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The Internet for Information and Communication

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Now let's come across with the relevance of internet in ICT. We are in the midst of Information and Communication revolution. The world is rapidly shrinking to a 'global village', which some call a global family. In the merger of telephony, television and computers, a new world of Communications is evolving. What triggered this undreamt of merger is the emergence of Internet through which millions of computers and computer networks connected with each other exchanging information. The word Internet flashes many images upon the canvas of the mind. The applications aspect of Internet is the multitude of different services it offers, example' email, searching information over web, discussion groups etc. The Internet was started as a military network in USA and has undergone tremendous change over a period of time, offering variety of services to the users. The Internet is a huge resource of information that was accessed by millions of users every day, accounts to 100 terra bits of data passes through internet backbone for every minute. As per the ITU (International Telecommunications Union, www.itu.int website) Information, there were 1.13 billion subscribers to Internet in December 2006. India had 6.93 million subscribers and 60 million users of Internet. The Internet penetration figures (the percentage of population using internet) for various countries are interesting. The services and information that Internet provides are increasing at a very fast pace.

We know Internet is simply a worldwide network of computer networks. It is an open inter connection of networks that enables connected computers to communicate with each other. These networks are scattered over the globe, yet are interconnected making it possible to communicate with each other in a few seconds. Internet is not owned by any individual organization or the country; it is a free for all open service facility. It is governed by INTERNIC (Internet Network Information centre). The rise of Internet and the ease of use of Internet have been growing in parallel. Till the early 80's, using the Internet was a complex process of issuing text commands and remembering the complex numeric addresses of the communicating sites. However, its power was obvious. There was no other

method to connect up universities and research labs around the world that was so fast, convenient and flexible. The Internet users at universities came up with the software to participate in discussions over the network. They created documents and software libraries on the network, which were accessible to all users. During this period the Internet remained within the narrow confines of the academic and research lab world. Another development that fuelled the growth of Internet was the birth of Personal Computer or PC in the early 80's. Prior to that research and business, both used huge mainframes or minicomputers. With the prices of PCs coming down more and more, people across the world had their own computers. The demand for connecting these machines with each other gave birth to service provider agencies like Telenet and Computer Serve. Individuals could connect to them and communicate with other users on the same, for a fee. Further, on-line services came with the concept of Bulletin Board Service (BBS), in which individuals connect to another computer for exchange information and sharing software etc. Initially, these private networks, both corporate as well as commercial, had different hardware and software platforms and could not talk to each other, but very quickly, TCP/IP came be used by them. Interconnection of these networks through TCP/IP gave birth to the Internet, as we know it today. All that is required to connect any network or computer with the Internet is the capability to use TCP/IP for exchanging the information.

History of Internet

Let's have a quick look into the background and genesis of Internet. The history of the Internet began with the development of electronic computers in the 1950s. The public was first introduced to the concepts that would lead to the Internet when a message was sent over the ARPANET from computer science Professor Leonard Kleinrock's laboratory at University of California, Los Angeles (UCLA), after the second piece of network equipment was installed at Stanford Research Institute (SRI). Packet switched networks such as ARPANET, Mark I at NPL in the UK, CYCLADES, Merit Network, Tymnet, and Telenet, were developed in the late 1960s and early 1970s using a variety of protocols. The ARPANET in particular led to the development of protocols for internetworking, in which multiple separate networks could be joined together into a network of networks.

In 1982, the Internet protocol suite (TCP/IP) was standardized, and consequently, the concept of a world-wide network of interconnected TCP/IP networks, called the Internet, was introduced. Access to the ARPANET was expanded in 1981 when the National Science Foundation (NSF) developed the Computer Science Network (CSNET) and again in 1986 when NSFNET provided access to supercomputer sites in the United States from research and education organizations. Commercial Internet service providers (ISPs) began to emerge in the late 1980s and early 1990s. The ARPANET was decommissioned in 1990. The Internet was commercialized in 1995 when NSFNET was decommissioned, removing the last restrictions on the use of the Internet to carry commercial traffic. Since the mid-1990s, the Internet has had a revolutionary impact on culture and commerce, including the rise of near-instant communication by electronic mail, instant messaging, Voice over Internet Protocol (VoIP) "phone calls", two-way interactive video calls, and the World Wide

Web with its discussion forums, blogs, social networking, and online shopping sites. The research and education community continues to develop and use advanced networks such as NSF's very high speed Backbone Network Service (vBNS), Internet2, and National Lambda Rail. Increasing amounts of data are transmitted at higher and higher speeds over fiber optic networks operating at 1-Gbit/s, 10-Gbit/s, or more. The Internet's takeover over the global communication landscape was almost instant in historical terms: it only communicated 1% of the information flowing through two-way telecommunications networks in the year 1993, already 51% by 2000, and more than 97% of the telecommunicated information by 2007. Today the Internet continues to grow, driven by ever greater amounts of online information, commerce, entertainment, and social networking. (Source: http://en.wikipedia.org/wiki/history of internet).

