

Unit III: Enabling Technologies of the World Wide Web

World Wide Web:

WWW is an information system of **Interlinked Hypertext Documents** that are accessed via the Internet. Individual document pages on the WWW are called **web pages** and are accessed with a software application running on the user's computer, commonly called a **web browser**.

Web pages may contain text, images, videos, and other multimedia components, as well as web navigation features consisting of hyperlinks.



Tim Berners-Lee, a British computer scientist and former **CERN (European Organization for Nuclear Research - French: *Conseil Européen pour la Recherche Nucléaire*)** employee is the inventor of the Web.

Abbreviated as Web, WWW, or W3 is a system of internet servers that supports hypertext to access several Internet protocols on a single interface. It is actually a service on the internet and is based on internet infrastructure. Almost every protocol type available on the internet is accessible on the Web i.e. Simple Mail Transfer Protocol (SMTP), File Transfer Protocol (FTP), Telnet, etc. along with its own protocol, the Hypertext Transfer Protocol (HTTP).

The Internet is a massive network of networks, a networking infrastructure. It connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. The World Wide Web, or simply Web, is a way of accessing information over the medium of the Internet. It is an information-sharing model that is built on top of the Internet.

Internet Client-Server Applications:

Several client-server applications are available through which users on internet interact. Basically two classifications in the client-server application: one is the Client Software and the other one is the Server Software. Client Software usually exists on an end-user desktop and provides navigation and display. Server Software usually exists on a workstation or a server-class machine and provides back-end data access services.

Some of the commonly used client-server applications are as follows:

Application	Protocol	Purpose
World Wide Web	HyperText Transport Protocol (HTTTP)	Offers access to hypertext documents, executable programs, and other Internet resources.
E-mail	Simple Mail Transport Protocol (SMTP) Post Office Protocol version 3 (POP3) Multiplepurpose Internet Mail Extensions (MIME) IMAP (Internet Message Access Protocol)	Allows the transmission of text messages and binary attachment across the Internet.
File Transfer	File Transfer Protocol (FTP)	Enables files to be uploaded and downloaded across the Internet. FTP transfers can be performed on the WWW even without special software. Web Browsers can suffice FTP transfers.
Chat	Internet Relay Chat Protocol (IRC)	Provides a way for users to talk to one another in real-time over the Internet. The real-time chat groups are called channels.

		To have access to IRC, IRC software program must be installed. Eg. UNIX/shell: ircll, Windows: mIRC or PIRCH
Usenet Newsgroups	Network News Transfer Protocol (NNTP)	Discussions forums where users can asynchronously post messages and read messages posted by others. Newsreader software is used to read newsgroups.
Interactive Text-oriented Communications	Telnet	Allows users to log into computers on the internet and use online databases, library catalogues, chat services & more.

Software Agents:

Traditional businesses have changed to a new perspective with the electronic business models. To cope with the market competition, the models further need new computational models and infrastructure. **Businesses are now developing a model of inter-organizational e-commerce** according to which different users are represented by autonomous software agents interconnected via the Internet.

The software agents act on behalf of their human users/organizations to perform information gathering tasks, such as locating and accessing information from various sources, filtering unwanted information and providing decision support.

Among a great many other applications, software agents:

- a. Conduct targeted Internet searches.
- b. Check and prioritize incoming e-mail.
- c. Test new computer games.
- d. Fill out e-forms.
- e. Conduct online job searches.
- f. Synchronize social networking profiles.
- g. Assemble customized news reports.
- h. Find good deals in e-commerce.

Information Overload:

Let Us Observe Some Simple Facts:

The number of **worldwide email accounts** continues to grow from over **4.1 billion accounts in 2014 to over 5.2 billion accounts (estimated) by the end of 2018**. The total number of **worldwide email users**, including both business and consumer users, is also increasing from over **2.5 billion in 2014 to over 2.8 billion in 2018**. In 2014, the majority of **email traffic** comes from the business world, which accounts for over **108.7 billion emails sent and received per day**.

Email remains the most common form of communication in the business space. Email use is growing in the business sector and by 2018, **business email will account for over 139.4 billion emails sent and received per day. Business users send and receive on average 121 emails a day in 2014, and this is expected to grow to 140 emails a day by 2018.**

Unfortunately, end-users are often overwhelmed due to the enormous volume of services and information resources. They spend most of their time navigating and sorting through the available data, spending little time interpreting, and even less time actually doing something about what they find. The end result is that much of the data we gather goes unused.

