**advantages of network layers**-Information hiding--Decoupling changes--Breaks up complex problem into smaller manageable pieces--Abstraction of implementation details--Separation of implementation and specification--Can change implementation as long as service interface is maintained--Can use functionality--Upper layers can share lower layer functionality. **Broadcast**-single communication channel that is shared by all the machines on the network. Packets sent by one to others. There is an address field in the packet. **Point-to-Point**-many connections of individual pairs of machines. moves from source to destination packet must to visit intermidiary machine. many different routes so find a good path. **simplex**-one way**Half duplex**:-Tx/Rx same time/channel**Full** **duplex:**-Tx/Rx same time, 2 channels. **Multiplexing-**is where multiple signals are combined into one signal/medium. **OSI**—The **Physical Layer** describes the physical properties of the various communications media, as well as the electrical properties and interpretation of the exchanged signals. Ex: this layer defines the size of Ethernet coaxial cable, the type of BNC connector used, and the termination method. The **Data Link Layer** describes the logical organization of data bits transmitted on a particular medium. Ex: this layer defines the framing, addressing and checksumming of Ethernet packets. The **Network Layer** describes how a series of exchanges over various data links can deliver data between any two nodes in a network. Ex: this layer defines the addressing and routing structure of the Internet. The **Transport Layer** describes the quality and nature of the data delivery. Ex: this layer defines if and how retransmissions will be used to ensure data delivery. The **Session Layer** describes the organization of data sequences larger than the packets handled by lower layers. Ex: this layer describes how request and reply packets are paired in a remote procedure call. The **Presentation Layer** describes the syntax of data being transferred. Ex: this layer describes how floating point numbers can be exchanged between hosts with different math formats. The **Application Layer** describes how real work actually gets done. Ex: this layer would implement file system operations. TCP/IP-Application--Defines TCP/IP application protocols and how host programs interface with transport layer services to use the network. Transport--Provides communication session management between host computers. Defines the level of service and status of the connection used when transporting data. Internet--Packages data into IP datagrams, which contain source and destination address information that is used to forward the datagrams between hosts and across networks. Performs routing of IP datagrams. Network interface-Specifies details of how data is physically sent through the network, including how bits are electrically signaled by hardware devices that interface directly with a network medium, such as coaxial cable, optical fiber, or twisted-pair copper wire. TCP (Transmission Control Protocol) is the most commonly used protocol on the Internet. The reason for this is because TCP offers error correction. When the TCP protocol is used there is a "guaranteed delivery." This is due largely in part to a method called "flow control." Flow control determines when data needs to be re-sent, and stops the flow of data until previous packets are successfully transferred. This works because if a packet of data is sent, a collision may occur. When this happens, the client re-requests the packet from the server until the whole packet is complete and is identical to its original. UDP (User Datagram Protocol) is anther commonly used protocol on the Internet. However, UDP is never used to send important data such as webpages, database information, etc; UDP is commonly used for streaming audio and video. Streaming media such as Windows Media audio files (.WMA) , Real Player (.RM), and others use UDP because it offers speed! The reason UDP is faster than TCP is because there is no form of flow control or error correction. The data sent over the Internet is affected by collisions, and errors will be present. Remember that UDP is **only** concerned with speed. This is the main reason why streaming media is not high quality. IMP-–The **Interface Message Processor** (IMP) was the packet-switching node used to connect computers to the original ARPANET in the late 1960s and 1970s. It was the first generation of what is known as a router today. **Shannon's Theorem--**Shannon's Theorem gives an upper bound to the capacity of a link, in bits per second (bps), as a function of the available bandwidth and the signal-to-noise ratio of the link. The Theorem can be stated as: **C = B \* log2(1+ S/N)**. **Nyquist's theorem:** A theorem, developed by H. Nyquist, which states that an **analog signal** **waveform** may be uniquely reconstructed, without **error**, from samples taken at equal [**time**](http://www.its.bldrdoc.gov/fs-1037/dir-037/_5459.htm) intervals. The [**sampling rate**](http://www.its.bldrdoc.gov/fs-1037/dir-032/_4673.htm) must be equal to, or greater than, twice the highest [**frequency**](http://www.its.bldrdoc.gov/fs-1037/dir-016/_2351.htm) [**component**](http://www.its.bldrdoc.gov/fs-1037/dir-008/_1166.htm) in the analog signal. The following are the difference between Single Mode and Multimode [fiber optics](http://www.blurtit.com/q664141.html):- Single Mode carries only a single ray of light whereas multiple rays of light can travel through Multimode fiber optics.- [Single mode fibers](http://www.blurtit.com/q664141.html) do not exhibit any dispersion unlike Multimode fibers.- Multimode fibers have multiple spatial modes unlike [single](http://www.blurtit.com/q664141.html) mode fibres.-Single mode fibres are better at retaining the fidelity of light pulse over long distances than multimode [fibers](http://www.blurtit.com/q664141.html).- Single mode fibers have higher bandwidth than multimode.- Single mode fiber equipment is more expensive than the equipment for multimode.-Single mode fiber is cheaper than multimode fiber. - Multimode fibers have higher capacity and reliability over short distances than single mode. - Multimode fibers [support](http://www.blurtit.com/q664141.html) more than one propagation mode unlike single fiber- Multimode fibers are limited by modal dispersion whereas [single](http://www.blurtit.com/q664141.html) mode is not. pecifies details of how data is physically sent through the network, including how bits are electrically signaled by hardware devices that interface directly with a network medium, such as coaxial cable, optical fiber, or twisted-pair copper wire. Injection light diode ILD A baud rate of 1 kBd = 1,000 Bd is synonymous to a symbol rate of 1,000 symbols per second. In case of a modem, this corresponds to 1,000 tones per second, and in case of a line code, this corresponds to 1,000 pulses per second

