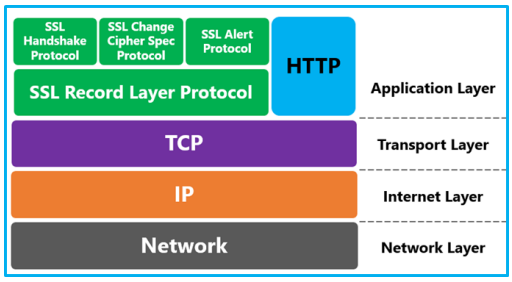
TOPIC: Fundamentals of computer networks: 4 Layer TCP/IP Model

LEARNING OBJECTIVES:

- **1: Application layer**
- **2: Transport layer**
- **3: Network layer**
- **4: Data link layer**

	Teacher Activity	Pupil Activity
Starter activity (5-10 mins) [individual/ paired or group]	**What does TCP / IP stand for?** *Transmission Control Protocol /* *Internet Protocol* ***TCP/IP** stands for **Transmission Control Protocol/Internet Protocol**, which is a set of networking protocols that allows two or more computers to communicate.* *There are 4 layers and students should be able to name the layers and describe their main function(s) in a networking environment.*	Discuss (individual/paired or group) What does TCP / IP stand for?

***Main activity** one* *(15 mins)*	***1: Application Layer:*** *The Application layer provides services for applications and to ensure ability to access the services of the other layers and defines the protocols that applications use to exchange data.* ***Most widely known application services are:*** • *File Transfer Protocol (FTP) is used for file transfer* • *Simple Mail Transfer Protocol (SMTP) the transfer of email* • *Domain Name System (DNS)* • *Web chat* • *Virtual Terminals* ***What is it used for?*** • *Makes sure that the other party is identified and can be reached* • *Authenticates either the message sender or receiver* • *Uses more than 15 protocols and interacts with the end user.*  ***2: Transport Layer*** *The Transport Layer provides the necessary functions to enable communication between software application processes on different computers; it acts as a liaison as sorts so they communicate using the same language. The transport layer provides a means by which applications can communicate with each other.* ***The Transport Layer encompasses two main protocol TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).*** ***TCP** – Establishes a connection via the three way handshake and is connection orientated. It is used for file transfer because when the connection breaks it will stop sending the file as you don't want any of the file missing.* ***UDP** – Is a connectionless transmission protocol that is used heavily in things such as VoIP (Voice Over IP) as when you are talking to someone you would rather have breaks in voice than everyone's voice coming through at the same time due to connection issues.*	Discuss (individual/paired or group) **Practical Activity** Demonstrate the TCP 3 way handshake when communicating by getting a student to request to speak to another, then the second student saying they acknowledge the request, and then finally the first student acknowledging the acknowledgment before they can being a proper conversation. This can reinforce their knowledge of the layer.

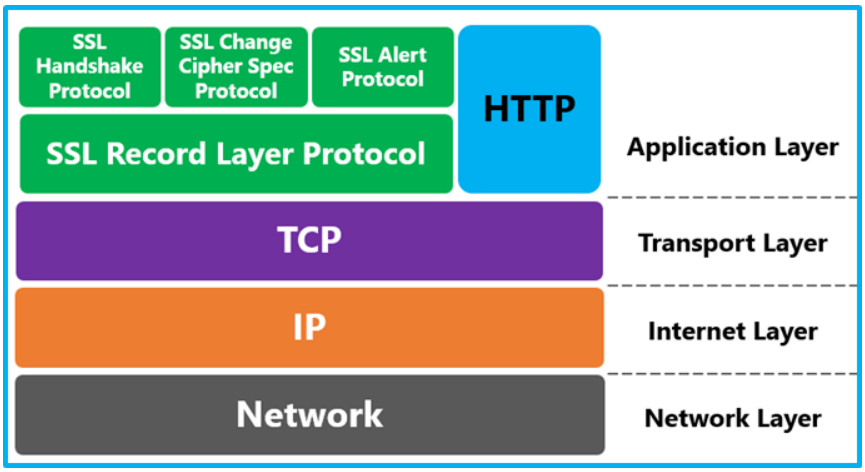
	Advantages *N/A* *Disadvantages* *N/A* *Who uses it?* *Anyone who uses devices within a network and sends data will use the transport layer as it will always been needed to establish efficient transportation of the data.*	

Plenary one (5-10 mins)	*Assess learning against the learning objectives* *This is an open activity whereby the teacher will decide on the best approach to do this based on the pedagogical approach your school takes on assessment.*	**For example:** • 5 minute timed writing exercise on what has been learned so far • Fill in class notes • Have a discussion • Answer open questions • Answer directed questions On: Application layer and transport layer

