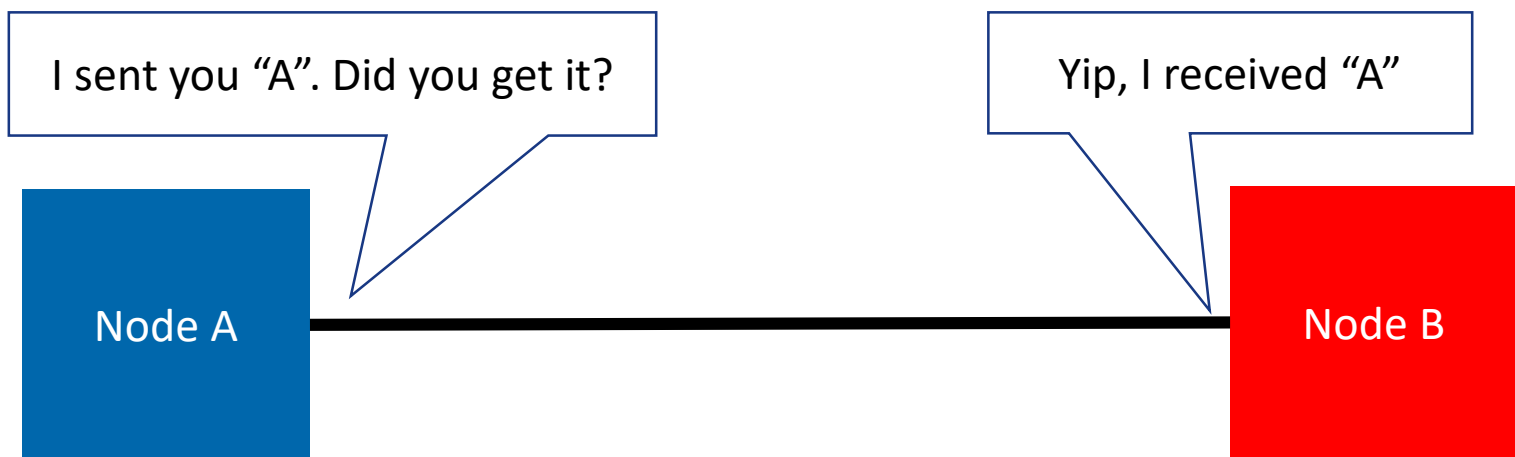
Flow control

- 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.

Keep up!

Node A

puffs *puffs*

Node B
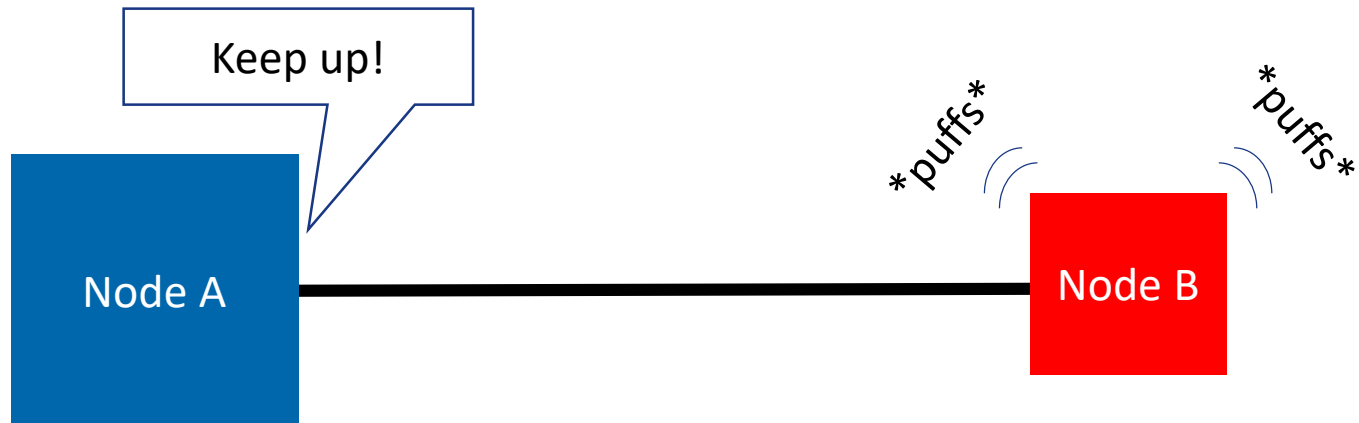
Deadlock

- 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.