Internet as a technology is a tool of very recent origin. United State Department of Defense Advanced Research Project Agency (ARPA) funded its evolution as ARPANET in 1969. The initial intention was simple: to develop geographically dispersed, reliable communication network for military use, that would not be disrupted even in case of partial destruction. That aim was, accomplished by splitting the data being transmitted into small packet which can take different routes to reach their destination. The procedure developed for interconnecting ARPA net computers and communicating the data is called TCP/IP, i.e. Transmission Control Protocol/ Internet protect ARPA net was first confined to organizations and individuals having Government security clearance and working on government contracts. It soon merged with a non-governmental, parallel academic network called Usenet News, launched in 1979, which grew and eventually became known as the Internet. In the late 1980's the American Government through it's agency National Science Foundation (NSF) set up five computer centres, which became the main nodes of the Internet, to which the universities and research labs all over the world got connected. Later the NSF permitted commercial networks to be connected to Internet. In 1984, development of technology and the running of the network were turned over to private sector research and scientific agencies for further development. Now, the internet has emerged as one of the most powerful tools for global communication.

Two other important developments underline the present explosive growth of the Internet. The first took place at CERN, the European high energy physics lab near Geneva. There, in 1990, physicists developed software for publishing, searching and accessing information on the internet, as a way for scientists to share documents with their colleagues at large. This came to be known as the World Wide Web (www). The second occurred at the University of Illinois, where a young student named Marc Andersen developed a graphical browser called Mosaic, to access information from the www. These two developments have captured Internet from the laboratory to the mainstream of life. The use and growth of www has been even faster than the exponential growth of Internet.

Terms used with Internet World Wide Web (WWW)

The World Wide Web (abbreviated as WWW or W3, commonly known as the web) is a system of interlinked hypertext documents accessed via the Internet. With a web browser, one can view web pages that may contain text, images, videos, and other

multimedia and navigate between them via hyperlinks. The terms Internet and World Wide Web are often used in everyday speech without much distinction. However, the Internet and the World Wide Web are not the same. The Internet is a global system of interconnected computer networks. In contrast, the web is one of the services that run on the Internet. It is a collection of text documents and other resources, linked by hyperlinks and URLs, usually accessed by web browsers from web servers. Most web pages contain hyperlinks to other related pages and perhaps to downloadable files, source documents, definitions and other web resources. In the underlying 'HTML, a hyperlink looks like *Example.org,,free encyclopedia*such a collection of useful, related resources, interconnected via hypertext links is dubbed a *web* of information. Publication on the Internet created what Tim Berners-Lee first called the *Worldwide Web* (in its original Camel Case, which was subsequently discarded) in November 1990.(Source: http://en.wikipedia.org/wiki/World Wide Web cite note W90-6) The hyperlink structure of the WWW is described by the web graph: the nodes of the web graph correspond to the web pages (or URLs) the directed edges between them to the hyperlinks. (Source: http://en.wikipedia.org/wiki/world wide web).

World Wide Web is a wide area, hypermedia information retrieval initiative aiming to give universal access to a large universe of documents. Hypermedia is a natural extension of hypertext, in that the contents of each document not only include text but also, images, sounds and video. WWW provides a consistent means to access a variety of information in a simplified manner to the users on computer networks. WWW contains a vast storehouse of hypertext documents written using the Hypertext Markup Language (HTML). Hypertext is a method for presenting text, images, sound, and videos that are linked together in non-sequential web of associations. Hypertext format allows the user to browse through topics in any order. WWW enables the users to view variety of information on any subject in the form of textual material, pictures, audio and videos. The information is also in the form of e-magazines, archives, public and university library resources, current world and business news. It provides a web of interactive documents that contain text, pictures, graphics, multimedia, animations, etc. The hyperlinks provide the links to the resources of the same page, other pages of the web site or the pages belongs to other web sites. The user can navigate through the information by pointing to special designated text or other objects on the screen. These objects link to the other WWW pages on the same server or any other WWW server on the network.

Web Browser

Let's see what a web browser is. A web browser (commonly referred to as a browser) is a software application for retrieving, presenting and traversing information resources on the World Wide Web. An *information resource* is identified by a Uniform Resource Identifier (URI/URL) and may be a web page, image, video or other piece of content. Hyperlinks present in resources enable users easily to navigate their browsers to related resources.

Although browsers are primarily intended to use the World Wide Web, they can also be used to access information provided by web servers in private networks or files in

systems. The major web browsers are Google Chrome, Mozilla Firefox, Internet Explorer, Opera, and Safari. Most major web browsers have these user interface elements in common:

- Back and forward buttons to go back to the previous resource and forward respectively.
- A refresh or reload button to reload the current resource.
- A stop button to cancel loading the resource. In some browsers, the stop button is merged with the reload button.
- A home button to return to the user's home page.
- An address bar to input the Uniform Resource Identifier (URI) of the desired resource and display it.
- A search bar to input terms into a search engine. In some browsers, the search bar is merged with the address bar.
- A status bar to display progress in loading the resource and also the URI of links when the cursor hovers over them, and page zooming capability.

