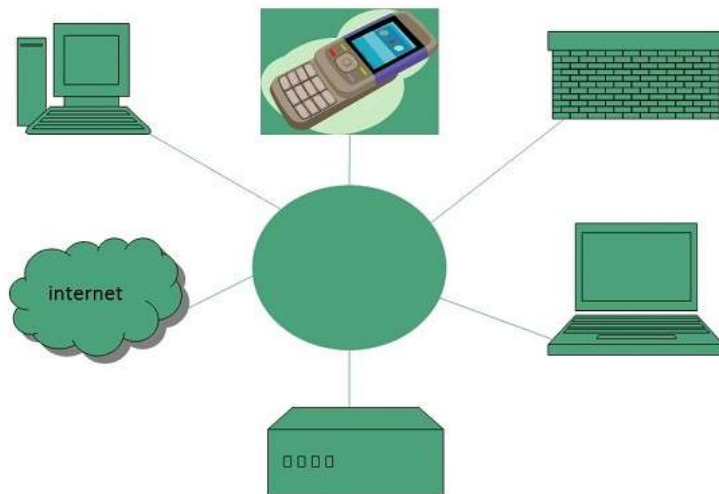


Internet technologies

Internet

Internet refers to network of networks. In this network each computer is recognized by a globally unique address known as IP address. A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name. It is an information super Highway, to access information over the web. However, It can be defined in many ways as follows:

- Internet is a world-wide global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP).
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer location.
- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name **http://www.helloworld.com** to a particular IP address to uniquely identify the computer on which this website is hosted.
- Internet is accessible to every user all over the world.



Evolution

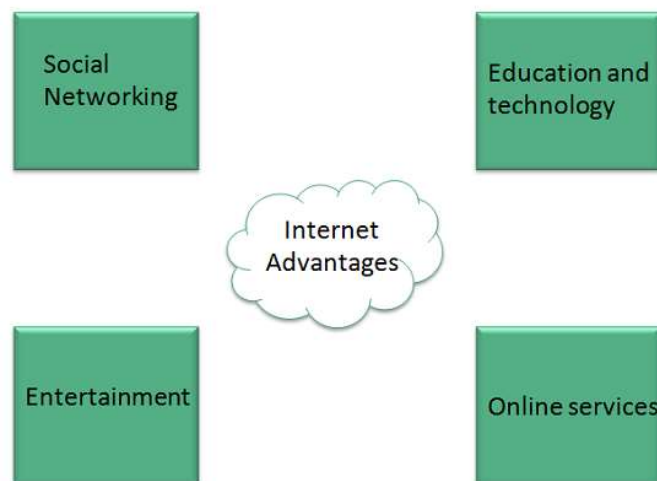
The concept of Internet was originated in 1969 and has undergone several technological & Infrastructural changes as discussed below:

- The origin of Internet devised from the concept of **Advanced Research Project Agency Network (ARPANET)**.

- **ARPANET** was developed by United States Department of Defense.
- Basic purpose of ARPANET was to provide communication among the various bodies of government.
- Initially, there were only four nodes, formally called **Hosts**.
- In 1972, the **ARPANET** spread over the globe with 23 nodes located at different countries and thus became known as **Internet**.
- By the time, with invention of new technologies such as TCP/IP protocols, DNS, WWW, browsers, scripting languages etc., Internet provided a medium to publish and access information over the web.

Advantages

Internet covers almost every aspect of life, one can think of. Here, we will discuss some of the advantages of Internet:

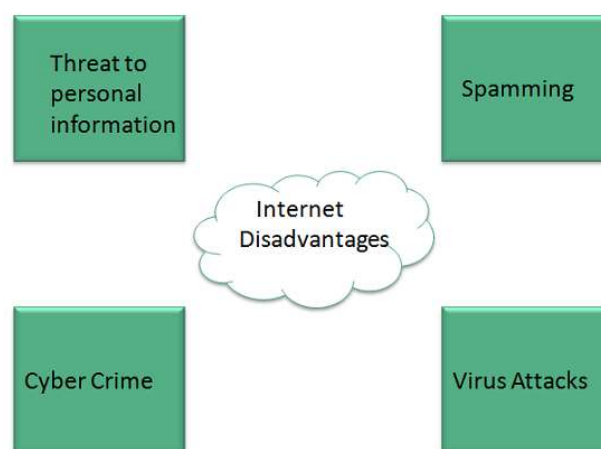


- Internet allows us to communicate with the people sitting at remote locations. There are various apps available on the web that uses Internet as a medium for communication. One can find various social networking sites such as:
 - Facebook, Twitter, Yahoo, Google+
- One can surf for any kind of information over the internet. Information regarding various topics such as Technology, Health & Science, Social Studies, Geographical Information, Information Technology, Products etc can be surfed with help of a search engine.
- Apart from communication and source of information, internet also serves a medium for entertainment. Following are the various modes for entertainment over internet.
 - Online Television, Online Games, Songs, Videos, Social Networking Apps

- Internet allows us to use many services like:
 - Internet Banking, Matrimonial Services, Online Shopping, Online Ticket Booking, Online Bill Payment, Data Sharing, E-mail
- Internet provides concept of **electronic commerce**, that allows the business deals to be conducted on electronic systems

Disadvantages

However, Internet has proved to be a powerful source of information in almost every field, yet there exists many disadvantages discussed below:

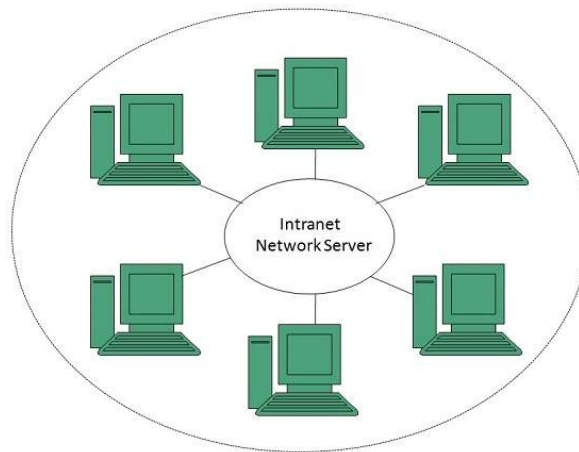


- There are always chances to loose personal information such as name, address, credit card number. Therefore, one should be very careful while sharing such information. One should use credit cards only through authenticated sites.
- Another disadvantage is the **Spamming**. Spamming corresponds to the unwanted e-mails in bulk. These e-mails serve no purpose and lead to obstruction of entire system.
- **Virus** can easily be spread to the computers connected to internet. Such virus attacks may cause your system to crash or your important data may get deleted.
- Also a biggest threat on internet is pornography. There are many pornographic sites that can be found, letting your children to use internet which indirectly affects the children healthy mental life.
- There are various websites that do not provide the authenticated information. This leads to misconception among many people.

