Computer Systems

Keywords

1.1 SYSTEMS ARCHITECTURE

CPU

The CPU carries out processing on the computer, it does this by fetching and executing instructions

ARITHMETIC LOGIC UNIT

Simple arithmetic operations

Logic (comparison) instructions

CONTROL UNIT

Provides timing signals
Provides control signals
Sends signals to memory // ALU // I/O devices

CACHE

Purpose is to store the most frequently accessed instructions and data needed by the processor

REGISTERS

MAR, MDR, PC, ACC

The purpose of each register, what it stores (data or address)

VON NEUMANN

In von Neumann architecture, both the program and data are stored together in same memory. This uses the stored program concept.

MEMORY ADDRESS REGISTER

Stores a single address where the next data will be fetched from

MEMORY DATA REGISTER

Stores the data that has just been fetched from RAM//main memory.

PROGRAM COUNTER

Stores a single address of the next instruction to be run
Is incremented each time an instruction is run

ACCUMULATOR

Stores the result of arithmetic operations/ calculations

CHARACTERISTICS AFFECTING PERFORMANCE:

CLOCK SPEED

CACHE SIZE

NUMBER OF CORES

EMBEDDED SYSTEMS

Limited functions, often built into a larger machine.

Purpose? Examples?

1.2 MEMORY

RAM

Stores currently running data **and** instructions

ROM

Read only memory, stores BIOS

VIRTUAL MEMORY

1.2 STORAGE

SECONDARY STORAGE

OPTICAL STORAGE

MAGNETIC STORAGE

S OLID STATE STORAGE

FLASH MEMORY

CHARACTERISTICS AFFECTING CHOICE:

CAPACITY

SPEED

PORTABILTY

DURABILITY

RELIABILITY

COST

UNITS OF DATA STORAGE:

UNITS: BIT, NIBBLE, B, KB, MB, GB, TB, PB

BIT

0 or 1

NIBBLE

4 bits

B

8 bits

KB

1000 Bytes

MB

1000 KiloBytes

GB

1000 Megabytes

TB

1000 Gigabytes

PB

1000 Terabytes

BIT
NIBBLE
B
KB
MB
GB
TB
PB

DATA CAPACITY & CALCULATIONS

DATA STORAGE:

DENARY NUMBERS

e.g. 55, 67, 10 etc

8 BIT

BINARY

NUMBERS

128   64   32   16   8   4   2   1

ADDING 8 BIT BINARY NUMBERS

OVERFLOW

When a calculation produces a result that is greater than the computer can deal with or store.

BINARY SHIFTS

Right shift = Divide
Left shift = Multiplication

HEXADECIMAL NUMBERS

Base 16:

0 1 2 3 4 5 6 7 8 9 A B C D E F

CHECK DIGITS

A digit added to a string digits which is used to check if all the digits have been entered and read correctly.

BINARY CODES AS CHARACTERS

CHARACTER SET

Letters, numbers, symbols being represented from binary form.

ASCII AND UNICODE

ASCII = 8bit   Unicode=16bits

IMAGES AS PIXELS IN BINARY

METADATA

Resolutions, Colour depth, location data, date/time etc.

COLOUR DEPTH AND RESOLUTION

SOUND SAMPLED IN DIGITAL FORM

SAMPLING INTERVALS

SAMPLE SIZE, BIT RATE AND SAMPLING FREQUENCY

NEED FOR COMPRESSION

Process for making a file size smaller.

TYPES OF COMPRESSION:

LOSSY

e.g.

LOSSLESS

e.g.

1.4 COMPUTER NETWORKS, CONNECTIONS & PROTOCOLS

NETWORK

LOCAL AREA NETWORK

WIDE AREA NETWORK

CLIENT-SERVER NETWORK

PEER-TO-PEER NETWORK

STAND-ALONE COMPUTERS

HARDWARE

Wireless access point (WAP)
Routers
Switches
NIC
Transmission media

WIRELESS ACCESS POINTS

WIFI FREQUENCY AND CHANNELS

Frequency: The rate at which the signal changes per unit of time measured in GHz
Channel: is the range of frequencies that will transmit data. Two devices using the same / overlapping channels will be subject to interference. Choice of channel allows users to reduce / minimise interference from other devices.

ROUTERS/ SWITCHES

NETWORK INTERFACE CARD

TRANSMISSION MEDIA

Ethernet (Cat 5e / Cat6) – Twisted-pair
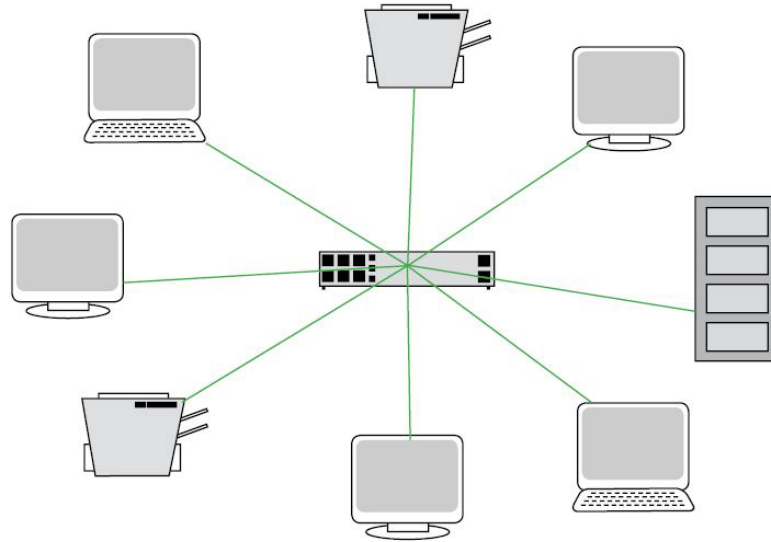Fibre optic
Coaxial Cable