Simply speaking, Web Browser is a software programme, which facilitates to access the information and presents it on the screen and helps in navigation on the internet. The browser provides with powerful and easy to use features that allow taking full advantage of web contents. The browser presents the formatted text, images, sound or other objects such as links in the form of web page on the computer screen. The web browsers also called as "Client" programmes, which takes commands from user and sends requests to "web server" to get information from it and presents it on the browser window. Web browsers give access to special multimedia contents that provide audio, video and interactive web pages. Web browsers were initially designed to interact with the content of World Wide Web. Most browsers now also interact directly with Gopher servers, FTP-sites and other internet tools and systems, thus providing a uniform, easy-to-use interface with many services of the Internet. Browsers can be divided into two basic groups: text mode and Graphic User Interface (GUI). Text-mode browsers are often faster and usable with a variety of hardware and software systems, but they have limitations as they can handle only text i.e. words. The Lynx is the most popular text-mode browser available on Unix based platforms. GUI browsers are easier to learn, faster to control and use. The GUI browsers can perform the same tasks as text-mode browsers. They are accomplished largely through mouse point-and-click operations in keeping with the native interface be it Windows, Macintosh, or X-Windows. The GUI browsers generally have some page-handling features like- the ability to save the page being viewed currently; print the page being viewed currently. Some browsers let you mail a page to yourself or someone else and some will even let you create and mail messages from within the browser. The leading browsers are Microsoft's Internet Explorer, Netscape Navigator and Fire fox.

Web page

A web page (or webpage) is a web document that is suitable for the World Wide Web and the *web browser*. A web browser displays a web page on a monitor or mobile device. The web page is what displays, but the term also refers to a computer file, usually written in HTML or comparable markup language, whose main distinction is to provide

hypertext that will navigate to *other* web pages via links. Web browsers coordinate web resources centered on the written web page, such as style sheets, scripts and images, to present the web page. On a network, a web browser can retrieve a web page from a remote web server. On a higher level, the web server may restrict access to only a private network such as a corporate intranet or it provides access to the World Wide Web. On a lower level, the web browser uses the Hypertext Transfer Protocol (HTTP) to make such requests.

A *static web page* is delivered exactly as stored, as web content in the web server's file system, while a *dynamic web page* is generated by a web application that is driven by server-side software or client-side scripting. Dynamic web pages help the browser (the client) to enhance the web page through user input to the server. Web pages usually include information as to the colours of text and backgrounds and very often also contain links to images and sometimes other types of media to be included in the final view. Layout, typographic and color-scheme information is provided by Cascading Style Sheet (CSS) instructions, which can either be embedded in the HTML or can be provided by a separate file, which is referenced from within the HTML. The latter case is especially relevant where one lengthy style sheet is relevant to a whole website: due to the way HTTP works, the browser will only download it once from the web server and use the cached copy for the whole site. Images are stored on the web server as separate files, but again HTTP allows for the fact that once a web page is downloaded to a browser, it is quite likely that related files such as images and style sheets will be requested as it is processed. An HTTP 1.1 web server will maintain a connection with the browser until all related resources have been requested and provided. Web browsers usually render images along with the text and other material on the displayed web page.

In simpler terms, a Web page is a single unit of information called a hypertext document. A webpage may consist of multimedia content such as text, images, sound and videos. A group of web pages created by one person or a company or organization is referred as web site. A hyper link can be used to link other documents, sounds, images, data bases, e-mail addresses etc. The links contained in web pages can point to areas within the same page, to other pages residing on the same web server, or to pages sitting on a computer on the other side of the world. Hyperlinks are usually underlined and are referred as URL. There is no need to know or type the URL. Each time the mouse moves over these links, the mouse pointer changes to a hand.

How does the Internet Work?

It is really interesting to learn how the Internet works. Internetworking is the practice of connecting a computer network with other networks through the use of gateways that provide a common method of routing information packets between the networks. The resulting system of interconnected networks is called an *internetwork*, or simply an *internet*. Internetworking is a combination of the words *inter* ("between") and networking; not *internet-working* or *international-network*. The most notable example of internetworking is the Internet, a network of networks based on many underlying hardware technologies, but unified by an internet working protocol standard, the Internet Protocol

Suite, often also referred to as TCP/IP. The smallest amount of effort to create an internet (an internetwork, not *the* Internet), is to have two LANs of computers connected to each other via a router. Simply using either a switch or a hub to connect two local area networks together doesn't imply internetworking; it just expands the original LAN. The definition of an internetwork today includes the connection of other types of computer networks such as personal area networks. The network elements used to connect individual networks in the ARPANET, the predecessor of the Internet, were originally called gateways, but the term has been deprecated in this context, because of possible confusion with functionally different devices. Today the interconnecting gateways are called Internet routers.

