FACTFILE:
GCE DIGITAL TECHNOLOGY

UNIT A2 1: INFORMATION SYSTEMS

Rewarding Learning

Protocols 1

Learning Outcomes

Students should be able to:

- explain the need for communication protocols;
- describe the Open Systems Interconnection (OSI) network organisation model and each of its component layers

Content in Protocols 1

- The need for communication protocols.
- The Open Systems Interconnection (OSI) model.
- Different communication protocols, as listed above.

The need for communication protocols.

A communication protocol is a standard set of rules used to ensure that different network devices, possibly using different technologies, can send and receive data properly.

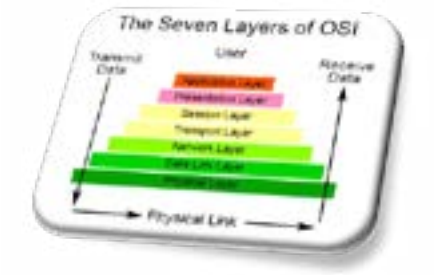
The rules formally defined by a communication protocol include message formats, authentication methods, error detection and correction methods, how data is split up into packets, and how data packets are sent and received.

The Open Systems Interconnection (OSI) model

The OSI Model provides a framework for data to be transferred between networked computers. The model works even if different data formats or different types of networks are communicating.

The core of this standard is the OSI Reference Model, a set of seven layers that define the different stages that data must go through to travel from one device to another over a network.

The OSI model was developed by the International Standards Organisation (ISO) as guidelines for developing standards. If a manufacturer's products obey these standards it will mean ease of connection to a device from another manufacturer. The OSI model is based on seven layers as shown below:



"All People Seem To Need Data Processing"

Benefits of OSI Model

Any hardware that meets the OSI standard will be able to communicate with any other hardware that also meets the standard; the same applies to software that meets the OSI standard – again, it will be able to communicate with any other hardware or software that also meets the standard.

Consumers are given a wider choice since hardware/software from any manufacturer will work together and as OSI is independent of country, it doesn't matter where the hardware/software is made.

OSI is not dependent on the operating system used and the protocols for OSI are defined at each stage. Other benefits include error handling in each layer and the different layers can operate automatically.

Basic rules in the OSI model

Application	**Application Set**
Presentation	
Session	
Transport	**Transport Set**
Network	
Data	
Physical	

Notice that the top three layers have been grouped together and are called the 'Application Set' and the bottom four layers are called the 'Transport set'.

The 'Application Set' is mainly concerned with controlling how the various applications currently running are making use of the network.

For example, you could be running 'Internet Explorer' to view web pages and at the same time be writing a report in 'Word' that is stored on the C2K file server. Both are making use of the network in different ways.

The 'Transport Set' is only concerned with passing information through the network – it does not care whether the information comes from the Internet Explorer application or the Word application currently running on the machine.

Each layer can only 'talk' to the one above it and below it e.g. The 'Network' layer can only pass information to the 'Transport' layer above it and the 'Data Link' layer below it.

Passing information from one layer to another is done in a standard way. This means that if company 'A' has written some software for the 'Transport' layer – and company 'B' has written some software for the 'Network' layer – then they are guaranteed to be able talk to each other.

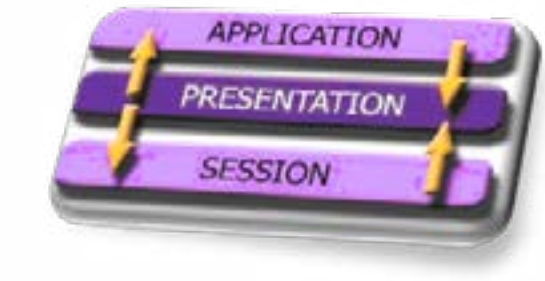
Application Layer

This is the top layer of the OSI model. The application layer is only concerned with presenting information in a human friendly way.

The OSI model is relevant to all kinds of devices, that use inbuilt computer processors, including mobile phones, iPods etc. The Application Layer receives its information from the 'Presentation' layer just below it.

Presentation Layer

This layer shares information with the Application layer above it and the Session layer beneath it.



Converting information
This layer is not concerned with 'presenting' information to a person, but rather 'presenting' information to the various electronic devices in the correct format. For example, it will send video information in the right format to the VDU or the correct audio information to the sound card.

Data Encryption
Another useful task for this layer is to implement encryption. For example, say the Application layer is running a shopping application and you have just pressed the 'Buy' button. The job of the Presentation layer is to scramble the credit card number you have supplied so that only the store itself can read the number.

Note that the Presentation layer on the shop computer will be responsible for 'unscrambling'

the data back into the correct credit card number (decryption). The presentation layer will encrypt \ decrypt information if required.

Data Compression
The presentation layer may compress \ decompress information.

Session Layer

The session layer shares information with the Presentation layer above it and the transport layer beneath it.

In the world of networking, a session begins when an application wants to make a connection to a remote server (WAN). The session layer opens a temporary 'channel' between the two to allow for communication. You can have more than one session running at the same time.

Transport Layer

The transport layer shares information with the Session layer above it and the Network layer beneath it:

It will divide the information into convenient sized packets – these packets will then be sent on different routes to their destination. The packets may arrive in a different order to which they were sent. The packets are then reassembled at the destination point into the order in which they were sent. This layer can also check for errors.

Network Layer

The Network layer shares information with the Transport layer above it and the Data Link layer beneath it.

The Network layer is the "traffic policeman" of the OSI model as it works out the best route for the packets to use.

Every packet that the Transport layer has created needs to be sent to the correct machine across the network.

Every computer has a unique address (IP address) allowing the network layer to add the correct address to each packet. It also reads the addresses of incoming packets to a computer and if they are destined for that computer then it allows them through. Packets not addressed are blocked (principle of network 'firewall').

Data Link Layer

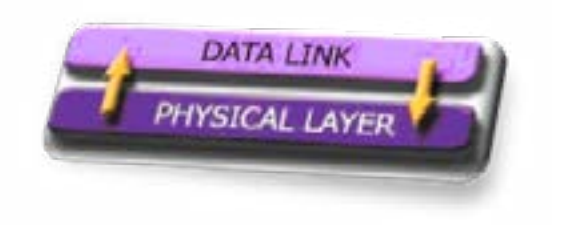
The Data Link layer shares information with the Network layer above it and the Transport layer beneath it

Data is broken down by the higher layers into 'packets'. Each packet needs to be broken up into the most basic form of data i.e. data 'bits'. A 'bit' has two values – a 'high' or a 'low'. (high is a 1 bit and a low is a 0 bit). Each packet is converted into a series of bits. This is the job of the data link layer. It converts the outgoing packets into the correct series of bits. It also converts incoming bits back into complete packets.

Bits can be corrupted as they travel along the network i.e. a bit can be flipped into the wrong state so a 'high' bit may become a 'low' bit and vice versa. The data link layer will attempt to spot these reversals and fix them.

Physical Layer

The Physical layer shares information with the Data Link layer above it.



Bits and bytes have to be converted into a physical effect so that they can be transmitted. There are various methods of transmitting information - for example a pulse of light can be used to represent a data bit, fibre optic cables are then used to provide a path in the network. A radio signal can be used, indeed, 'Wi-Fi' networks have become ubiquitous. Electrical signals can be used, which are carried along copper wires. There are millions of Ethernet networks using this method.

It is the job of the Physical layer to convert the abstract 'data bit' inside the computer into a physical effect of some kind.