

FACTFILE: GCE DIGITAL TECHNOLOGY

UNIT A2 1: INFORMATION SYSTEMS



Network Resources

Learning Outcomes

Students should be able to:

- Describe networks by their scope: local area network (LAN), metropolitan area network (MAN) and wide area network (WAN);
- Describe the purpose of the network resources: network card, server, switched hub, repeater, wireless access point, media converter, IP address and media access control (MAC) address;
- Define the purpose of an IP address and a MAC address;
- Describe the features of a peer-to-peer (P2P) and server-based networks;
- Evaluate the bus, star and ring network topologies;

Content in Network Resources

- The scope of computer networks.
- Network Resources
- Client Server Network
- Peer to Peer Network (P2P)
- Network Topologies

The scope of computer networks

A network consists of a number of computers (devices, nodes) linked together by cable or by wireless technology. Computers on a network can share resources (hardware, software and data) and can communicate with each other.

Networks can be classified as LANs (Local Area Networks), WANs (Wide Area Networks) or MANs (Metropolitan Area Networks). They differ in their scale, method of connection and purpose.

A LAN is spread over a relatively small geographical area such as a single building or a cluster of buildings, all close together belonging to a particular organisation. The devices on a LAN are close enough together to be connected physically by wire cables or wirelessly.

A WAN is spread over a very large geographical area, typically on a global scale, and requires telecommunications links provided by public

telephone systems, underwater cables or communication satellites. WANs are typically used by organisations which are national or global in scale.

A MAN is spread over a highly populated area such as a city or large town. A MAN provides services for the people within the area it covers, rather than for a particular organisation, using fibre optic cable or wirelessly.

Network Resources

Server

A server is a computer on a network responsible for managing and sharing resources. There are different types of servers. For example, a file server is responsible for managing the storing and sharing of user files while a print server is responsible for managing one or more printers on the network.

Network Card or Network Interface Card (NIC)

A network interface card is an electronic device which enables a computer to connect with the file server and to share data with other computers on the network. Nowadays most computers have a network interface built directly into the motherboard. Today, most network cards use the Ethernet standard.

Switched Hub

A switched hub acts as a single connection point for the devices on a network by forwarding data packets to the appropriate destination using each packet's address. Most switching hubs also support load balancing, so that data packets are forwarded via different network segments based on traffic patterns.

Repeater

Repeaters are used in network transmission to regenerate or amplify signals which may be weakened or distorted particularly when transmitted over long distances.

Wireless Access Point (WAP)

A WAP is a hardware device that allows a wireless capable device (using Wi-Fi or Bluetooth, for example) to connect to a network using radio transmitters and antennae.

A WAP creates what is known as a hotspot. Hotspots can provide network connectivity in offices, for example, enabling employees to work anywhere in the office. They can also be used to provide access to the Internet in public places such as coffee shop.

Media Converter

A media converter is a device that makes it possible to connect together networks using dissimilar media such as copper cable and fibre optic cable.

IP Address

Any network device such as a personal computer, tablet or smart phone connected to a network must have a unique IP address within the network. The IP Address enables the device to identify itself and communicate with other devices in the network. IP addresses can be either static or dynamic. Static IP addresses are permanent. Dynamic IP addresses are temporary and are assigned each time a device connects to a network. They are assigned from a pool of IP addresses that are shared among the devices on the network.

An IP address consists of 32 bits formatted as 4 octets of numbers ranging from 0-255 in decimal form. For example, an IP address of a device could be 134.213.246.167

Media Access Control (MAC) address

A MAC address is allocated to a network interface card usually when it is manufactured. It is coded onto the computer's NIC and is unique to it. A MAC address consists of six two-digit hexadecimal numbers, separated by colons. For example, a network card may have a MAC address of 0a:1d:8f:b1:c0:8e.

One of the applications of MAC addresses is in the filtering process used on wireless networks to track network users, and to limit their access. The router can be set to accept only specific MAC addresses. On the other hand, if the IP address of a device changes, for example in the case of dynamic IP addresses, the MAC address can still identify the device.

Client Server Network

In a client server network, at least one computer acts as a server controlling file storage and backup, and providing application software and printer management. All other computers on the network are connected to the server via a switch or a hub.

To access the server users must log on to one of the client computers using a username and password. They will then have access to resources such as a dedicated data storage area, hardware resources such as printers, and application software.

Peer to Peer Network (P2P)

All the computers on a P2P network have equal status. A peer-to-peer network allows computer hardware and software to function without the need

for any dedicated server devices. Each computer on the network is defined as both a supplier and a consumer of resources. Computers make some of their resources such as processing power and disk storage available to other computers and in turn they can request a resource from another computer.

Network Topologies

Ring Network

A ring network consists of a number of nodes connected together without the need for a fileserver. Each node is connected to two other adjacent nodes. A special message called a token is passed from node to node. While a node has possession of the token it can add a message data to the network. This is passed from node to node until it arrives at its destination. All data travels in one direction only, therefore avoiding any potential collisions.

It is difficult adding new nodes to this network. To add a new node to the network an existing cable has to be severed and join to either end of the new node. A broken connection in the main cable will also cause the network to fail but in some cases it is possible to isolate a faulty node. If data travels large distances around the cable this can lead to problems with the data signal; it tends to degenerate and weaken. To overcome this repeaters are used which are known as special boosters

Bus Network

In this network all nodes are connected onto the main cable (known as the backbone). Data can be

transmitted in both directions on the main cable. At both ends of the main cable terminators are used. Every node can transfer data directly to any other node by sending it onto the main cable.

If one of the nodes is not functioning correctly the network can still operate. It is easier to add new nodes on this network compared to other topologies such as ring. The downside is the more nodes added to the backbone the slower the transmission speeds due to increased volumes of traffic.

Problems arise when more than one node wishes to send a message at the same time. This can lead to collisions. To avoid collisions a protocol known as CSMA/CD is used on a bus network. This involves each node checking whether or not the main cable is busy. If the main cable is busy then the terminal will wait. If a collision occurs the node will re-transmit the same message at a later time.

Star Network

In this type of network there is a central fileserver (host computer) and each node is connected to the fileserver by its own cable. The host computer controls all communication on the network such that if a node wishes to communicate with another node this must be done via the fileserver. If the fileserver malfunctions then the whole network fails

Using a star network has advantages. Because each node has its own connection to the hub there is no contention for pathways. Also if a node fails then the network can still operate as it only affects that node. Adding a new node is only a matter of connecting it to the hub if there is capacity.