Yet another type of interconnection of networks often occurs within enterprises at the Link Layer of the networking model, i.e. at the hardware-centric layer below the level of the TCP/IP logical interfaces. Such interconnection is accomplished with network bridges and network switches. This is sometimes incorrectly termed internetworking, but the resulting system is simply a larger, single sub network, and no internetworking protocol, such as Internet Protocol, is required to traverse these devices. However, a single computer network may be converted into an internetwork by dividing the network into segments and logically dividing the segment traffic with routers. The Internet Protocol is designed to provide an unreliable (not guaranteed) packet service across the network. The architecture avoids intermediate network elements maintaining any state of the network. Instead, this function is assigned to the endpoints of each communication session. To transfer data reliably, applications must utilize an appropriate Transport Layer protocol, such as Transmission Control Protocol (TCP), which provides a reliable stream. Some applications use a simpler, connection-less transport protocol, User Datagram Protocol (UDP), for tasks which do not require reliable delivery of data or that require real-time service, such as video streaming or voice chat.

Actually there is no single central server or Computer or organization to make Internet work. All the Computers working independently, at various locations across the globe, are connected by the Internet. The information can be exchanged between these computers over the Internet, irrespective of the architecture of the hardware system, and operating system software working on the computers. It works because they follow the rules framed by the TCP/IP protocol (Transmission Control Protocol/Internet protocol). Because of heterogeneous computers and operating systems, a specific protocol is required, which can connect them into a common platform over internet to exchange the information easily. The TCP/IP is a standard protocol, which works with Internet. TCP/IP performs an important role when the data was sent by a computer. It breaks the data into smaller packets; each packet has three parts, the address where the packet is meant to go, and the data and error control information. The data packets will move to the destination in different paths with the help of the address. At the receiving end the packets were reassembled to get back to the original shape of data. There is no central computer or authority, instead of having the data gone to a central computer and then to its destination. Internet is dependent on the existing infrastructure developed by the telephone companies and Internet Service Providers (ISPs) to transmit the data. Internet service providers lease data circuits from the telephone networks and have dedicated computers at the data centres, network devices such as routers, firewall etc. These relay on the distributed intelligence of

networking equipment known as “Routers”. The content of internet is hosted on a computer known as “web server”. The web servers of data centre of ISP may be owned by the organizations, called as “Co-location” or certain space on the web server may be given to the organizations on lease to host the content. When a request is made of these servers for the information, they bundle the requested information in small packets, with address as to where it is to be sent, and send them to the nearest connection on the Internet. On the Internet, the packets are received by the router, which is nothing more than a traffic controller, and sent it down in the same general direction of the address. A similar thing happens at the next junction on the Internet. This goes on till the packet is-delivered to the right address, where it is put together again with other packets, to make up the original information. Say for example “you are sending a message from ICAR Head Quarters in Delhi to a server named google.com in USA. The message will be broken up into packets of approximately 1500 bytes, and some may travel from MTNL, Delhi ISP to the Google router in the US, some may travel to Hyderabad ISP and then to the Google router and so forth. There is no predetermined path and even individual packets of the same message may follow different paths. It all depends on the traffic at that node, at that moment in time. As the packets reach google.com, they are all put together as in the original message and delivered-to the given address.

Domain Names and Addresses

Let’s look into the terminology of domain name. A domain name (for instance, "example.com") is an identification string that defines a realm of administrative autonomy, authority, or control on the Internet. Domain names are formed by the rules and procedures of the Domain Name System (DNS). Any name registered in the DNS is a domain name. Domain names are used in various networking contexts and application-specific naming and addressing purposes. In general, a domain name represents an Internet Protocol (IP) resource, such as a personal computer used to access the Internet, a server computer hosting a web site, or the web site itself or any other service communicated via the Internet. Domain names serve as humanly memorable names for Internet participants, like computers, networks, and services. A domain name represents an Internet Protocol (IP) resource. Individual Internet host computers use domain names as host identifiers, or host names. Host names are the leaf labels in the domain name system usually without further subordinate domain name space. Host names appear as a component in Uniform Resource Locators (URLs) for Internet resources such as web sites (e.g., en.wikipedia.org).

Networks and computer systems on the Internet can communicate with each other. In order to communicate with each other, every computer on the Internet will be identified as a unique system like telephone numbers. All computers on the Internet have been assigned with an address system called IP address, which is unique number on Internet. These addresses are made up of a sequence of four three digit (decimal) numbers separated by periods. Eg: 164.100.140.2. Each number is in the range of 0 to 255. For example www.google.com is a domain name, which will be identified by the IP address 64.233.189.104. Because IP addresses are not easy to remember, computers are also identified by a name called domain name. A domain name server translates a domain name

into an IP address. This numeric scheme of IP addresses works well for computer systems, but it is difficult for people to remember and type correctly for every Internet site they need to contact. Therefore, Internet sites also have names associated with them. For example, ori.nic.in. Like the IP addresses, domain names are a sequence of words separated by periods. There are at least two words and can have three or more. The collection of networks making up the internet is divided into groups called domains. The domains represent type of organization and geographical location. For example a site in the domain 'edu' would be an educational institution. The domain name will give meaningful information to the users. For example www.nic.gov.in, which will tell that a web site named as 'NIC", owned by the government and belongs to India. An address specified as a domain name is automatically converted to the IP address. e.g. ori.nic.in IP address 164.100.140.2

