The OSI Model and IP Suite

* All languages have basic data types (or arrays of them) and the compiler allocates RAM for each of them so that they are back-to-back in memory.
* Some third gen languages like C, allow programmers to package these data types as defined structures.
* We are able to send a data structure byte by byte across a wire or via Wi-Fi from one computer to another so clearly there must be an order from top to bottom to allow this.
* If different applications are going to either be used by one person or many people and have many programmers work on them, these details need to be agreed upon and documented. This is because clearly if data is sent over a network the receiving program/application needs to have been programmed to understand the incoming data structures otherwise chaos will ensue.
* These documented details were called RFCs or Request for Comments, and the name has remained, as the IETF (Internet Engineering Task Force) manages them.
* We can put data structures within other data structures, and this is called nesting. The IP Suite does this and we call each instance of nesting a layer, and each layer handles a unique and well-defined part of the data transmission process from one computer to another.
* Graphical user interface

  Description automatically generatedA screenshot of a computer

  Description automatically generated with medium confidenceIn the 1970s, when the IP suite was created (for DARPA), it was thought that only FIVE layers could be distinguished. However, in the 1980s the Open Systems Interconnection (OSI) model was developed by the International Organisation for Standardisation (ISO) and it stated that SEVEN layers were required to define a network.

Internet Protocol Suite – 5 Layers

* The OSI model is an abstract reference model and is also a set of generic definitions and actions, but if we make specific choices for the protocols at each layer and then implement software for these we end up defining what’s called a Protocol Suite. An example of which is the Internet Protocol Suite which has no protocols defined at layers 5 and 6.
* There are two versions of the Internet Protocol Suite. There’s IPv4 which is very commonly used globally and is known as the internet. However, there’s also an upgraded version called IPv6, but this has yet to completely replace IPv4 although someday it will.
* There are many advantages to the OSI Model such as:
* By separating the network communications into smaller logical pieces, the OSI model simplifies how network protocols are designed.
* The OSI model was built in order to ensure that different types of equipment such as switches, routers or NICs would all be compatible with the same equipment from different manufacturers.
* Therefore, also opens the market to competition.
* Adding new protocols / network services is easier in a layered architecture in comparison to a monolithic one.
* There are also many disadvantages to the OSI Model such as:
* The choice of a layered model for the network is an engineering design choice.
* Science doesn’t require the model. This is because that in networking, science only limits the physical layer, e.g. electrical (cable), radio waves (Wi-Fi).
* Due to the OSI Model having seven different layers, there will be some latency when processing occurs throughout them.
* In many modern-day examples of business, such as in the stock market, times lost means that money is lost. Therefore, to combat this a lot of research into cross-layer optimisation is done.
* Where are each of the layers of the OSI Model implemented:
* Layer 1 – Physical Layer – this layer is the hardware such as the NIC or Wi-Fi chip.
* Layers 2-4 – are all implemented into the Operating System (Ethernet, IP, TCP, UDP etc)
* Layers 5 & 6 – if they exist, they are implemented into the applications.
* Layer 7 – Each application using the network is said to be this layer.
* The ITU (International Telecommunications Union) worked closely with the development of the OSI and have published the standards of the model known as X.200.
* What are the seven layers of the OSI model, from top to bottom, and what do they do:
* **Layer 7 – Application Layer** – At this layer, all of the applications (client and server) that utilise the network operate. Some examples of web-applications at this layer are: file transfer applications, mail applications and web applications. Also, datagrams at this layer are called Upper Layer Data (ULD)
* **Layer 6 – Presentation Layer** – This layer provides a context for communications between layers (e.g. ASCII) or in other words, ensures data is in the correct format for the application. Data is also encrypted / decrypted at this layer and compression also occurs here. Datagrams are called ULD at this layer still.
* **Layer 5 – Session Layer** – This layer controls the dialogs between computers as well as duplexing, terminating and restarts, so in other words, is responsible for creating and closing communication channels. Datagrams are called ULD on this layer.
* **Layer 4 – Transport Layer** – This layer provides transparent transfer of data by using either UDP or TCP. This layer can provide end-to-end connections, reliability and operates and manages the flow of data segments. Datagrams at this layer are called Segments.
* **Layer 3 – Network Layer** – This layer provides connections between hosts on different networks using either IPv4 or IPv6. Network routing of packets happens at this layer. Datagrams are called Data packets at this layer.
* **Layer 2 – Data Link Layer** – This layer provides connections between hosts on the same Local Area Network (LAN) through ethernet and using MAC addresses. Datagrams are called Frames at this layer.
* **Layer 1 – Physical Layer** – This layer describes the electrical and physical specifications for devices such as: cables, connectors, hubs, and repeaters. At this layer the DATA is called bits.