System Design basics

IB Computer Science
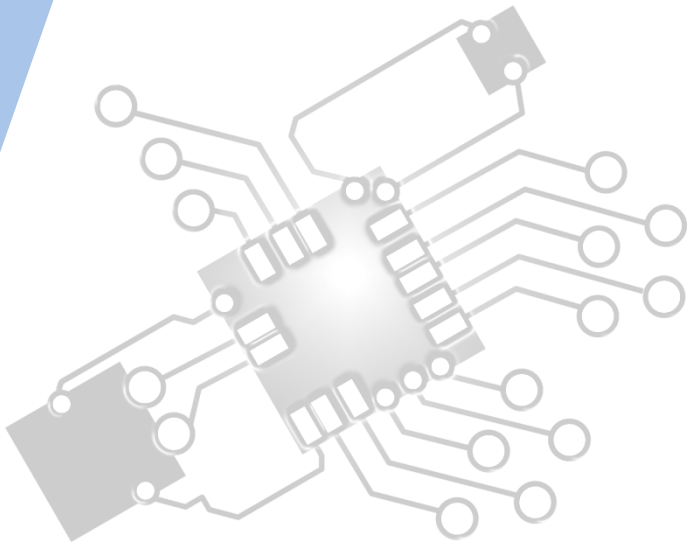
HL Topics 1-7, D1-4
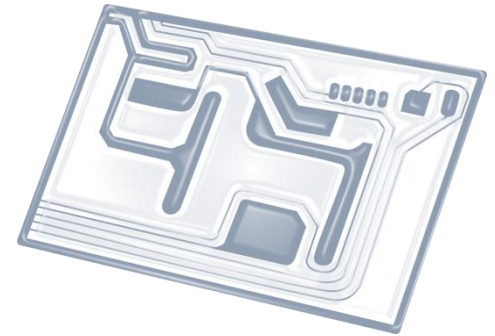
1: System design

2: Computer Organisation

3: Networks

4: Computational thinking

5: Abstract data structures

6: Resource management

7: Control

D: OOP

HL & SL 1.2 Overview

Components of a computer system

1.2.1 Define the terms: hardware, software, peripheral, network, human resources

1.2.2 Describe the roles that a computer can take in a networked world

1.2.3 Discuss the social and ethical issues associated with a networked world

System design and analysis

1.2.4 Identify the relevant stakeholders when planning a new system

1.2.5 Describe methods of obtaining requirements from stakeholders

1.2.6 Describe appropriate techniques for gathering the information needed to arrive at a workable solution

1.2.7 Construct suitable representations to illustrate system requirements

1.2.8 Describe the purpose of prototypes to demonstrate the proposed system to the client

1.2.9 Discuss the importance of iteration during the design process

1.2.10 Explain the possible consequences of failing to involve the end-user in the design process

1.2.11 Discuss the social and ethical issues associated with the introduction of new IT systems

Human interaction with the system

1.2.12 Define the term usability

1.2.13 Identify a range of usability problems with commonly used digital devices

1.2.14 Identify methods that can be used to improve the accessibility of systems

1.2.15 Identify a range of usability problems that can occur in a system

1.2.16 Discuss the moral, ethical, social, economic and environmental implications of the interaction between humans and machines