List of Domains by Type of organization: A list of Domain name types used internationally is given here under:

Domain Type of Organization

.com	Commercial Origination
.edu	Educational Institution
.gov	Government (United States)
.org	Non-profit Organizations
.net	Networks

In India, Centre for Development of Advanced computing, Mumbai (formerly known as National Centre for Software Technology) is one of the Internet Domain Name Registrars. It regulates issue of domain names.

co.in	registered commercial organizations
ac.in	for academic community
res.in	for research institutes
gov.in	for government organizations
net.in	for network service providers
mil.in	for military establishments
org.in	for miscellaneous organizations

The indicator 'in' at the end of all the domain names above indicates that they are registered in India. For other countries there are different identifiers. A list of some well-known countries domain name indicators is given here under:

List of Geographical Domains

Domain	**Country Name**
.in	India
.au	Australia
.ca	Canada
.jp	Japan
.uk	United Kingdom

The two letter country code for all the countries is available at anonymous ftp site rtfm.mit.edu fl in the directory /pub/usenet /news.answers/mail/ and on www at http: //www. ee.ic.ac.uk/misc/country code.html

Internet Connection

Internet access refers to the means by which users connect to the Internet. There are number of ways one can connect to the Internet. An Internet Service Provider (ISP) is a company that provides access to Internet. In general, there are two types of connections offered by Internet Service Provider. They are 1) Dial-up connection 2) direct indirect link (leased line or ISDN line).

Dial-up connectivity

The Dial-up connection is also known as Level Two connection. This provides connection to Internet through a dial-up terminal connection. The computer, which provides Internet access, is known as 'Host' and the computer that receives the access, is 'Client' or 'Terminal'. The client computer uses modem to access a "host" and acts as if it is a terminal directly connected to that host. 56K modem access is now widely available and supported by most ISPs. It allows user to surf the Web at 56 Kbps with graphics. So this type of connection is also known as 'Remote Modem Access' connection. And the host to which the client gets connected is actually connected to the Internet by a full time connection (See Leased Connection). In dial-up connection to Internet, Host carries all the command that are typed on a client machine and forward them to Internet. It also receives the data or information from the Internet on behalf of the 'Client' and passes it to them. The client computer acts as a 'dumb' terminal connected to remote host. This type of connection can further be divided into three categories.

Shell Connection: In this type of Internet Connection, the user will get only textual matter of a Web Page. This connection does not support Graphics display. Shell Accounts were the only type of Internet access available for many years before the Internet entered in to the world of graphics and became more user friendly.

TCP/IP Connection: Today's graphical World Wide Web browsers provide easier access with multimedia sound and pictures. The major difference between Shell and TCP/IP account is that, Shell account can only display text and does not support graphics display, whereas TCP/IP can display both.

ISDN: ISDN (Integrated Services Digital Network) offers Internet connectivity at speeds of up to 128 Kbps through the use of digital phone lines. ISDN is a dial-up service that has been provided by telephone companies for many years.

To access any of these dial-up accounts you need the following:

- Computer
- Modem
- Telephone Connection
- Shell or TCP/IP/ISDN account from the ISP
- Internet client software such as Internet browser

For smaller organizations, to establish link through a dial-up connection, computer calls to ISP over a telephone line. For instance, you might have a communication server on your network that calls the service provider to send and receive any Internet communications. The obvious advantage of service provider is that they are less expensive than establishing your own direct link with the Internet. The drawback is that the bandwidth is limited and the speed also depends on the number of connections accessing the same ISP.

Direct Internet Link

The direct Internet link can be provided in the form of leased line connectivity or ISDN connectivity by the ISP. In this type of connectivity, the organization router directly connects to the service provider with a higher bandwidth limit (64 kbps or 128 kbps or 256 kbps or 512 kbps or 1 mbps etc.) This type link is generally used by larger institutions, corporations and government agencies. It involves establishing internet gateway with a full-time link with the Internet for 24 hours/day. This type connectivity is beneficial to have the maximum traffic and throughput i.e. amount of data transferred with the Internet. The drawback, however, is the cost for band width.

Internet Services

Today the Internet is growing tremendously and is known mainly for the services it provides some of the best-known services available on the Internet including following:

- World Wide Web (www)
- File Transfer Protocol (FTP) service
- Electronic mail
- Discussion groups and News Groups

Let's see the glimpses of each service one by one.

World Wide Web

The term 'WWW' refers to the World Wide Web or simply the Web. The World Wide Web consists of all the public Web sites connected to the Internet worldwide, including the client devices (such as computers and cell phones) that access Web content. The WWW is just one of many applications of the Internet and computer networks.