Intranet

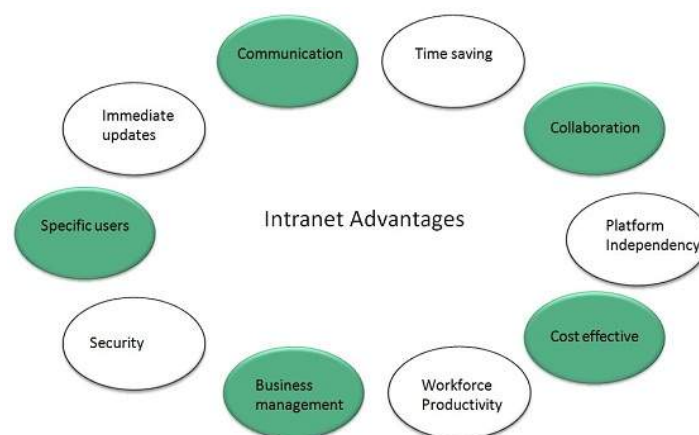
Intranet is defined as private network of computers within an organization with its own server and firewall. Moreover we can define Intranet as:

- Intranet is system in which multiple PCs are networked to be connected to each other. PCs in intranet are not available to the world outside of the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.
- Every computer in internet is identified by a unique IP address.
- Each computer in Intranet is also identified by a IP Address, which is unique among the computers in that Intranet.



Benefits

Intranet is very efficient and reliable network system for any organization. It is beneficial in every aspect such as collaboration, cost-effectiveness, security, productivity and much more.



Communication- Intranet offers easy and cheap communication within an organization. Employees can communicate using chat, e-mail or blogs.

Time Saving-Information on Intranet is shared in real time.

Collaboration-Information is distributed among the employees as according to requirement and it can be accessed by the authorized users, resulting in enhanced teamwork.

Platform Independency-Intranet can connect computers and other devices with different architecture.

Cost Effective-Employees can see the data and other documents using browser rather than printing them and distributing duplicate copies among the employees, which certainly decreases the cost.

Workforce Productivity-Data is available at every time and can be accessed using company workstation. This helps the employees work faster.

Business Management-It is also possible to deploy applications that support business operations.

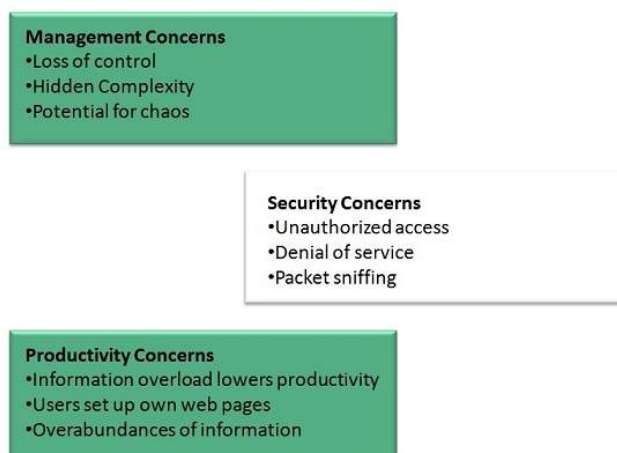
Security-Since information shared on intranet can only be accessed within an organization, therefore there is almost no chance of being theft.

Specific Users-Intranet targets only specific users within an organization therefore, once can exactly know whom he is interacting.

Immediate Updates-Any changes made to information are reflected immediately to all the users.

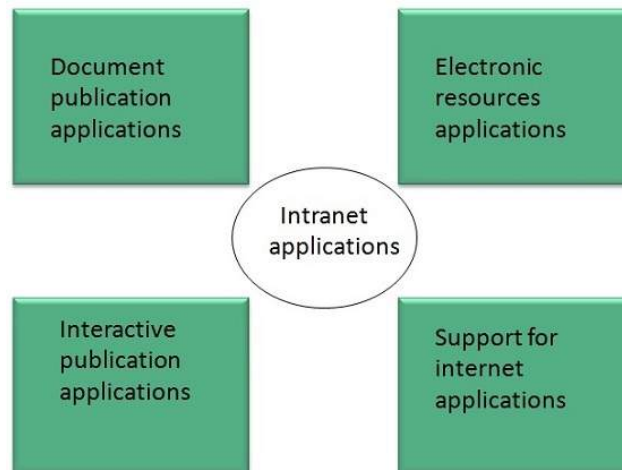
Issues

Apart from several benefits of Intranet, there also exist some issues. These issues are shown in the following diagram:



Applications

Intranet applications are same as that of Internet applications. Intranet applications are also accessed through a web browser. The only difference is that, Intranet applications reside on local server while Internet applications reside on remote server. Here, we've discussed some of these applications:



Document publication applications-Document publication applications allow publishing documents such as manuals, software guide, employee profiles etc without use of paper.

Electronic resources applications-It offers electronic resources such as software applications, templates and tools, to be shared across the network.

Interactive Communication applications-Like on internet, we have e-mail and chat like applications for Intranet, hence offering an interactive communication among employees.

Support for Internet Applications-Intranet offers an environment to deploy and test applications before placing them on Internet.

