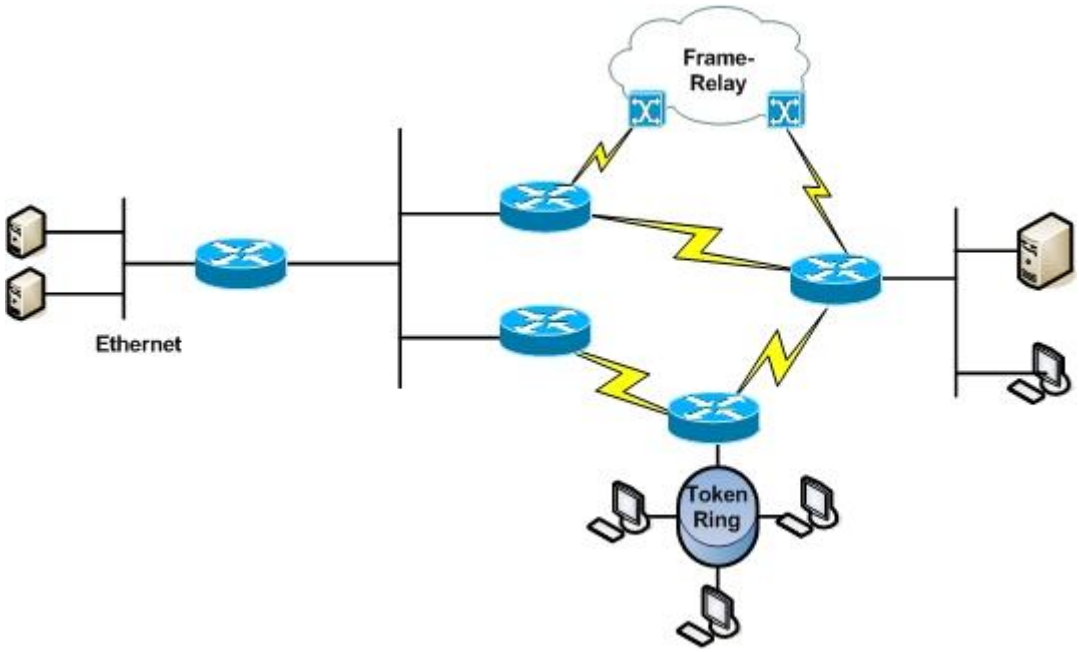
CCNA – What is an Internetwork?



The different kinds of networks that join together to form an Internetwork can be categorized as Local Area Networks (LANs) and Wide Area Networks (WANs)

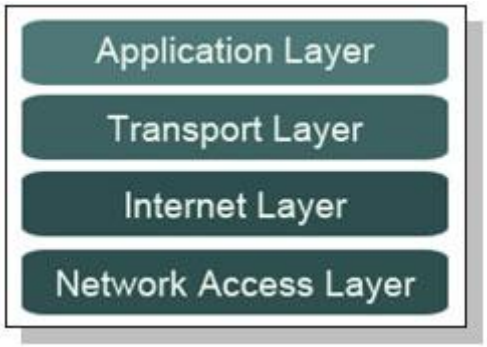
Local Area Network (LAN) is a network that is limited to small geographical area, such as an office building or even a network of computers and devices in a home. A Local Area Network (LAN) is used for many purposes like sharing of resources, gaming and collaboration. In a Local Area Network the complete infrastructure of the network is owned by the company itself that includes devices like switches and cables. A Local Area network provides high-speed connectivity ranging from 10 Mbps to 10 Gbps but the media suffers from distance limitation.

Wide Area Networks (WAN) cover a broad geographic area such as cities, country or even across continents. Wide Area Networks are used to interconnect multiple Local Area Networks that are several miles apart. Due to the long distance connectivity an organization has to purchase WAN service from a service provider or a carrier. There are several types of Wide Area Networks such as leased lines, circuit-switched networks and packet-switched networks.