The World Web is based on these technologies:

- HTML - Hypertext Markup Language

- HTTP - Hypertext Transfer Protocol
- Web servers and Web browsers

Researcher Tim Berners-Lee led the development of the original World Wide Web in the late 1980s and early 1990s. He helped build prototypes of the above Web technologies and coined the term "WWW." Web sites and Web browsing exploded in popularity during the mid-1990s. The World Wide Web (www) is the Internet's multimedia service that contains a vast storehouse of hypertext documents written using the Hypertext Markup Language (HTML). Hypertext is a method for presenting text, images, sound and videos that are linked together in a non-sequential web of associations. The hypertext format allows the user to browse through topics in any order. There are tools and protocols to explore the Internet. These tools help to locate and transport resources between computers.

File Transfer Protocol (FTP)

The 'File Transfer Protocol' (FTP) is a standard network protocol used to transfer files from one host to another host over TCP-based network, such as the Internet. FTP is built on a client server architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves using a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that hides (encrypts) the username and password, and encrypts the content, FTP is often secured with SSL/TLS ("FTPS"). SSH File Transfer Protocol ("SFTP") is sometimes also used instead, but is technologically different. The first FTP client applications were command line applications developed before operating systems had graphical user interfaces, and are still shipped with most Windows, Unix, and Linux operating systems. Dozens of FTP clients and automation utilities have been developed for desktops, servers, mobile devices, and hardware, and FTP has been incorporated into hundreds of productivity applications, such as Web page editors.

File Transfer Protocol (FTP) support is one method of supporting remote Networks. It is a protocol, which allows simple file transfer of documents. There are FTP servers, which provides vast amount of information stored as files. The data in these files cannot be accessed directly; rather the entire file must be transferred from the FTP server to the local computer. The most common protocol used for sending files between computers is the FTP, which allows for transferring both text and binary files. Both Microsoft operating systems and unix system include the traditional character based FTP client. This is one of the utilities that are copied onto the system when the TCP/IP protocol suit is installed. In addition, most Internet browsers such as Microsoft Internet Explorer, Netscape support FTP and use it behind the scenes when transferring files.

E-Mail

E-mail or the electronic mail is the most widely used application on the Internet for sending and receiving electronic messages. It is currently one of the most popular activities on the Internet. Most of the Internet users, have practically replaced other traditional

methods such as telephones, faxes etc. Technically E-mail is a system of delivery of messages on the computer connected via communication networks. E-mail is electronic version of paper mail or letters used to deliver personal and official messages. E-mail used to communicate all types of messages like text, graphics, audio and all visual clips as long as these can be digitized. Hence for all communication, needs e-mail that offers a quicker, cheaper and convenient option. To send e-mail, you must know the recipients' e-mail address. These addresses are composed of the user's identification, followed by the @sign, followed by the locations of the recipient's computer. For example, the e-mail address of an employee of MANAGE is name@manage.gov.in. The last three letters indicate this location is a government sponsored domain on Internet. When you access the Internet through a local service provider, you can exchange e-mail without incurring the long distance charges of telephone call. E-mail has the added advantage of allowing you to access messages at your convenience. You can also send an identical message any number of people at one time.

In government offices and research organizations, most of the communication with the international organizations like the World Bank, Food and Agricultural Organization, United Nations Development Programmers etc. is in form of e-mail. The largest users of e-mail, however, are the students of graduate and post graduate programmes in the universities. The students use e-mail as most efficient method of keeping in touch with their friends (in some other university in India or abroad), getting information on career and academic opportunities and also for seeking information on academic needs.

Discussion Groups and News Groups

Discussion groups and News groups also do have a vital role. Discussion Groups are the virtual networks of Scientists and other stake holders having email interactions/message postings on a common subject. Discussion groups undertake in-depth discussion on email mode. The emerging subject, issue is flagged by one of the group members and then email alert is sent to all the members. An agreed timeframe of one week to 10 days is decided for getting inputs from all the group members and responses are shared among all. Thus, highly focused discussions take place on the internet, without having any physical meeting. Discussion groups a emerging as one of the very effective scientific discussion forums on the internet. The solution exchange supported by United Nations Organizations (UNO) (website address : www.solutionexchange-un.net.in), has proved to an excellent enabler of focused group discussions on highly topical issues like "Sustainable Agricultural Extension Systems", "Spreading the ICT Revolution, in Rural India- Experiences and Examples", "Establishing Rural Business Hubs" during last two years. Over 4000 experts and field managers have participated and contributed / benefited from the discussions. The consolidated responses on all these topics were later published for wider circulation. The solution exchange has organized its discussion forums in following groups: Food and Nutrition Security, Education, Environment, Gender, Health, Poverty, Aids, Decentralization, Disaster Management and ICT for Development. Each community (group) has over 1000 members and most of them contribute to take the discussions highly valuable and problem solving in nature. The community also shares latest developments in the concerned area and news about the emerging trends / issues in national and international arena. Discussion forums are also known as web forums, message boards,

discussion boards, (electronic) discussion groups, discussion forums, bulletin boards with a little variation in information Sharing mechanism. Essentially all these are tools for information-sharing on electronic-platform.

Search Engines and Searching

With over a thousand million pages and continuously increasing information in audio and video form on the World Wide Web, the task of finding precisely what you are looking for is very difficult. Search tools available on the internet make your search tasks easier. Many web based search, engines are available the search return the result of an internet search in a matter of seconds.