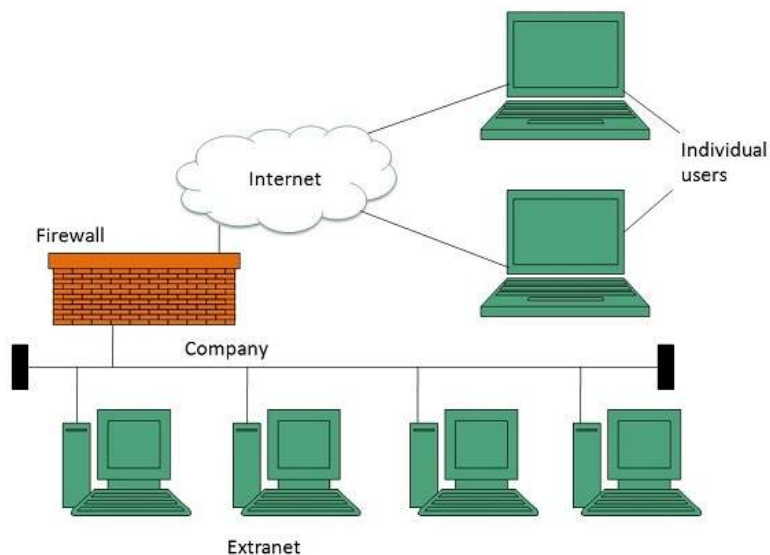
Internet vs. Intranet

Apart from similarities there are some differences between the two. Following are the differences between Internet and Intranet:

Intranet	Internet
Localized Network.	Worldwide Network
Doesn't have access to Internet	Have access to Internet.
More Expensive	Less Expensive
More Safe	Less Safe
More Reliability	Less Reliability

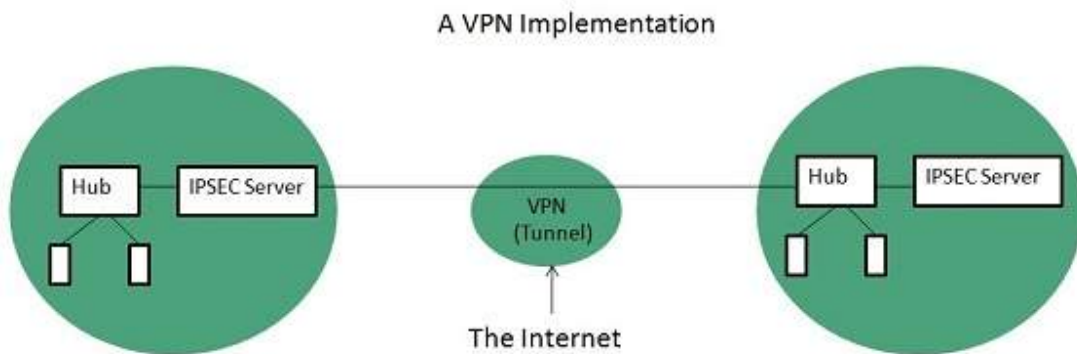
Extranet

Extranet refers to network within an organization, using internet to connect to the outsiders in controlled manner. It helps to connect businesses with their customers and suppliers and therefore allows working in a collaborative manner.



Implementation

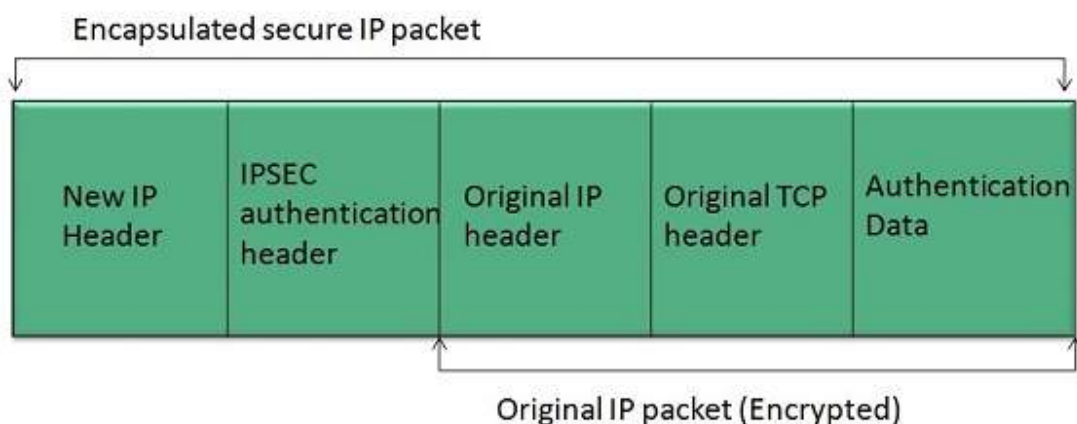
Extranet is implemented as a Virtual Private Networks (VPN) because it uses internet to connect to corporate organization and there is always a threat to information security. VPN offers a secure network in public infrastructure (Internet).



Key Points

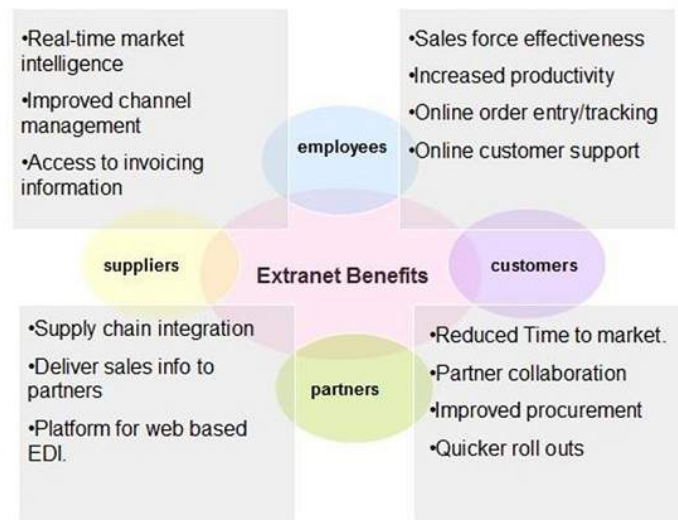
- The packet is encapsulated at boundary of networks in IPSEC compliant routers.
- It uses an encryption key to encapsulate packets and IP addresses as well.
- The packet is decoded only by the IPSEC compliant routers or servers.
- The message is sent over VPN via VPN Tunnel and this process is known as tunneling.

