Network Protocols

Protocols

A **network protocol** is a set of rules which allows devices on a network to communicate.

Protocols have been agreed as **standard** ways in which data will be packaged together. This means that any device that knows the protocol can unpack data and give it meaning.

For example, a **data packet** will have a series of identifying data at the beginning – what type of data it is, where it has come from, where it is going etc… At the end of the data there will be some kind of end marker to let a device know that the data packet is finished. This sort of identifying information allows devices to manage data in the right way – otherwise it's just 1 and 0s.

Application Layer Protocols:

Web Protocols

HTTP – Hypertext Transfer Protocol: deals with the retrieval and display of web pages. Clicking a hyperlink sends a request from the **client** web browser to the **server** hosting the webpage for the data required to display the webpage. The idea of a **client-server relationship** is an important one.

HTTPS – as HTTP but adding an S for secure. Data is encrypted before being sent. Used for online banking or taking payments in an online shop.

File Transfer Protocol (FTP)

FTP – File Transfer Protocol: a standard network protocol used when transferring computer files between a client and a server on a network. Used when retrieving a document previously saved on a server and then saving changes to that document.
FTP is also used to upload web pages to a **web server**.

E-mail Protocols

IMAP – Internet Message Access Protocol: used by e-mail software (the client) to retrieve e-mail messages from a **mail server**. Allows the manipulation of messages – deleting messages, storing them in folders etc… – on the mail server.

SMTP – Simple Mail Transfer Protocol: allows e-mail messages to be sent between servers, allowing messages to be sent to someone using a different mail server.

For example, the teletype machines that first used ASCII code had headers and footers for each message. Today e-mail does the same thing.

Standards within computing set rules to deal with how data will be encoded – for example, JPEG or MP3 data. These are a similar idea to protocols

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E-mail works because of the internet – the network of connected computers and servers that provides the backbone for communication.

The World Wide Web (webpages) are another part of the internet. E-mail doesn't requires the Web to work and existed before web pages did.

Transport Layer Protocols

These protocols **set up the communication** between the two computers

TCP – Transmission Control Protocol: defines how data is broken into **packets** so that they can be transmitted to another device. Packets keep the amount of data being transferred at one go to a manageable amount.

Once data packets arrive, TCP also deals with reassembling the data in the right order and checking that there have been no errors – it can then ask for any missing or damaged data packets to be sent again.

UDP – User Datagram Protocol: a simpler way than TCP to organise the transmission of data packets (**datagrams**) across a network. Data is not checked as thoroughly and there is no ability for UDP systems to ask for data packets to be sent again. This makes it quicker, so UDP is used to systems such as **VOIP** (e.g. Skype) or online games.

Internet Layer Protocols

These address data packets so they can get to their destination

IP – Internet Protocol: identifies the location of a device on the internet (its **IP address**) and **addresses** data packets so that they can be **routed** from their source to their destination via **routers**.

IP addresses provide a numeric label for each device connected to a network. Originally these were 32-bit numbers (IPv4), but now use 128-bit numbers (IPv6).

Link Layer Protocol Families

The last two protocols are both **families** of protocols which are related to each other member of the family. The hardware is located on this layer.

Ethernet: a family of protocols which deal with the linking together of devices on a network (including a LAN or WAN as well as the internet). Data streams using Ethernet are broken into **frames** which contain source and destination and error checking data.

Wi-Fi: a family of protocols which set the rules for how devices can connect wirelessly to a network. For example, they specify the radio wavelengths that communications can occur on and that data is broken into frames in the say way as Ethernet does.

Wi-Fi is a **trademark** of the Wi-Fi Alliance, and although it is used to refer to any wireless network, the technical name for a wireless network is a **WLAN** (a Wireless LAN).

You'll need to do more work on how TCP and IP work together in the **TCP/IP model**.

VOIP is Voice Over Internet Protocol. It samples sound files to transfer data.

IP addresses can change when a device disconnects from a network

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Ethernet is a really important family of protocols within any network.

Frames are similar to data packets

The fact that Wi-Fi is a trademark is specifically mentioned as something you need to know in the syllabus

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Activity 1:
a) Define the term network protocol (2 marks)
b) Explain why data is normally broken down into packets or frames before it is transferred.
c) Why do you think UDP is used rather than TCP to deal with VOIP in online games?
d) Suggest why IPv6 saw the number of bits used to identify an IP address increase so much
e) Give the meaning of the term **WLAN**.