The Search Engines are powerful tools as they do the searching for you by following the instructions you give. Search engines search information on the World Wide Web. You need to supply the key words to the search engine and the search engine returns the index of pages, websites, where it finds match with your key words. The more detailed use of keywords, phrases with the combination of Boolean logic + (and), - (or) in your instructions, the more accurate the results will be. Some of the popular search engines are: google, yahoo, altavista, ask.com, gigablast.com, etc.

Agricultural Search Engines

The major search engines for Agriculture domain are:

1. www.agfind.com
2. www.agriculture.com
3. www.agricultureinformation.com
4. www.usagnet.com
5. www.farms.com
6. www.agcareers.com
7. www.produceindustry.com
8. www.usdareports.com
9. www.fruitsearch.com
10. www.producelinks.com

Almost all the above agricultural search engines are developed by US based companies and their focus is accordingly to serve their clientele. Hence, most of the information they search is US based/ hosted. In India as well as in other developing countries majority of the Agricultural scientists, extension Officials use generic search engines like Yahoo, Google, Alta Vista, Khoj etc.

How do Search Engines Work?

The World Wide Web has thousands of millions of pages on the net. You may wonder how your search engines browse through each of them and how does it return the information in such a little time? Secondly, why different search engines return different information for the same given key words? For example a search for the key words

"Agricultural Extension, India" returned 26,60,000 search results in 0.87 seconds on www.yahoo.co.in and the same search returned 21,20,000 search results in 0.15 seconds on www.google.co.in. Further only six out of first 1-10 of the results were common in both the lists. These questions will be answered once we understand how search engines work.

A search engine is a web-based application programme, which acts keywords/phrases submitted by the user. The search engines are support by a well developed database on keywords of web Content. The keywords are indexed and classified. When a user submits the keyword/phrases, the search engine submits to the database as query. The keywords will be searched in the database and the list matched will be returned to computer browser as a search results. The search results will contain a brief description of the word or phrase where it was found, web site address and a URL hyper linked, so that the user can jump to that particular page. There are basically two search methodologies, the search engines use. These are crawler based search methodology, example: google.com, and human powered directory based search methodology, example: yahoo.com. There are two more categories of search engines: combination search results of crawler based and also supported by human-power Dictionaries, example MSN.com, and Meta search engines, which query other search engines and return their top results, example: Ixquick, dog pile.

Crawler Based Search Methodology

Let's see the methodology of Crawler based search. The Crawler based search methodology has three steps or distinct parts. First: the crawler part of the search engine portal crawl, the web sites, i.e. the visit and re-visit the web sites on continuous basis. The "crawler" visits a web-site, reads all the pages (including all the links), and identifies the repetitions of certain words and phrases. The more number of times a word or phrase is found in the web-page or web-site, higher goes its possibility in the search results. Also the words or phrases found in the title of the website or Close to it have higher importance in the search results. The crawler submits these words, phrases to the second part of the search process– The Index. The Index holds all the words, phrases and their locations, with a hyper-link to their actual location, as index and a reference with brief details about the content of the web-site, for potential search query. The Index is giant catalogue which is built upon the information supplied, and updated by the crawler. The third and most important part of the search process is the actual search. The search engine searches the Index created by the crawler and returns the information which matches with the key words supplied by the user, in the order the search engine logic believes is the most relevant to the user. This logic is decided by the search engine development team. Normally top 10 results are returned by most of the search engines on the first return page.

Human-Powered Directory Based Search Methodology

In human-powered directory based search methodology, the web-site owner has to submit their website information including title and brief description to the Directory. For example, you can submit your site information to yahoo.com by simply clicking at "submit your site" hyperlink on yahoo.com search engine page. The directory is maintained by an editorial board at the search engine web-site. The information you submit is validated and

then sometimes edited by the Directory's editors. In the second step of this method, the search engine searches the Directory and returns the information which matches with the key words supplied by the user, in the order the search engine logic believes is the most relevant to the user.

Combination Search Results

Besides pure crawler based and pure Dictionary based search engines, there are some search engines which use a combination of both. For example, the "Live Search" of MSN uses the Look Smart listings. A search on Look Smart results from its own database and also from Inktomi submissions (Directory). Many search engines have agreements with other engines to use their results as primary or secondary listings.

Meta Search Engines

Meta search engine is a search tool that sends user requests to several other search engines and/or databases and aggregates the results into a single list or displays them according to their source. Meta search engines enable users to enter search criteria once and access several search engines simultaneously. Meta search engines operate on the premise that the Web is too large for any one search engine to index it all and that more comprehensive search results can be obtained by combining the results from several search engines. This also may save the user from having to use multiple search engines separately. The term "meta search" is frequently used to classify a set of commercial search engines, see the list of Meta search engine, but is also used to describe the paradigm of searching multiple data sources in real time. The National Information Standards Organization (NISO) uses the terms Federated Search and Meta search interchangeably to describe this web search paradigm. In brief, Meta search engines or Meta crawlers are those search engines that do not maintain their own listings or Directories but query other search engines for results. Examples of Meta crawlers are Ixquick, dogpile, excite.