VPN uses **Internet Protocol Security Architecture (IPSEC)** Protocol to provide secure transactions by adding an additional security layer to TCP/IP protocol. This layer is created by encapsulating the IP packet to a new IP packet as shown in the following diagram:



Benefits

Extranet proves to be a successful model for all kind of businesses whether small or big. Here are some of the advantages of extranet for employees, suppliers, business partners, and customers:



Issues

Apart for advantages there are also some issues associated with extranet. These issues are discussed below:

Hosting - Where the extranet pages will be held i.e. who will host the extranet pages. In this context there are two choices:

- Host it on your own server.
- Host it with an Internet Service Provider (ISP) in the same way as web pages.

But hosting extranet pages on your own server requires high bandwidth internet connection which is very costly.

Security- Additional firewall security is required if you host extranet pages on your own server which result in a complex security mechanism and increase work load.

Accessing Issues - Information cannot be accessed without internet connection. However, information can be accessed in Intranet without internet connection.

Decreased Interaction - It decreases the face to face interaction in the business which results in lack of communication among customers, business partners and suppliers.

Extranet vs. Intranet

The following table shows differences between Extranet and Intranet:

Extranet	Intranet
Internal network that can be accessed externally.	Internal network that can not be accessed externally.
Extranet is extension of company's Intranet.	Only limited users of a company.
For limited external communication between customers, suppliers and business partners.	Only for communication within a company.

Domain Name Server (DNS)

Overview

When **DNS** was not into existence, one had to download a **Host file** containing host names and their corresponding IP address. But with increase in number of hosts of internet, the size of host file also increased. This resulted in increased traffic on downloading this file. To solve this problem the DNS system was introduced.

Domain Name System helps to resolve the host name to an address. It uses a hierarchical naming scheme and distributed database of IP addresses and associated names

IP Address

IP address is a unique logical address assigned to a machine over the network. An IP address exhibits the following properties:

- IP address is the unique address assigned to each host present on Internet.
- IP address is 32 bits (4 bytes) long.
- IP address consists of two components: **network component** and **host component**.
- Each of the 4 bytes is represented by a number from 0 to 255, separated with dots. For example 137.170.4.124

IP address is 32-bit number while on the other hand domain names are easy to remember names. For example, when we enter an email address we always enter a symbolic string such as webmaster@tutorialspoint.com.

Uniform Resource Locator (URL)

Uniform Resource Locator (URL) refers to a web address which uniquely identifies a document over the internet.

This document can be a web page, image, audio, video or anything else present on the web.

For example, **www.tutorialspoint.com/internet_technology/index.html** is an URL to the index.html which is stored on tutorialspoint web server under internet_technology directory.

URL Types

There are two forms of URL as listed below:

- Absolute URL
- Relative URL

Absolute URL

Absolute URL is a complete address of a resource on the web. This completed address comprises of protocol used, server name, path name and file name.

For example `http:// www.tutorialspoint.com / internet_technology /index.htm`. where:

- **http** is the protocol.
- **tutorialspoint.com** is the server name.
- **index.htm** is the file name.

The protocol part tells the web browser how to handle the file. Similarly we have some other protocols also that can be used to create URL are:

- FTP
- https
- Gopher
- mailto
- news

Relative URL

Relative URL is a partial address of a webpage. Unlike absolute URL, the protocol and server part are omitted from relative URL.

Relative URLs are used for internal links i.e. to create links to file that are part of same website as the WebPages on which you are placing the link.

For example, to link an image on `tutorialspoint.com/internet_technology/internet_referemce_models`, we can use the relative URL which can take the form like **/internet_technologies/internet-osi_model.jpg**.

Difference between Absolute and Relative URL

Absolute URL	Relative URL
Used to link web pages on different websites	Used to link web pages within the same website.
Difficult to manage.	Easy to Manage
Changes when the server name or directory name changes	Remains same even if we change the server name or directory name.
Take time to access	Comparatively faster to access.

Domain Name System Architecture

The Domain name system comprises of **Domain Names, Domain Name Space, Name Server** that have been described below:

Domain Names

Domain Name is a symbolic string associated with an IP address. There are several domain names available; some of them are generic such as **com, edu, gov, net** etc, while some country level domain names such as **au, in, za, us** etc.

The following table shows the **Generic** Top-Level Domain names:

Domain Name	Meaning
Com	Commercial business
Edu	Education
Gov	U.S. government agency

Int	International entity
Mil	U.S. military
Net	Networking organization
Org	Non profit organization

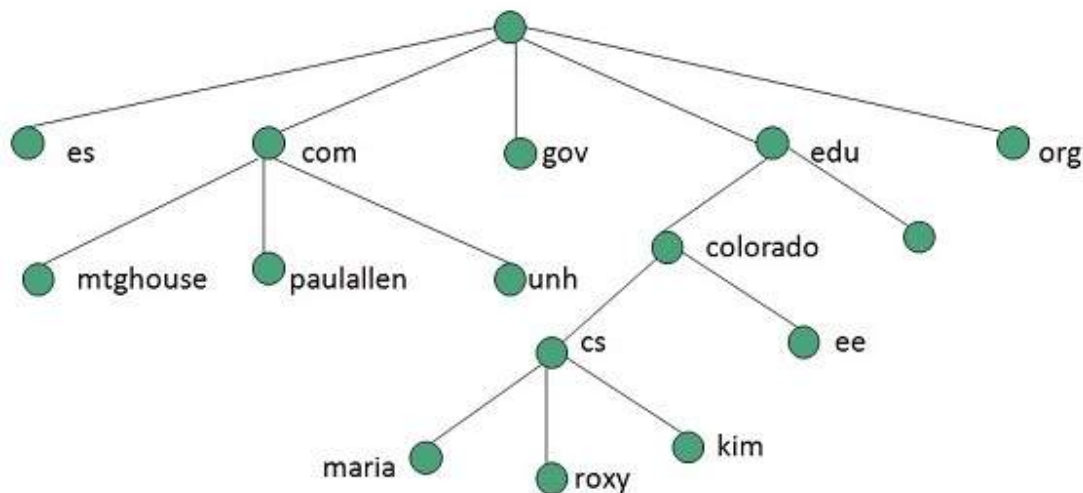
The following table shows the **Country top-level** domain names:

Domain Name	Meaning
Au	Australia
In	India
Cl	Chile
Fr	France
Us	United States
Za	South Africa
Uk	United Kingdom
Jp	Japan
Es	Spain
De	Germany

Ca	Canada
Ee	Estonia
Hk	Hong Kong

Domain Name Space

The domain name space refers a hierarchy in the internet naming structure. This hierarchy has multiple levels (from 0 to 127), with a root at the top. The following diagram shows the domain name space hierarchy:



In the above diagram each subtree represents a domain. Each domain can be partitioned into sub domains and these can be further partitioned and so on.

