

Definitions and Concepts for AQA Computer Science A-level

Topic 9: Fundamentals of Communication and Networking

9.1 Communication

9.1.1 Communication Methods

Asynchronous Transmission: The transmission of data intermittently between devices without the use of an external clock signal.

Parallel Transmission: The transmission of data through multiple channels allowing for several bits to be transmitted at a time.

Serial Transmission: The transmission of data through a single channel a single bit at a time.

Start Bit: The bit used to indicate the beginning of a unit of data in asynchronous transmission.

Stop Bit: The bit used to indicate the end of a unit of data in asynchronous transmission.

Synchronous Transmission: The transmission of data as a continuous between devices whose time signals are synchronised via a common clock.

9.1.2 Communication Basics

Bandwidth: The range of frequencies at which data can be transmitted through a channel, measured in Hertz.

Baud Rate: The number of symbol changes, waveform changes, or signaling events across a channel per unit time.

Bit Rate: The number of bits transmitted per unit time.

Latency: The time delay between the transmitter sending the data and the recipient receiving the data.

Protocol: A common set of rules followed during data transmission over a network to minimise inconsistencies.

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9.2 Networking

9.2.1 Network Topology

Logical Bus Topology: A network arrangement where every host computer is connected to a single main data cable.

Physical Star Topology: A network arrangement where every host computer has a dedicated connection to a central hub computer or switch.

9.2.2 Types of Networking between Hosts

Client-Server Network: A type of network organisation where networked computers (clients) connect to one or more powerful central computers (servers) that handles service requests and has resources.

Peer-to-Peer Network: A type of network organisation where networked computers are connected to each other with equal status and share resources and workloads without any central server.

9.2.3 Wireless Networking

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA): A wireless protocol where computers attempt to avoid interference or collision in the channel by transmitting data only after the channel is sensed to be idle.

Media Access Control Address (MAC): A hardware identification number assigned to network interface cards used to uniquely identify a device on a network for communication purposes.

Request to Send/ Clear to Send (RTS/CTS): A protocol to prevent data collision during transmission on a wireless network, involving the transmitter sending a RTS to the receiver, and the receiver sending a CTS back to confirm it is idle.

Service Set Identifier (SSID): A local 32 character identifier for a group of wireless network devices, used to identify the network as a whole.

Wi-Fi: A wireless local area network that is based on international standards. †

Wi-Fi Protected Access (WPA/WPA2): A security certification program that secures wireless networks by encrypting transmitted data.

Wireless Network Adapter: A physical device that allows a computer system to connect to a wireless network.

Wireless Network Adapter: A physical device that creates a wireless local area network that



allows multiple devices to connect to a wired network.

9.3 The Internet

9.3.1 The Internet and How it Works

Domain Name: The name that locates a domain on the internet. It is included as part of a URL.

Domain Name Server (DNS) System: A hierarchical and decentralized naming system for computer systems connected to the Internet. It contains the IP addresses of all domain names on the internet.

Fully Qualified Domain Name (FQDN): A domain name specifying the exact location of a domain in the Domain Name Server System hierarchy.

Gateway: A device that allows data to flow from one network to another.

Internet: A global network of computer systems communicating using TCP/IP.

Internet Registries: Organisations responsible for the allocation and distribution of domain names and IP addresses.

IP Address: A numerical address assigned to any device communicating via Internet Protocol on a network that identifies its host and addresses its location.

Packet: A block of data.

Packet Switching: A method for sending data over a network by breaking data into several data packets which are sent independently and then reassembled once they all reach their destination.

Routers: A device used to direct packets being transmitted between networks.

Uniform Resource Locator (URL): A reference to a resource on the internet that is able to locate and retrieve it.

9.3.2 Internet Security

Firewalls: A security checkpoint application that monitors incoming and outgoing network traffic, designed to prevent external users from gaining unauthorised access between two networks.

Asymmetric Encryption: An encryption technique where a public key available to everyone is used to encrypt the data, and the data is decrypted by the paired private key known only by the recipient.