original data = clock XOR Manchester value

0 0 0

0 1 1

1 0 1

1 1 0rnet, Token Ring, FDDI, X.25, Frame Relay, RS-232,

**Comparison with TCP/IP**In the [TCP/IP model](http://en.wikipedia.org/wiki/TCP/IP_model) of the Internet, protocols are deliberately not as rigidly designed into strict layers as the OSI model.[[6]](http://en.wikipedia.org/wiki/OSI_model#cite_note-5) [RFC 3439](http://tools.ietf.org/html/rfc3439) contains a section entitled "Layering [considered harmful](http://en.wikipedia.org/wiki/Considered_harmful)." However, TCP/IP does recognize four broad layers of functionality which are derived from the operating scope of their contained protocols, namely the scope of the software application, the end-to-end transport connection, the internetworking range, and lastly the scope of the direct links to other nodes on the local network.Even though the concept is different than in OSI, these layers are nevertheless often compared with the OSI layering scheme in the following way: The Internet [Application Layer](http://en.wikipedia.org/wiki/Application_Layer) includes the OSI Application Layer, Presentation Layer, and most of the Session Layer. Its end-to-end [Transport Layer](http://en.wikipedia.org/wiki/Transport_Layer) includes the graceful close function of the OSI Session Layer as well as the OSI Transport Layer. The internetworking layer ([Internet Layer](http://en.wikipedia.org/wiki/Internet_Layer)) is a subset of the OSI Network Layer, while the [Link Layer](http://en.wikipedia.org/wiki/Link_Layer) includes the OSI Data Link and Physical Layers, as well as parts of OSI's Network Layer. These comparisons are based on the original seven-layer protocol model as defined in ISO 7498, rather than refinements in such things as the internal organization of the Network Layer document.The presumably strict consumer/producer layering of OSI as it is usually described does not present contradictions in TCP/IP, as it is permissible that protocol usage does not follow the hierarchy implied in a layered model. Such examples exist in some routing protocols (e.g., OSPF), or in the description of [tunneling protocols](http://en.wikipedia.org/wiki/Tunneling_protocol), which provide a Link Layer for an application, although the tunnel host protocol may well be a Transport or even an Application Layer protocol in its own right.The TCP/IP design generally favors decisions based on simplicity, efficiency and ease of implementation.