The TCP/IP Model

The whole point about networks is that they let computers communicate with each other – whether that's sharing files, sending e-mail or accessing web pages.

To communicate, computers need to use **protocols**.

By communicating, we mean sending data to somewhere else on a network. That could be a LAN network, a Bluetooth PAN or across the internet (a WAN). It's sometimes easiest to think about sending data across the internet.

The way that computers use protocols is defined by the **TCP/IP model**.

You need to know the 8 protocols and 2 protocol families and what they do.

The **TCP/IP** model is a set of **four layers** of protocols. You need to know:

- the names of the layers
- the order the layers go in
- which layer each protocol goes in
- what each layer does
- how the layers work together to organise communication

The TCP/IP Layers:

The order of the layers in the stack is important. You can remember this using **ATIL**.

The model has 4 layers. These are organised as a **stack** that can be worked through in order.

Each layer deals with a different stage in the process of sending data to and from a network. In general we start at the top of the stack and work down.

1. Application layer:

This is where the protocols that work in the applications (software) that users operate appear. This includes e-mail software and web browsers.

The protocols operating in this layer are:

- **HTTP, HTTPS** - in web browsers
- **SMTP, IMAP** - in e-mail software
- **FTP** - in file management software (such as documents folders or file transfer software used to push website pages to and from a server)

FTP stands for File Transfer Protocol.

2. Transport layer:

Data packets are small files of data. A message, file or request may be made up of more than one packet.

This layer **sets up the communication** between the sending and the receiving computers or servers. It agrees settings such as the type of file, the encoding language used and the size of data packets that will be sent.

It's important to get the idea that this layer is about **agreeing stuff** - not actually doing it. It makes sure that both computers know what to expect so that when data is sent the receiving computer knows what to do with it.

Remember, **UDP** doesn't have as many features such as error checking. It's used for faster communication, such as VOIP or in-game chat.

The protocols operating in this layer are:

- **TCP, UDP** - both of which set things up

3. Internet layer - sometimes called the Network layer:

This layer actually **sets up the network addresses for data** and **creates data packets** for sending. This is that stuff that the Transport layer agreed on. This allows data packets to be routed across the network.

The protocol that operates in this layer is:

- **IP**

The Internet layer is sometimes called the **Network layer**. Not every network is connected to the internet.

4. Link layer:

This is where **network hardware** such as the network interface card or wi-fi card are located. This includes operating system device drivers - the software that allows these cards to work. These allow the computer to actually connect to the network to send or receive data.

The network families which operate in this layer are:

- **Ethernet, Wi-Fi** - remember, these are families of protocols rather than protocols themselves. Ethernet allows the LAN cable in a machine to actually work.

ATIL is the way to remember the layers in order.

Application layer
Transport layer
Internet layer (network layer)
Link layer

The TCP/IP stack is simple enough to learn, but the way it actually works might come up in an exam question. This is the tricky bit…

How the TCP/IP Model works:

A user opens their web browser and types in a web address. The browser uses HTTP or HTTPS to manage the address so that it knows what to do with it. This happens in the **Application layer**.

The TCP/IP model works to get data from the **client** (your computer) to a **server** and back again. It works both ways.

The request is then passed to the **Transport layer**. TCP sets up the communication between the user's computer (the client) and the web server where the website lives. This sets the rules for the data packets required to send the request and arranges how the data packets will be sent back from the web server.

The request then goes to the **Internet layer**. This actually addresses the data packets and splits them up ready to be transmitted. IP does this.

Error checking is done by **TCP** in the **Transport layer**. It checks that all the data packets have been received and sends a request for them if one hasn't arrived.

The request is moved to the **Link layer**. This sends them to the network using either Ethernet or Wi-Fi.

The web server then receives the data and follows the process in reverse, moving **up** the stack - unpacking it and checking it for errors. It can then respond, providing the data o display the webpage in the client's web browser. This follows the same process down the stack.

Activities:

a) Create a table with the names of the layers, the protocols which operate in them and what each layer is responsible for

b) What is the alternative name for the Internet layer?

c) Explain the difference between the jobs done by the **Transport layer** and the **Internet layer**

d) Explain what the terms **client** and **server** mean in the context of the TCP/IP stack

e) Describe the processes the TCP/IP model will use when a user sends an e-mail. Specify which protocols will operate in which layers in your answer