Using Internet for Searching Agricultural Information

Really speaking, the face-to-face interaction among farmers, extension functionaries and the agricultural research scientists has been the most important process of Agricultural Extension in the developing countries, particularly in India. The system has been very effective and has delivered very good results in many situations. For example, during the Green Revolution period of late 60's, the fortnightly workshops among the farmers, extension functionaries and the agricultural research scientists under the "Training and Visit (T&V)" system were a huge hit and their impact on the production and productivity of major crops, particularly Paddy and Wheat were well documented. The uniformity of the "package of practices" and homogeneity of the farming situations were the main enablers in the Extension process during the early 70s'. Now, with focus to cover all Agro-eco-situations and including value addition and marketing issues as part of Agricultural Extension agenda, the process of Agricultural Extension has become complex. Alternative channels of

access to Agricultural Information have already overtaken the reach of public extension system in India. The access to modern agricultural technology was credited to Television by 9.3 % farmers and to Radio by 13 % of farmers as against only by 5.7 % of farmers to Extension Workers and only 0.7 farmers to the Krishi Vigyan Kendra's (KVKs), (Source: NSSO Report, Government of India, NSSO 2005).

Nowadays, the electronic media has already overtaken the traditional method of outreach. Now with increasing penetration of telephones and "Internet Cafes" in the rural areas the "Cyber Extension" is gaining momentum. There were over 26,000 Internet Kiosks in Rural India in 2006. The Government of India has already declared the "Common Service Centre (CSC)" Project, wherein 1,00,000 Common Service Centres were set-up under Public-Private Partnership mode (during 20O7-2OO8). With this rural infrastructure in place, it is expected that majority of farming community will have access to Internet in very near future. The pilot projects taken up Dr. M.S. Swaminathan Research Foundation (MSSRF), Chennai in Pondicherry providing Internet based information services to 15 villages, by National Informatics Centre (NIC) connecting 45 villages under Warna Wired Village Project in Kolhapur and Sangli Districts of Maharashtra and by ElD parry Ltd, in Cuddalore district of Tamil Nadu by giving Internet connectivity to over 70 Villages in the areas, have demonstrated that the Internet based information services are highly economical and serve the farmers at their door step. The farmers and extension functionaries are browsing the Internet to find the recommended "package of practices", best prices and markets for their produce and also meteorological data to take advance actions. The farmers are searching for the potential markets and customers for their produce not only in India but also overseas. Internet is thus emerging as one of the most important tools to search for Agricultural Information. At the same time, almost all the Agricultural Research and training institutions have started to host and enrich their web-sites with farmer-friendly information. For example, the website of Department of Agriculture Maharashtra www.agri.mah.nic.in is extremely farmer friendly and provides information on issues related to Government support to agriculture with complete information on development schemes, department plans, meteorological forecast and advisory to the farmers. The information is available in English and Marathi languages.

On the research side, almost all the ICAR Institutions have hosted their websites and are in process of putting their farmer-centric information on the sites.

Important Indian Agricultural Web Sites and portals

The addresses of some of the important (50 nos) Indian 'Agricultural Websites' are given below. (Source: MANAGE. 2012. Information and Communication Technologies in Agricultural Information Management and Networking, Training module. pp 1-30.)

1. www.agricoop.nic.in
2. www.indiaagristat.com
3. www.isapindia.org
4. www.carrittmoran.com
5. www.fciweb.nic.in
6. www.fredisurti.com
7. www.indiancommodities.com

8. www.dare.nic.in
9. www.dacnet.nic.in
10. www.agmarknet.in
11. www.indiastat.com
12. www.manage.gov.in
13. www.icar.org.in
14. www.cazri.res.in
15. www.caie.nic.in
16. www.cifa.in
17. www.cife.edu.in
18. www.cpcri.ernet.in
19. www.dryland.ap.nic.in
20. www.crri.nic.in
21. www.iasri.res.in
22. www.iihr.res.in
23. www.spices.res.in
24. www.iisr.nic.in
25. www.nianp.nic.in
26. www.nbagr.ernet.in
27. www.nbfgr.res.in
28. www.nbpgr.ernet.in
29. www.nbsslup.nic.in
30. www.ncap.res.in
31. www.nrcaf.ernet.in
32. www.nrccashew.org
33. www.nrce.nic.in
34. www.iari.res.in
35. www.nrcgrapes.mah.nic.in
36. www.nrcipm.org.in
37. www.nrc-map.org
38. www.nrcmashroom.org
39. www.nrccig.mah.nic.in
40. www.nrcjowar.res.in
41. www.nrcsoya.com
42. www.nrcws.org
43. www.iimahd.ernet.in
44. www.itcibd.com
45. www.esagu.in
46. www.agri.mah.nic.in
47. www.nird.ap.nic.in
48. www.emandi. mla.iitk.ac.in
49. www.nafed-india.com
50. www.iffco.nic.in

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