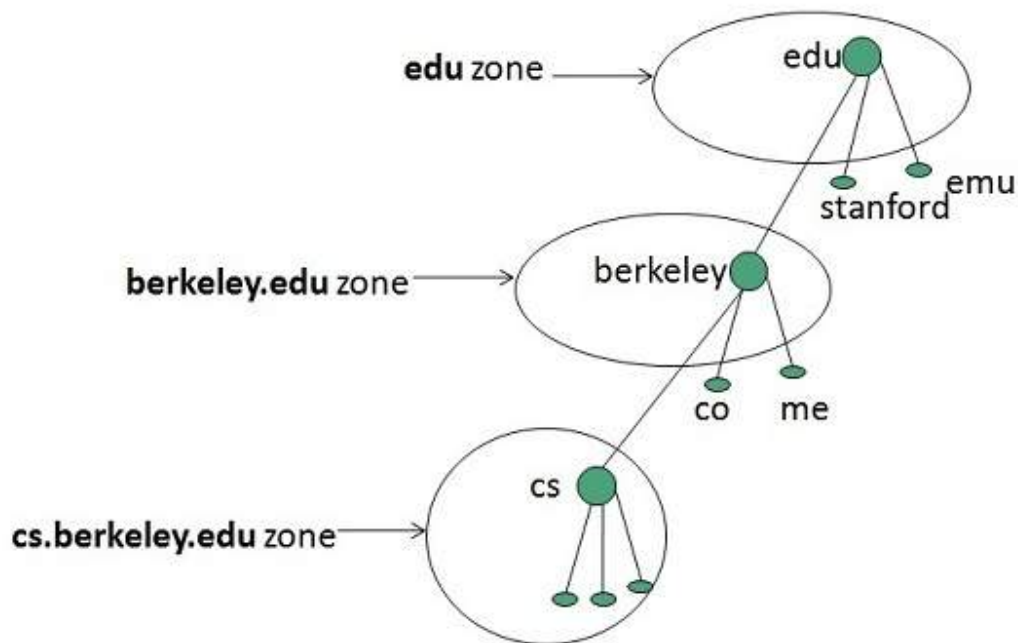
Name Server

Name server contains the DNS database. This database comprises of various names and their corresponding IP addresses. Since it is not possible for a single server to maintain entire DNS database, therefore, the information is distributed among many DNS servers.

- Hierarchy of server is same as hierarchy of names.
- The entire name space is divided into the zones

Zones

Zone is collection of nodes (sub domains) under the main domain. The server maintains a database called zone file for every zone.



If the domain is not further divided into sub domains then domain and zone refers to the same thing.

The information about the nodes in the sub domain is stored in the servers at the lower levels however; the original server keeps reference to these lower levels of servers.

Types of Name Servers

Following are the three categories of Name Servers that manages the entire Domain Name System:

- Root Server
- Primary Server
- Secondary Server

Root Server

Root Server is the top level server which consists of the entire DNS tree. It does not contain the information about domains but delegates the authority to the other server

Primary Servers

Primary Server stores a file about its zone. It has authority to create, maintain, and update the zone file.

Secondary Server

Secondary Server transfers complete information about a zone from another server which may be primary or secondary server. The secondary server does not have authority to create or update a zone file.

DNS Working

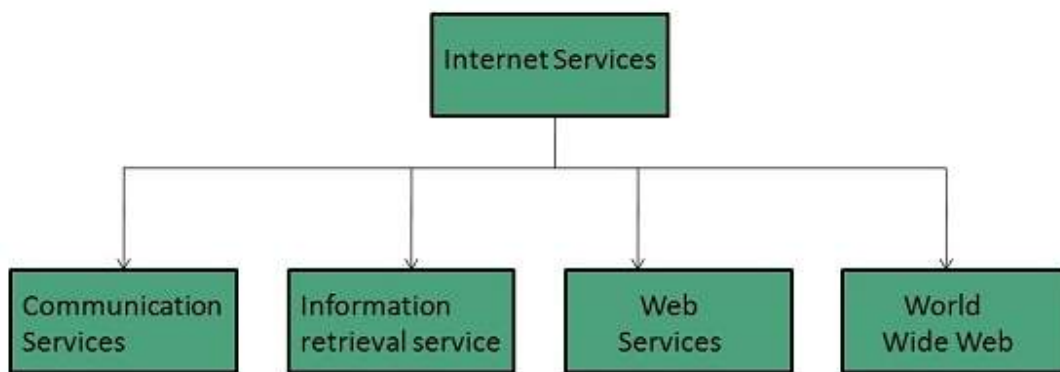
DNS translates the domain name into IP address automatically. Following steps will take you through the steps included in domain resolution process:

- When we type **www.tutorialspoint.com** into the browser, it asks the local DNS Server for its IP address.

Here the local DNS is at ISP end.

- When the local DNS does not find the IP address of requested domain name, it forwards the request to the root DNS server and again enquires about IP address of it.
- The root DNS server replies with delegation that **I do not know the IP address of www.tutorialspoint.com but know the IP address of DNS Server.**
- The local DNS server then asks the com DNS Server the same question.
- The **com** DNS Server replies the same that it does not know the IP address of www.tutorialspont.com but knows the address of tutorialspoint.com.
- Then the local DNS asks the tutorialspoint.com DNS server the same question.
- Then tutorialspoint.com DNS server replies with IP address of www.tutorialspoint.com.
- Now, the local DNS sends the IP address of www.tutorialspoint.com to the computer that sends the request.