1: System design

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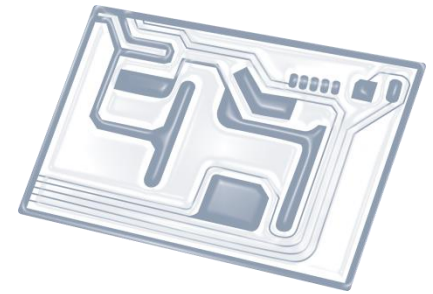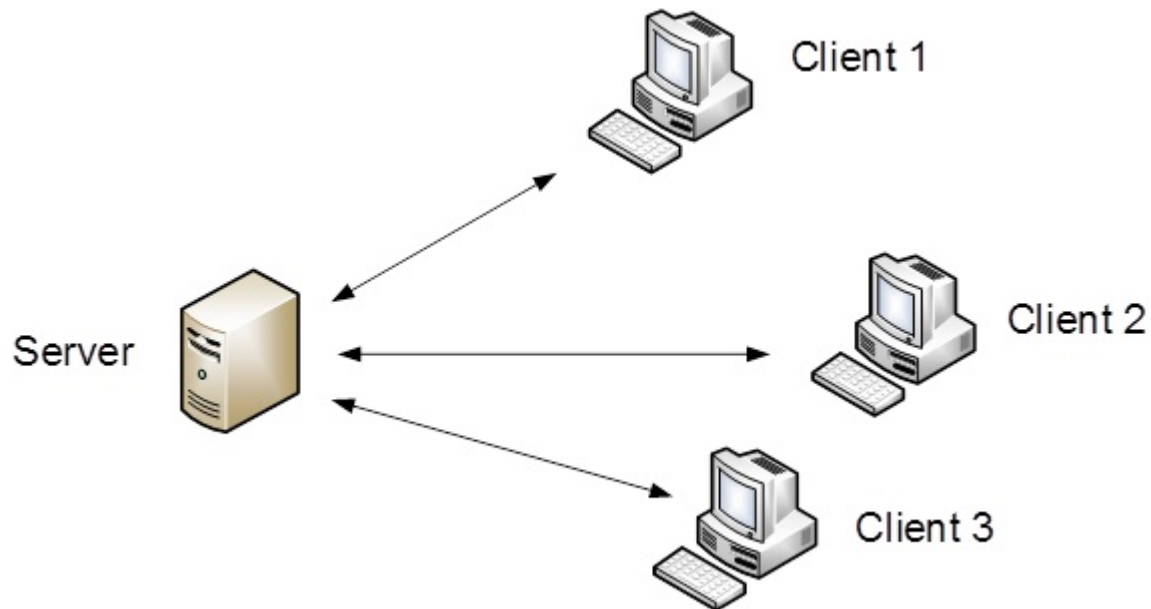5: Abstract data structures