Symmetric Encryption: An encryption technique where the same key is used to encrypt and decrypt data. A copy of the key must be transferred between both parties.

Digital Certificate: An electronic document proving ownership of a public key and hence authenticating your identity.

Digital Signature: A mathematical scheme for producing a unique signature, that verifies the authenticity of encrypted digital messages.

Trojan: A malware that hides within another file and misleads the user of its true intent.

Virus: A program that attaches itself to another computer file to infect a computer system by replicating itself and inserting its code into other files.

Worm: A standalone virus capable of spreading and infecting a computer without being attached to a file.

9.4 The Transmission Control Protocol/Internet Protocol (TCP/IP) Protocol

9.4.1 TCP/IP

Ports: A communication endpoint that addresses a service on a network. It is used to represent services or applications.

Sockets: A software that serves as an endpoint for sending and receiving data across a network.

Transmission Control Protocol / Internet Protocol (TCP/IP) Stack: A suite of networking protocols that allow networked computers to communicate, consisting of 4 connected layers. Incoming and outgoing data packets are passed through these layers.

9.4.2 Standard Application Layer Protocols

Email Server: A computer system on a network designated to handle emails being sent and received by other computers on the network.

File Transfer Protocol (FTP): A protocol used for downloading or uploading files from a computer system.

Hyper Text Transfer Protocol (HTTP): A protocol used to fetch, render and transmit webpages.

Hyper Text Transfer Protocol Secure (HTTPS): An encrypted version of HTTP.

Post Office Protocol version 3 (POP3): An application-layer internet standard protocol



protocol used to receive emails from a server.

Secure Shell (SSH): A cryptographic network protocol for secure remote access to computers.

Simple Mail Transfer Protocol (SMTP): an internet standard communication protocol for sending emails.

Web Browser: An application software used to view webpages a computer system had requested from a web server.

Web Server: A computer system on a network designated to handle web requests through HTTP(S).

9.4.3 IP Address Structure

Host Identifier: A series of bits that form part of the IP address that uniquely identify the computer on the network it is in.

Network Identifier: A series of bits that form part of the IP address and identify the network the computer connected to the internet is on.

9.4.4 Subnet Masking

Subnets: A smaller network that forms a subset of a whole network.

9.4.6 Public and Private IP Addresses

Non-Routable IP Address: A private IP address used for a device on a private network hidden behind a router or firewall.

Routable IP Address: A public IP address that is registered under the DNS.

9.4.7 Dynamic Host Configuration Protocol (DHCP)

Dynamic Host Configuration Protocol (DHCP): A protocol for allocating unique dynamic IP addresses for computers on a local network when the local network attempts to connect to the internet.

9.4.8 Network Address Translation (NAT)

Network Address Translation (NAT): The process of mapping a private IP address to a public IP address by modifying address information in the packet header when the packet is sent through the router.



9.4.9 Port Forwarding

Port Forwarding: The process of routing data through additional ports to allow a server in a non-routable network to provide services to the internet.

9.4.10 Client Server Model

Client Server Model: A model where the client sends a request message to the server, and the server responds to the request by replying with a response message to the client. †

CRUD Applications: A web application with create, retrieve, update and delete functionality.

Extension Markup Language (XML): A markup language for encoding documents to be sent over a network in a human-readable and machine-readable format.

JavaScript Object Notation (JSON): A human-readable file format used for transmitting information in attribute-value pairs and arrays.

REST: A representational state transfer methodology used to map a network's functionality to database operations.

Web Socket Protocol: A protocol specification which defines an API (Application Programming Interface) establishing a full-duplex 'socket' connection between a web browser and a server over TCP. This creates a persistent connection between client and server. †

9.4.11 Thin- Versus Thick-Client Computing

Thick Client Computing: A network where the clients have sufficient processing power and storage to handle its requests, while the server acts as external storage.

Thin Client Computing: A network where a powerful, central server computer, contains the majority of the processing power and storage capacity to handle client requests.

Definitions with a '†' taken from [AQA AS and A-level Computer Science specification version 1.5](#)