Node A

Node B

Node C
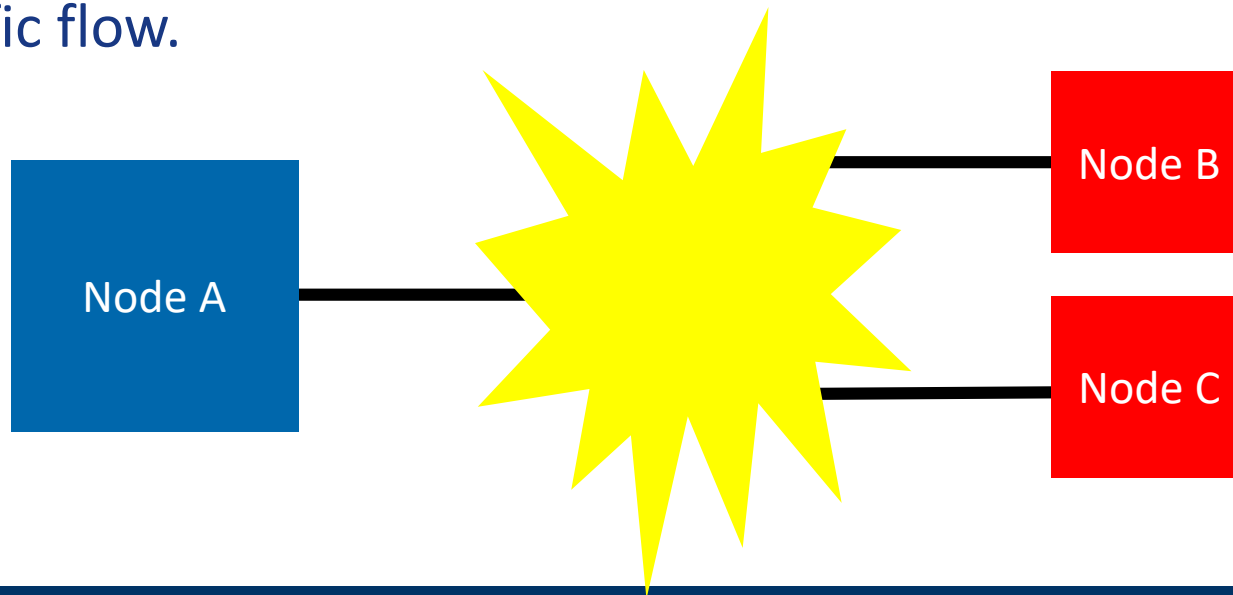
Congestion control

- 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.
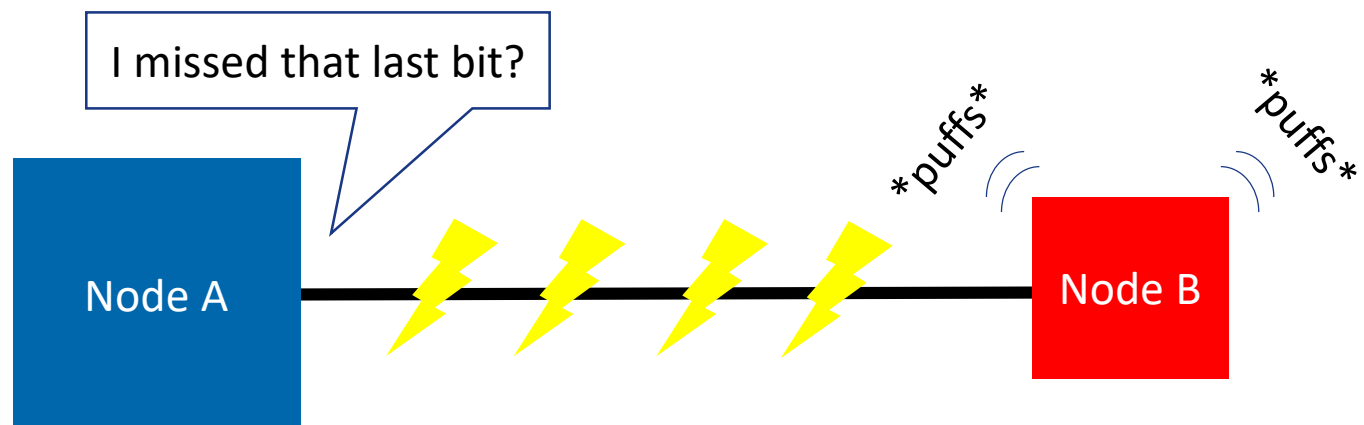
Error checking

- **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.

This one looks bad!

Node A

Node B
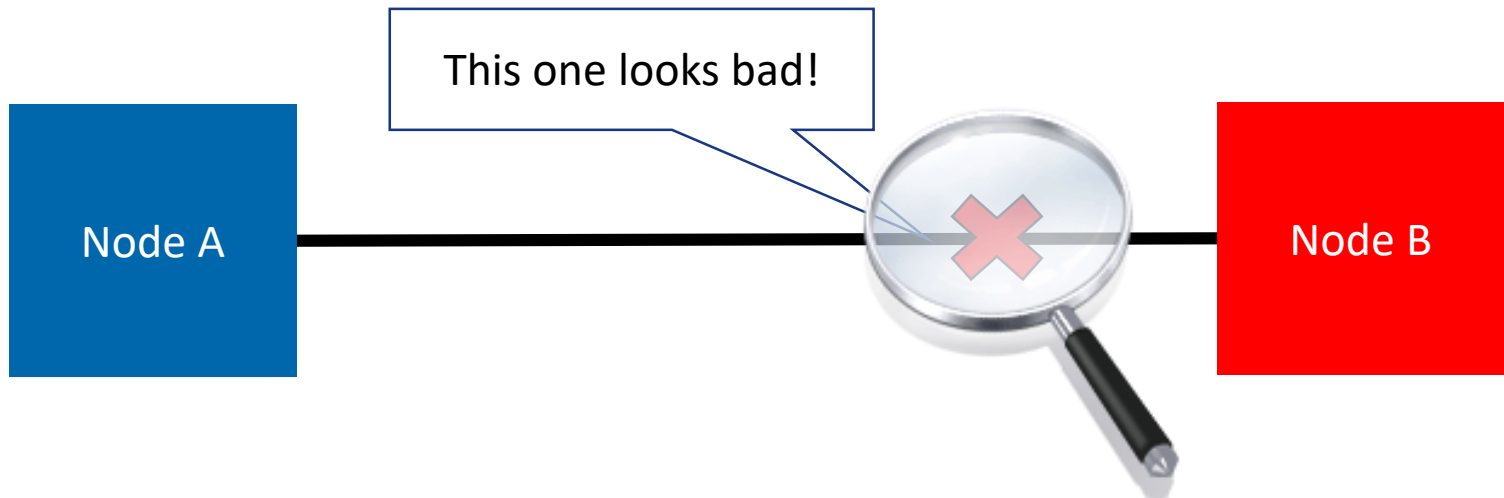
Model Exam Question

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]