6: Resource management
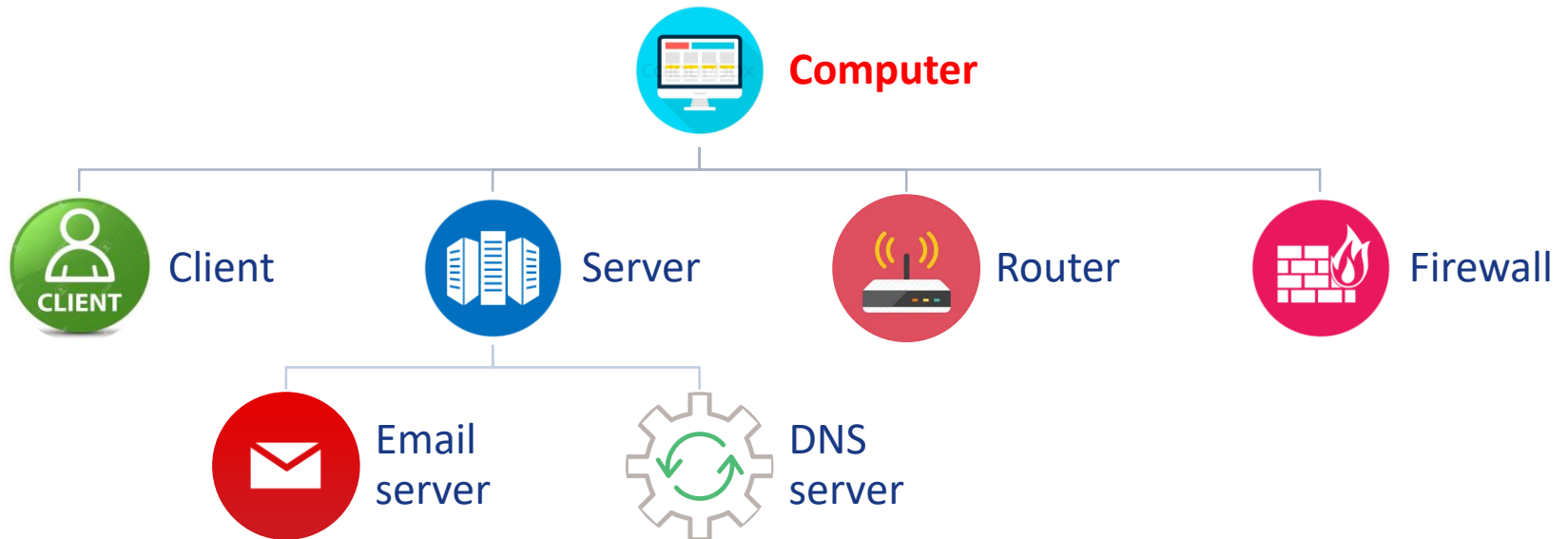
7: Control

D: OOP

Topic 1.2.2

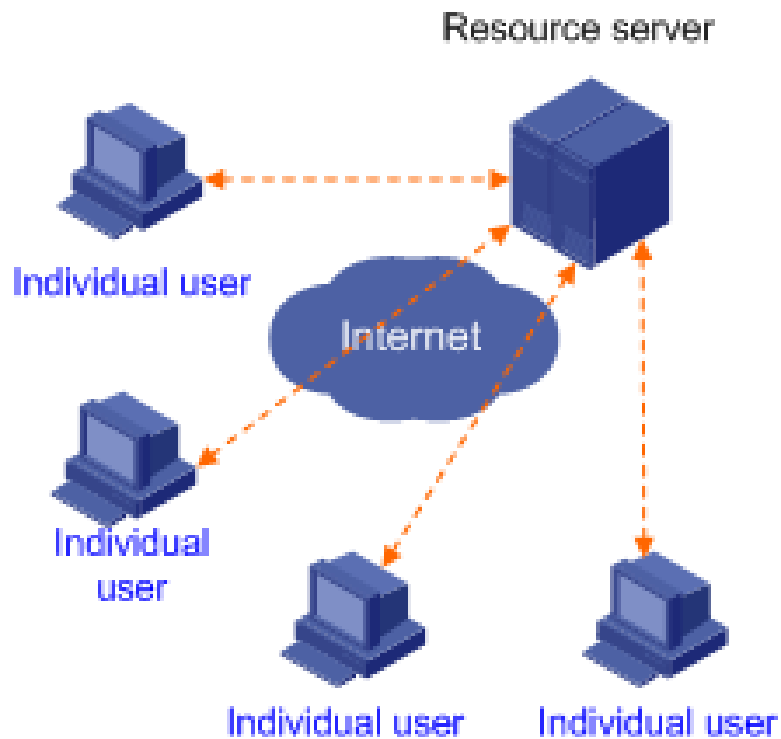Describe the **roles** that a **computer** can take in a **networked world**