A company or an organization that has to connect multiple offices that span over cities, countries or even the entire globe subscribe to WAN service from a provider, whereas Local Area Networks are owned by the organization itself and there is no need to purchase any kind of connectivity service.

The Internet Protocol Suite commonly known as the TCP/IP Protocol Stack is a standard set of communication protocols developed as a result of research and development conducted by the DARPA for the ARPANET. This protocol suite was developed so that a standard means of communications can be achieved which would allow different types of networks having different computer systems to communicate with each other. The Internet Protocol Suite is framework that defines a set of general design guidelines and implementations of specific networking protocols to enable computers to communicate over a network. RFC 1122 describes the Internet Protocol Suite architectural model which commonly is referred as the TCP/IP Model. To communicate using the over the Internet, a host must implement the layered set of protocols comprising the Internet protocol suite.

Figure below shows the TCP/IP model that comprises of four layers.



The Application Layer is the top-most layer, it refers to the higher-level protocols used by applications for network communication such as File Transfer Protocol (FTP), Hyper Text Transfer Protocol (HTTP) and Simple Mail Transfer Protocol (SMTP).

The transport layer provides end-to-end communication services for applications. There are two primary transport layer protocols

· Transmission Control Protocol (TCP)

· User Datagram Protocol (UDP)

TCP is a reliable connection-oriented transport service that provides end-to-end reliability, resequencing, and flow control. While UDP is a connectionless (“datagram”) transport service.

The Internet Layer describes a group of methods, protocols, and specifications which are used to transport datagrams (packets) from a host across network boundaries, if necessary, to the destination host specified by a network address (IP address) which is defined for this purpose by the Internet Protocol (IP). Every machine on the Internet whether it is a host machine accessing services or a server providing services needs a unique IP address which identifies that system on the Internet. IP version 4 (IPv4) is the current version of Internet Protocol being used on the Internet. IPv4 defines a 32-bit address which allows the possibility of 4,294,967,296 unique addresses, however due to the rapid growth of the Internet this space is limited. IP version 6 (IPv6) which is

intended to be the successor of IPv4 has a 128-bit address space which vastly larger than IPv4 address space.

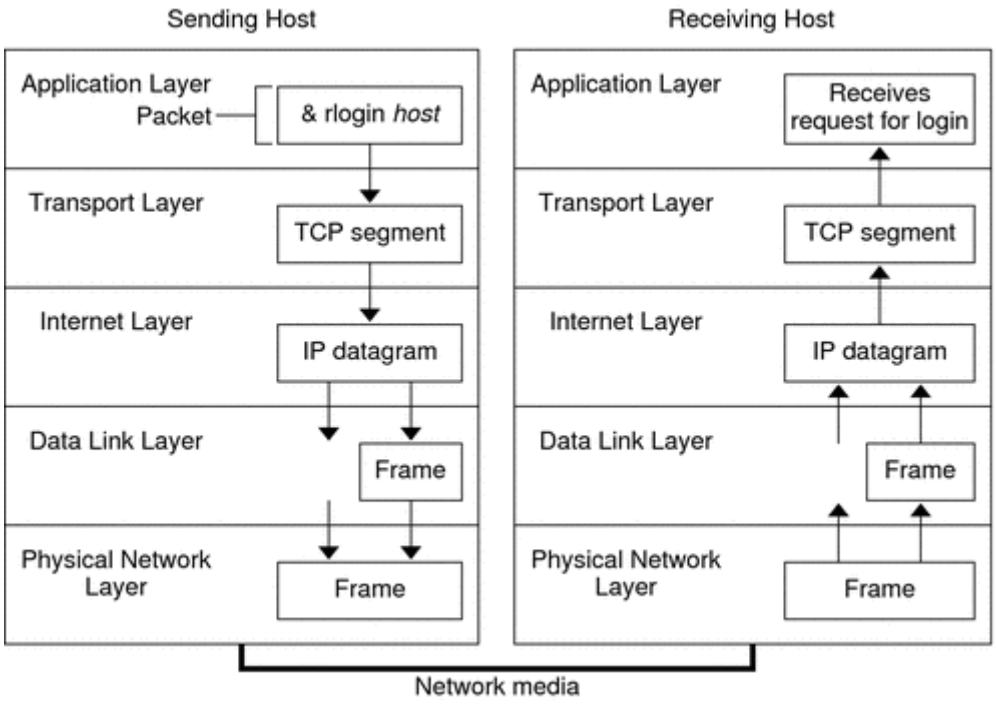
All Internet transport protocols use the Internet Protocol (IP) to carry data from source host to destination host. IP is a connectionless or datagram internetwork service, providing no end-to-end delivery guarantees.