Internet Services allows us to access huge amount of information such as text, graphics, sound and software over the internet. Following diagram shows the four different categories of Internet Services.



Web Services

Web services allow exchange of information between applications on the web. Using web services, applications can easily interact with each other.

The web services are offered using concept of **Utility Computing**.

World Wide Web (WWW)

WWW is also known as W3. It offers a way to access documents spread over the several servers over the internet. These documents may contain texts, graphics, audio, video, hyperlinks. The hyperlinks allow the users to navigate between the documents.

Video Conferencing

Video conferencing or Video teleconferencing is a method of communicating by two-way video and audio transmission with help of telecommunication technologies.

Modes of Video Conferencing

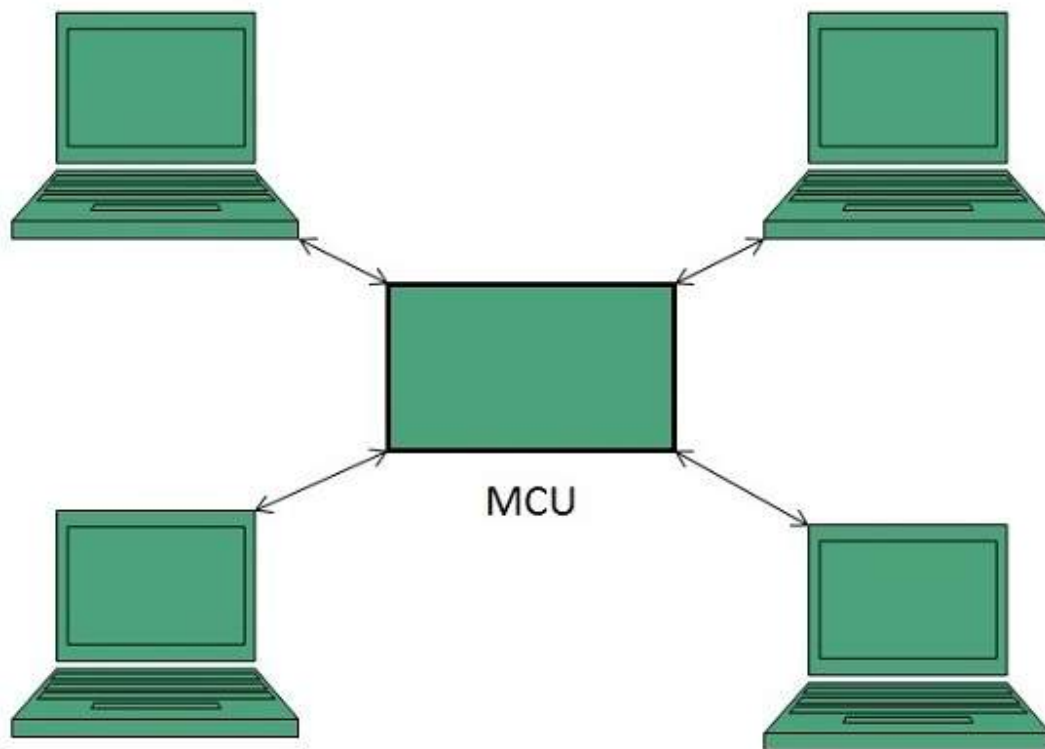
Point-to-Point

This mode of conferencing connects two locations only.



Multi-point

This mode of conferencing connects more than two locations through **Multi-point Control Unit (MCU)**.



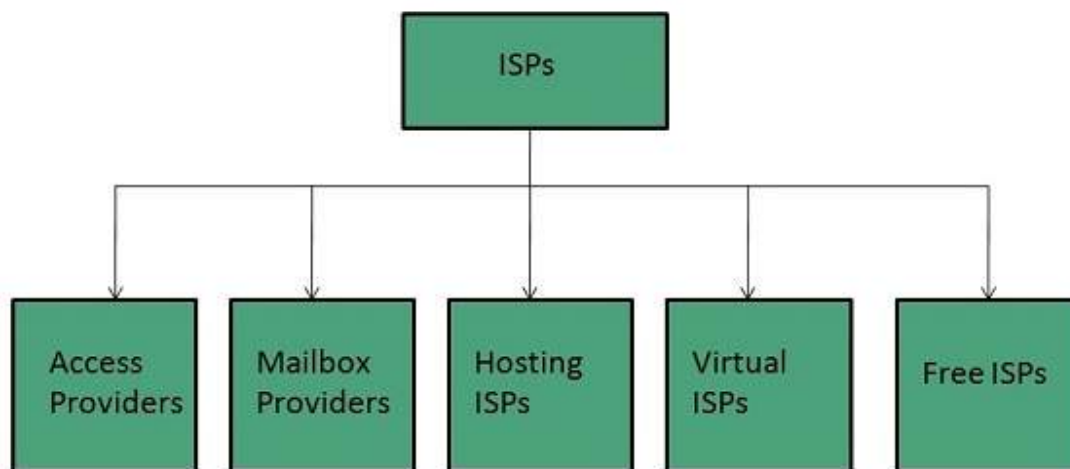
Internet Service Providers (ISP)

Internet Service Provider (ISP) is a company offering access to internet. They offer various services:

- Internet Access
- Domain name registration
- Dial-up access
- Leased line access

ISP Types

ISPs can broadly be classified into six categories as shown in the following diagram:



Access providers

They provide access to internet through telephone lines, cable wi-fi or fiber optics.

Mailbox Provider

Such providers offer mailbox hosting services.

Hosting ISPs

Hosting ISPs offers e-mail, and other web hosting services such as virtual machines, clouds etc.

Virtual ISPs

Such ISPs offer internet access via other ISP services.

Free ISPs

Free ISPs do not charge for internet services.