1 computer = many possible roles

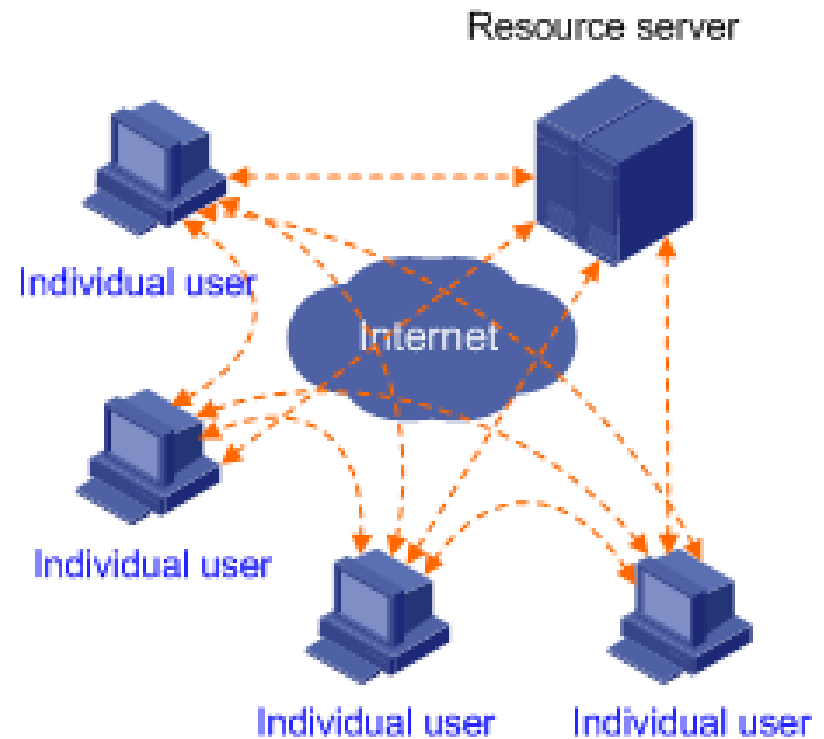Depending on what **software** is installed on a networked computer, it can do a variety of different tasks

Computer

Client

Server

Router

Firewall

Email server

DNS server

# Client/Server vs Peer-to-Peer (P2P)

Traditional traffic model

P2P traffic model

Client

- In the real world, businesses have clients.

- In the computer world, servers have **clients**.

- The "client-server" architecture is common in both local and wide area networks.

- For example, if an office has a server that stores the company's database on it, the **other computers** in the office that can access the database are "clients" of the server.
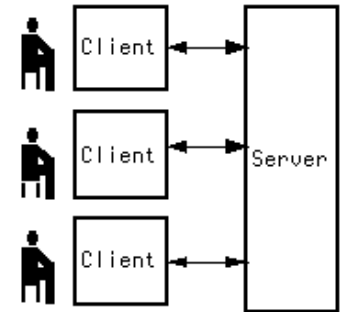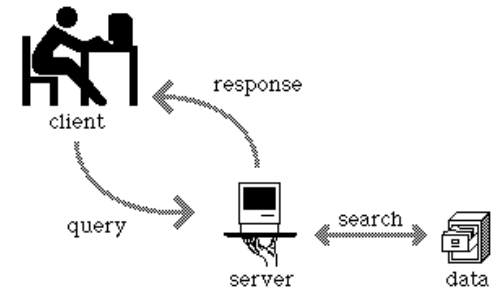
Server
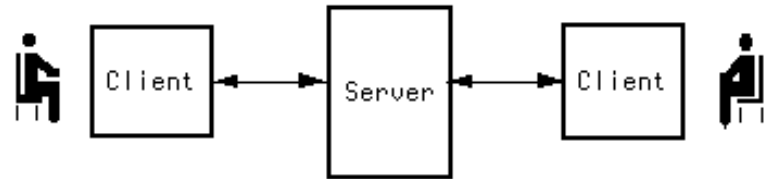
- A server is a computer that **provides data** to other computers.

- It may serve data to systems on a local area network (LAN) or a wide area network (WAN) over the Internet.

- Many types of servers exist, including web servers, mail servers, and file servers.

- Each type runs software specific to the purpose of the server.

- For example, a Web server may run Apache HTTP Server or Microsoft IIS, which both provide access to websites over the Internet.

- A mail server may run a program like Exim or iMail, which provides SMTP services for sending and receiving email.

- A file server might use Samba or the operating system's built-in file sharing services to share files over a network.

- While **server software is specific** to the type of server, the **hardware is not as important**. In fact, a regular desktop computers can be turned into a server by adding the appropriate software.

Client-Server Model

- The client-server model describes how a server provides resources and services to one or more clients.

- Examples of servers include web servers, mail servers, and file servers.

- Each of these servers provide resources to client devices, such as desktop computers, laptops, tablets, and smartphones.