The Network Access Layer also known as the Link Layer or the Media Access Layer defines protocols and specifications that must be implemented by the host to communicate with its directly connected network.

How the TCP/IP Protocols Handle Data Communications

When a user issues a command that uses a TCP/IP application layer protocol, a series of events is initiated. The user's command or message passes through the TCP/IP protocol stack on the local system. Then, the command or message passes across the network media to the protocols on the remote system. The protocols at each layer on the sending host add information to the original data. Protocols on each layer of the sending host also interact with their peers on the receiving host.

Figure below shows how two hosts communicate using the TCP/IP protocol stack.



The Internet is the most notable example of an Internetwork. Internet is the global network formed by connecting several computer networks across the globe. The individual private and public networks of different sizes and categories, used for different purposes and utilizing a broad array of technologies interconnect together to form the internet. The origins of the Internet date back to 1960s when Defense Advanced Research Projects Agency (DARPA) of the United States developed the ARPANET which is known as the predecessor of the Internet. The ARPANET which was research government military project become commercialized in the 1980s and

within a couple of years a rapid expansion and interconnection of several different computer networks led to the Internet.

Key Internet Services, and technologies and protocols that enable these services

Today the Internet has become a globally distributed network that can be accessed from anywhere by numerous means. Over the years the Internet has evolved from a defense research project to global network used for various purposes such as business/corporate communications, social networking and multimedia.

The Internet offers various services using different technologies and protocols some of which are discussed below

World Wide Web

World Wide Web (WWW) is a system of interlinked hypertext documents contained on the Internet. With a web browser, one can view web pages that may contain text, images, videos, and other multimedia and navigate between them by using hyperlinks. Today there are millions of websites on the Internet that provide different types of content, this services is one of the biggest selling points for the Internet. The entire web is supported by the Hyper Text Transfer Protocol (HTTP), an application layer protocol used by web browsers that act as HTTP clients requests information from Web Servers that host websites. A Uniform Resource Locator (URL) is used to identify a Web Site address, HTTP is used to request resources/information from web servers using URLs.

Email

Electronic Mail or in short e-mail is method of exchanging digital messages. Along with the World Wide Web the Email is one of the most popular service offered by the Internet. There are several standards and protocols for the Email system which allows Internet users to exchange messages over the Internet. Simple Mail Transfer Protocol (SMTP) is an Internet standard for electronic mail (e-mail) transmission across Internet Protocol (IP) networks. SMTP is used by Email servers to send and receive mail messages while clients (end-users) usually use Post Office Protocol (POP) or the Internet Message Access Protocol (IMAP) to access their mail box accounts on a mail server.

Internet Infrastructure

As mentioned above the Internet is made of up several interconnected networks, at its very edge individual users or corporate private networks connect to the Internet via an Internet Service Provider (ISP), the ISP serves many users through various physical mediums such as Wireless Connections and DSL, these ISP in an Internet Infrastructure are known as Local ISPs. The Local ISP may peer with each other but usually they peer with a regional ISP that interconnects multiple local ISPs, the regional ISP peer with the bigger provider called the Network Service Provider (NSP). However this may not be assumed as true Internet infrastructure as a complete picture of the Internet is difficult to graph due to various peerings, connections and other complexities.

This brings us to the end of this lesson in which we covered the Internetwork and its core underlying technologies.