Connection Types

There exist several ways to connect to the internet. Following are these connection types available:

1. Dial-up Connection
2. ISDN
3. DSL
4. Cable TV Internet connections
5. Satellite Internet connections
6. Wireless Internet Connections

Dial-up Connection

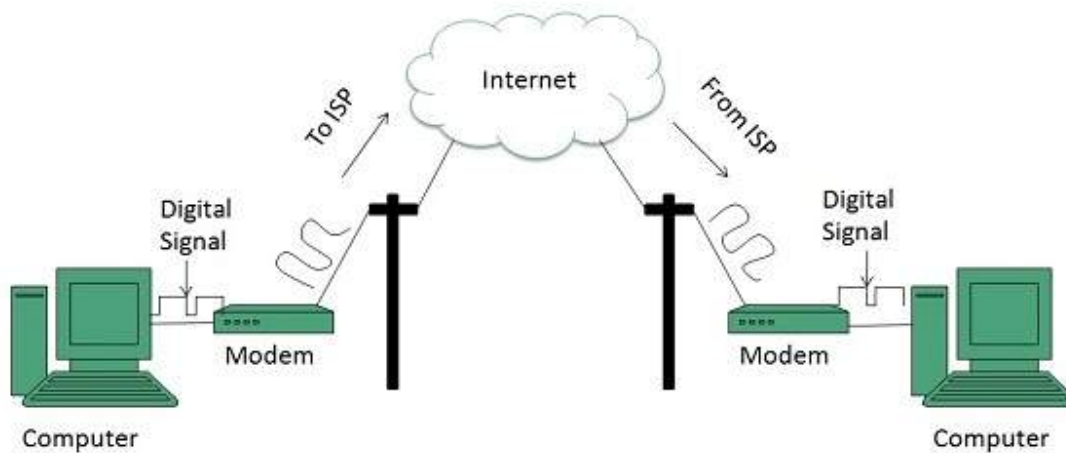
Dial-up connection uses telephone line to connect PC to the internet. It requires a modem to setup dial-up connection. This modem works as an interface between PC and the telephone line.

There is also a communication program that instructs the modem to make a call to specific number provided by an ISP.

Dial-up connection uses either of the following protocols:

1. Serial Line Internet Protocol (SLIP)
2. Point to Point Protocol (PPP)

The following diagram shows the accessing internet using modem:



ISDN

ISDN is acronym of **Integrated Services Digital Network**. It establishes the connection using the phone lines which carry digital signals instead of analog signals.

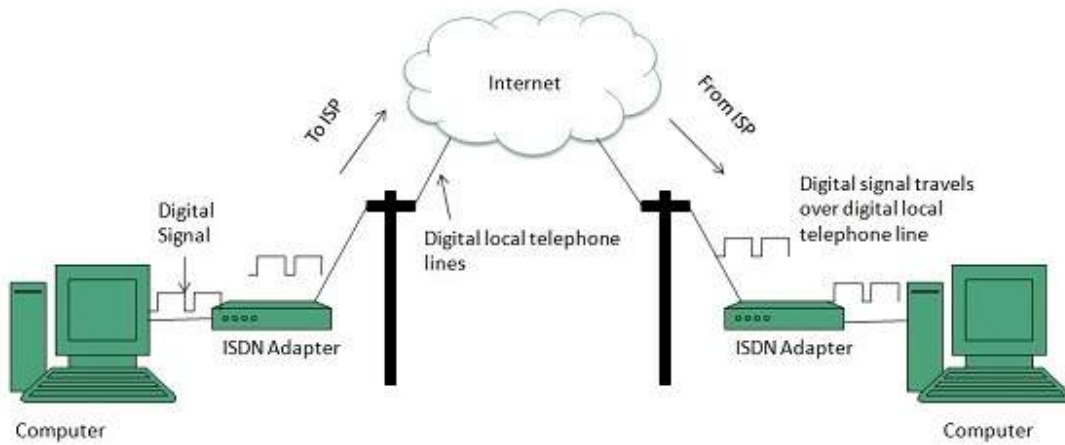
There are two techniques to deliver ISDN services:

1. Basic Rate Interface (BRI)
2. Primary Rate Interface (PRI)

Key points:

- The BRI ISDN consists of three distinct channels on a single ISDN line: two 64kbps B (Bearer) channel and one 16kbps D (Delta or Data) channels.
- The PRI ISDN consists of 23 B channels and one D channels with both have operating capacity of 64kbps individually making a total transmission rate of 1.54Mbps.

The following diagram shows accessing internet using ISDN connection:



DSL

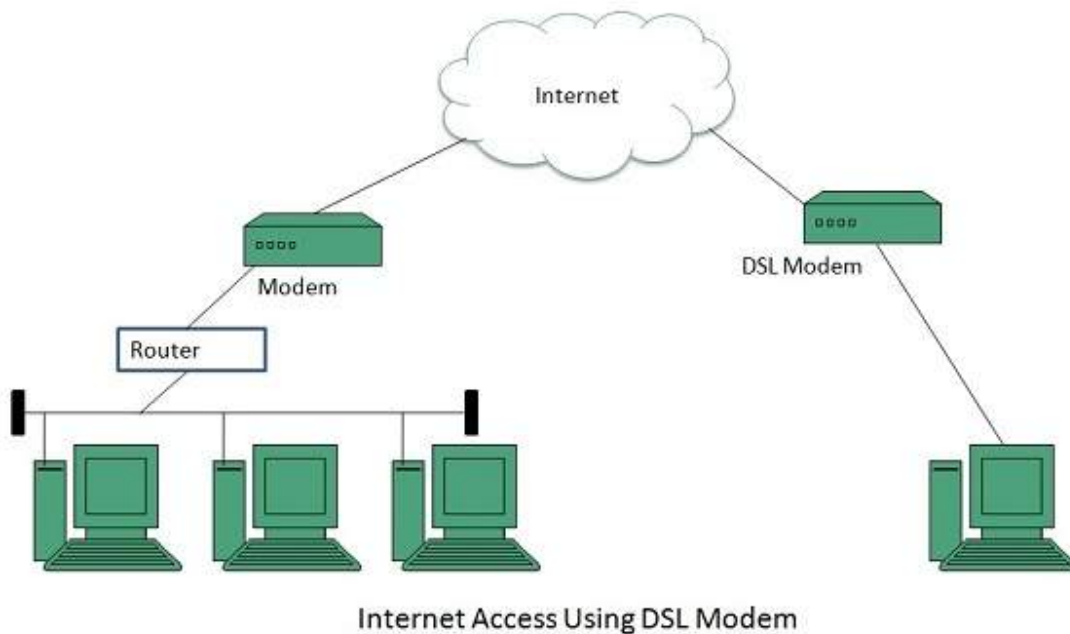
DSL is acronym of **Digital Subscriber Line**. It is a form of broadband connection as it provides connection over ordinary telephone lines.