Main activity two (15 mins)	***3 Network Layer:*** ***The Network Layer (also known as the Internet Layer) is the third lowest layer of the TCP/IP model.*** *It specifies how to route data from hosts on one network to hosts on another network and contains several protocol families categorized based on functions they perform – Reliability, Establishing/Maintaining, Routing.* ***These protocols include IP, IGMP, ICMP, ARP, RIP*** *The internet layer has three basic functions:* • *For outgoing packets, select the next-hop host (gateway) and transmit the packet to this host by passing it to the appropriate link layer implementation.* • *For incoming packets, capture packets and pass the packet payload up to the appropriate transport layer protocol, if appropriate.* • *Provide error detection and diagnostic capability.* ***4 Data Link Layer*** *The Data Link Layer is the protocol layer that transfers data between networks (WAN or LAN). This is where the network hardware such as the NIC (network interface card) is located. OS device drivers also sit here.* *The Data Link Layer is the first layer of the TCP/IP model.* ***Three main functions of the Data Link Layer:*** • *Deal with transmission errors.* • *Regulate data flow* • *Provide a well-defined interface to the network layer.*	Discuss (individual/paired or group) Which protocols are included? What do these stand for? ***IP, IGMP, ICMP, ARP, RIP*** *Note down their meanings* *Name the three main functions of the Data Link Layer*
Plenary two (5-10 mins)	*Assess learning against the learning objectives* *This is an open activity whereby the teacher will decide on the best approach to do this based on the pedagogical approach your school takes on assessment.*	**For example:** • 5 minute timed writing exercise on what has been learned so far • Fill in class notes • Have a discussion • Answer open questions • Answer directed questions On: Network Layer and Data Link Layer

Homework (optional)	*Teacher choice based on homework policy of school.*	**For example:** Note down the main components of the 4 layer TCP/IP model

Key Terms: Fundamentals of computer networks: 4 Layer TCP/IP Model	
TCP/IP	**TCP/IP** stands for **Transmission Control Protocol/Internet Protocol**, which is a set of networking protocols that allows two or more computers to communicate. The Defense Data Network, part of the Department of Defense, developed **TCP/IP**, and it has been widely adopted as a networking standard

1 Application Layer	***Application layer:*** *this is where the network applications, such as web browsers or email programmes, operate.* The Application layer provides services for applications and to ensure ability to access the services of the other layers and defines the protocols that applications use to exchange data. **Most widely known application services are:** - File Transfer Protocol (FTP) is used for file transfer - Simple Mail Transfer Protocol (SMTP) the transfer of email - Domain Name System (DNS) - Web chat - Virtual Terminals **What is it used for?** Makes sure that the other party is identified and can be reached Authenticates either the message sender or receiver  Uses more than 15 protocols and interacts with the end user.

2 Transport Layer	***Transport layer:*** *this layer sets up the communication between the two hosts and they agree settings such as 'language' and size of packets.* The Transport Layer provides the necessary functions to enable communication between software application processes on different computers; it acts as a liaison as sorts so they communicate using the same language. The transport layer provides a means by which applications can communicate with each other. **The Transport Layer encompasses two main protocol TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).** **TCP** – Establishes a connection via the three way handshake and is connection orientated it is used for file transfer because when the connection breaks it will stop sending the file as you don't want any of the file missing. **UDP** – Is a connectionless transmission protocol that is used heavily in things such as VoIP (Voice Over IP) as when you are talking to someone you would rather have breaks in voice than every-one's voice coming through at the same time due to connection issues. **Advantages** N/A **Disadvantages** N/A **Who uses it?** Anyone who uses devices within a network and sends data will use the transport layer as it will always been needed to establish efficient transportation of the data.
3 **Network Layer**	***Network layer****: addresses and packages data for transmission. Routes the packets across the network.* **The Network Layer (also known as the Internet Layer) is the third lowest layer of the TCP/IP model.** It specifies how to route data from hosts on one network to hosts on another network and contains several protocol families categorized based on functions they perform – Reliability, Establishing/ Maintaining, Routing. These protocols include IP, IGMP, ICMP, ARP, RIP The internet layer has three basic functions: • For outgoing packets, select the next-hop host (gateway) and transmit the packet to this host by passing it to the appropriate link layer implementation. • For incoming packets, capture packets and pass the packet payload up to the appropriate transport layer protocol, if appropriate. • Provide error detection and diagnostic capability.

4 **Data Link Layer**	***Data link layer:*** *this is where the network hardware such as the NIC (network interface card) is located. OS device drivers also sit here.* The Data Link Layer is the protocol layer that transfers data between networks (WAN or LAN). This is where the network hardware such as the NIC (network interface card) is located. OS device drivers also sit here. The Data Link Layer is the first layer of the TCP/IP model. **Three main functions of the Data Link Layer:** • Deal with transmission errors. • Regulate data flow. • Provide a well-defined interface to the network layer.
	Teachers should be aware that the ***network layer*** *is sometimes referred to as the* ***internet layer*** *and that the* ***data link layer*** *is sometimes referred to as the* ***network interface layer****. However, students will not be expected to know these alternative layer names*