THE INTERNET

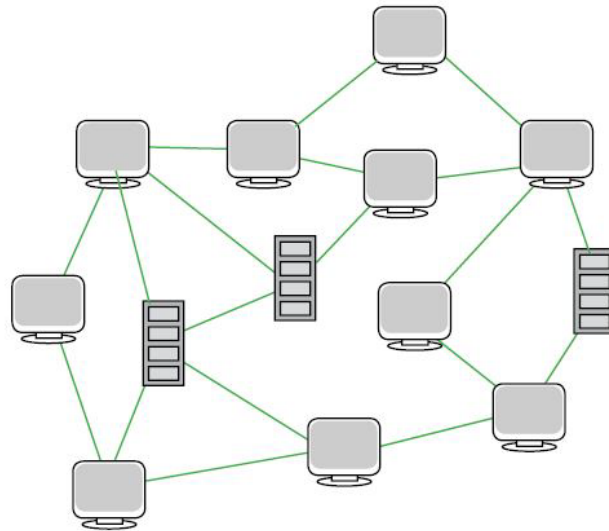# DOMAIN NAME SERVER (DNS)

HOSTING

THE CLOUD

WEB SERVERS AND CLIENTS

STAR TOPOLOGY

MESH TOPOLOGY

ETHERNET

Ethernet is a protocol
… within the TCP/IP stack
… it governs the connection of devices within the office
… that governs the transmission of data between devices in the office
… uses cables to transmit data between devices in a LAN

WI-FI & BLUETOOTH

ENCRYPTION

IP & MAC ADDRESSING

STANDARDS

PROTOCOLS:

TRANSMISSION CONTROL PROTOCOL (TCP/IP)

HYPER TEXT TRANSFER PROTOCOL (HTTP)

HYPER TEXT TRANSFER PROTOCOL SECURE (HTTPS)

FILE TRANSFER PROTOCOL (FTP)

POST OFFICE PROTOCOL (POP)

INTERNET MESSAGE ACCESS PROTOCOL (IMAP)

SIMPLE MAIL TRANSFER PROTOCOL (SMTP)

LAYERS:

APPLICATION

TRANSPORT

INTERNET

DATA LINK

1.4 NETWORK SECURITY

FORMS OF ATTACK

POOR NETWORK POLICY

MALWARE

Piece of software that replicates itself and causes damage e.g. editing/deleting files.

SOCIAL ENGINEERING

People are the 'weak point' in secure systems

PHISHING

An e-mail has a link that when clicked directs the user to a fake website that collects personal data.

BRUTE FORCE ATTACKS

Person/software using every combination of passwords to gain access.

DENIAL OF SERVICE ATTACKS

Flooding a website with more data requests than the web server can handle which will eventually bring the website down.

DATA INTERCEPTION AND THEFT

Data sent to another device and is intercepted by a third party/hacker.

SQL INJECTION

Using specific programming commands/code in order to gain access to a database for malicious purposes.

IDENTIFYING AND PREVENTING VUNERABILITIES

PENETRATION TESTING

ANTI-MALWARE SOFTWARE

FIREWALLS

USER ACCESS LEVELS

PASSWORDS

ENCRYPTION

PHYSICAL SECURITY

1.5 SYSTEM SOFTWARE

THE FUNCTIONALITY OF OPERATING SYSTEMS

USER INTERFACE

MEMORY MANAGEMENT/ MULTITASKING

PERIPHERAL MANAGEMENT AND DRIVERS

USER MANAGEMENT

FILE MANAGEMENT

UTILITY SYSTEM SOFTWARE:

ENCRYPTION SOFTWARE

DEFRAGMENTATION

DATA COMPRESSION

1.6 ETHICAL, LEGAL, CULTURAL & ENVIRONMENTAL IMPACT

IMPACTS OF DIGITAL TECHNOLOGY ON WIDER SOCIETY:

ETHICAL ISSUES

LEGAL ISSUES

CULTURAL ISSUES

ENVIRONMENTAL ISSUES

PRIVACY ISSUES

STAKEHOLDERS AFFECTED BY TECHNOLOGY

LEGISLATION RELEVANT TO COMPUTER SCIENCE:

DATA PROTECTION ACT 2018

COMPUTER MISUSE ACT 1990

COPYRIGHT DESIGNS AND PATENTS ACT 1998

OPEN SOURCE VS PROPRIETARY SOFTWARE