Following are the several versions of DSL technique available today:

1. Asymmetric DSL (ADSL)
2. Symmetric DSL (SDSL)
3. High bit-rate DSL (HDSL)
4. Rate adaptive DSL (RDSL)
5. Very high bit-rate DSL (VDSL)
6. ISDN DSL (IDSL)

All of the above mentioned technologies differ in their upload and download speed, bit transfer rate and level of service.

The following diagram shows that how we can connect to internet using DSL technology:



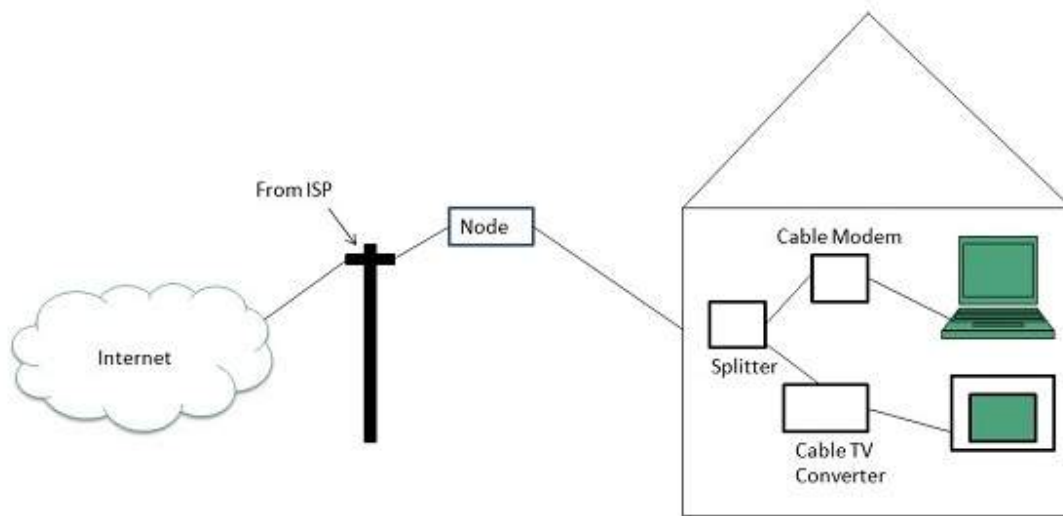
Cable TV Internet Connection

Cable TV Internet connection is provided through Cable TV lines. It uses coaxial cable which is capable of transferring data at much higher speed than common telephone line.

Key Points:

- A cable modem is used to access this service, provided by the cable operator.
- The Cable modem comprises of two connections: one for internet service and other for Cable TV signals.
- Since Cable TV internet connections share a set amount of bandwidth with a group of customers, therefore, data transfer rate also depends on number of customers using the internet at the same time.

The following diagram shows that how internet is accessed using Cable TV connection:



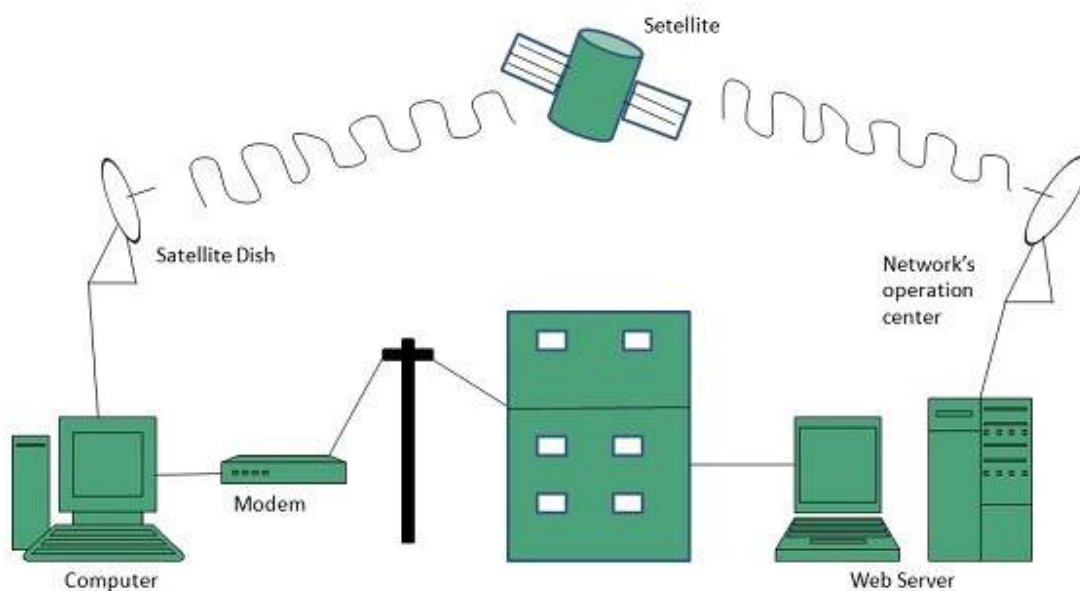
Satellite Internet Connection

Satellite Internet connection offers high speed connection to the internet. There are two types of satellite internet connection: one way connection or two way connection.

In one way connection, we can only download data but if we want to upload, we need a dialup access through ISP over telephone line.

In two way connection, we can download and upload the data by the satellite. It does not require any dialup connection.

The following diagram shows how internet is accessed using satellite internet connection:



Wireless Internet Connection

Wireless Internet Connection makes use of radio frequency bands to connect to the internet and offers a very high speed. The wireless internet connection can be obtained by either WiFi or Bluetooth.

Key Points:

- Wi Fi wireless technology is based on IEEE 802.11 standards which allow the electronic device to connect to the internet.
- Bluetooth wireless technology makes use of short-wavelength radio waves and helps to create personal area network (PAN).