- Most servers have a one-to-many relationship with clients, meaning a single server can provide resources to multiple clients at one time.

- When a client requests a connection to a server, the server can either accept or reject the connection.

- If the connection is accepted, the server establishes and maintains a connection with the client over a specific protocol.

Router

- A router is a hardware device that **routes** data (hence the name) from a local area network (LAN) to **another network** connection.

- It can be a separate hardware device or software loaded onto a server.
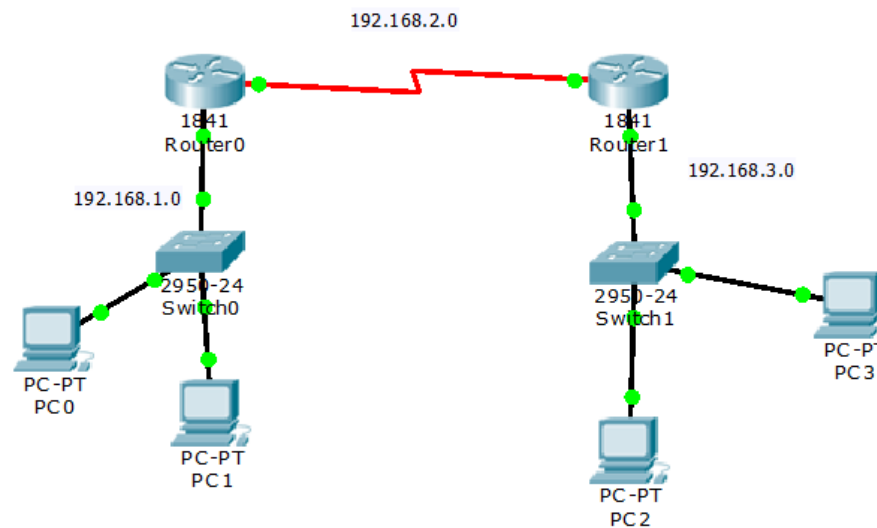
DNS server

- Stands for **Domain Name System** server

- Domain names serve as memorisable names for websites and other services on the Internet.

- However, computers access Internet devices by their IP addresses, not domain names (also called web addresses).

- DNS **translates** domain names into IP addresses, allowing you to access an Internet location by its domain name.
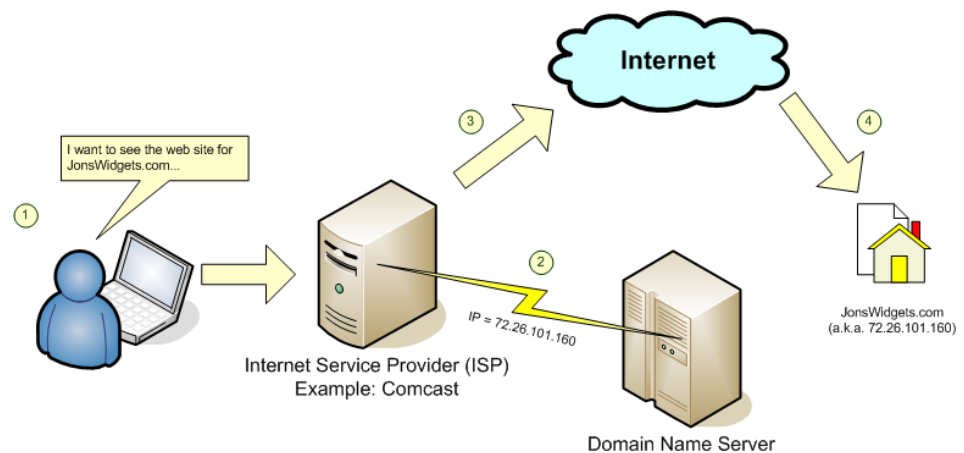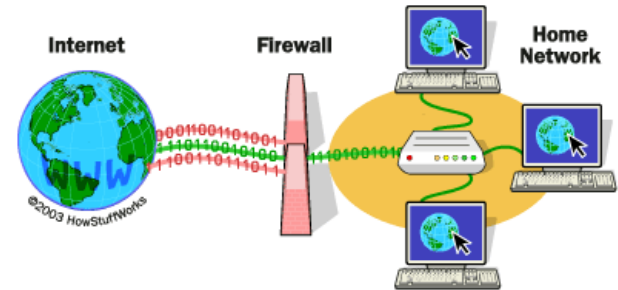
How DNS works: Video link
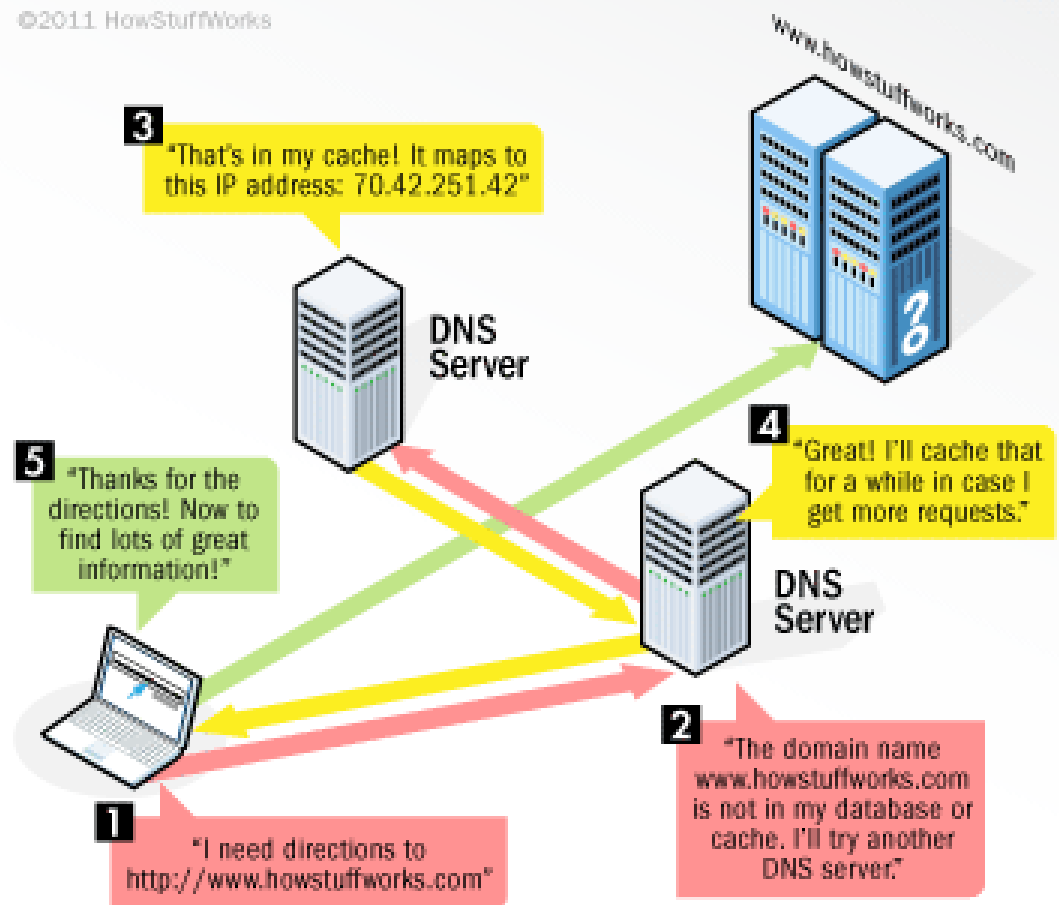
Firewall

- A physical firewall is a wall made of brick, steel, or other inflammable material that prevents the spread of a fire in a building.

- In computing, a firewall acts as a **barrier** between a trusted system or network and outside connections, such as the Internet.

- However, a computer firewall is more of a **filter** than a wall, allowing trusted data to flow through it.

- A firewall can be created using **either hardware** or **software**.