The Other Analytical Fact Is:

The amount of data collected by large enterprises doubles every year. Knowledge workers can analyze only about 5 percent of the data. **Most of the knowledge workers' efforts are** spent trying to discover important patterns in the data **(60 percent or more)**, a much smaller percentage is spent determining what those patterns **mean (20 percent or more)**, and very little time **(10 percent or less)** is spent actually doing something based on the patterns. ***Due to which Information overload reduces knowledge workers' decision-making capabilities by 50 percent.***

What Is The Solution To The Problem Of Data Overload?

Simple solution is to workout with the Software Agents.

Value of Software Agents in Networked World:

A major value of employing software agents with Intranet, Internet and Extranet applications is that they can assist in locating and filtering data. They save time by making decisions about what is relevant to the user. They can sort through the network and the various databases effortlessly and with reliable attention to detail to extract the best data.

Software agents are not limited to hard (quantitative) data; they can also obtain soft data about new trends that may cause unexpected changes (and opportunities) in local or even global markets. With

an agent at work, the competent user's decision-making ability is enhanced with information rather than paralyzed by too much input.

An agent can be an autonomous, (preferably) intelligent, collaborative, adaptive, computational entity. The Intelligent Agent (IA) is an agent which can deal with new and trying new situations. The range of firms and universities actively pursuing agent technology is quite broad and is always ever-growing. It includes small, medium to large multinational organizations.

The software agents have synonyms like Knowbots (i.e. Knowledge-Based Robots), Softbots (Software Robots), Taskbots (Task-Based Robots), Userbots, Robots, Personal agents, Autonomous agents and Personal assistants.

Information access and navigation are today's major applications of software agents in the intranet, Internet, and extranet worlds. There are also other reasons why this technology is expected to grow rapidly:

1. Mundane (Routine) Personal Activity:

In a fast-paced society, time-strapped people need new ways to minimize the time spent on routine personal tasks such as shopping for groceries or travel planning, so that they can devote more time to professional activities.

2. Search And Retrieval:

It is not possible to directly manipulate a distributed database system containing millions of data objects. Users will have to refer the task of searching and cost comparison to agents. These agents will perform the tedious, time-consuming, and repetitive tasks of searching databases, retrieving and filtering information and delivering it back to the user.

3. Repetitive Office Activity:

There is a pressing need to automate tasks performed by administrative and clerical personnel in functions such as **sales or customer support to reduce labour costs and increase office productivity**. Today, labour costs are estimated to be as much as 60 percent of the total cost of information delivery.

4. Decision Support:

There is a need for increased support for tasks performed by knowledge workers, especially in the decision-making area. Timely and knowledgeable decisions made by these professionals greatly increase their effectiveness and the success of their businesses in the marketplace.

5. Domain Experts:

It is advisable to model costly expertise and make it widely available. Expert software agents could model real-world agents such as translators, lawyers, diplomats, union negotiators, and stockbrokers.

Thus the list of tasks to which commercially available agents and research prototypes have been applied includes:

Advising	Alerting	Broadcasting	Browsing
Distributing	Enlisting	Empowering	Explaining
Guiding	Identifying	Matching	Monitoring
Evaluating	Filtering	Navigating	Negotiating
Organizing	Presenting	Querying	Reminding
Reporting	Retrieving	Scheduling	Searching
Securing	Soliciting	Sorting	Storing
Suggesting	Teaching	Summarizing	Translating

This shows that software agents make the networked world less forbidding, and save time by reducing the effort required to locate and retrieve data, and improve productivity by off-loading a variety of mundane, tedious, and mindless tasks. Which thus makes the significant value of software agents in the networked world.

A Typology of Agents:

The software agents can be classified based on their **mobility** as the first classification, i.e. by their ability to move around some networks. So a software agent can be a **static agent or mobile agents**.

The second classification is either *Deliberative or Reactive*:

1. Deliberative (Meaning Purposeful) Agents:

The agents possess an internal, symbolic, reasoning model and they engage in planning and negotiation to achieve coordination with other agents.

2. Reactive Agents:

They can reach their goal only by reacting reflexively on external stimuli, a deliberative agent's internal processes are more complex. The third classification is based on several ideal and primary attributes which they need to exhibit.

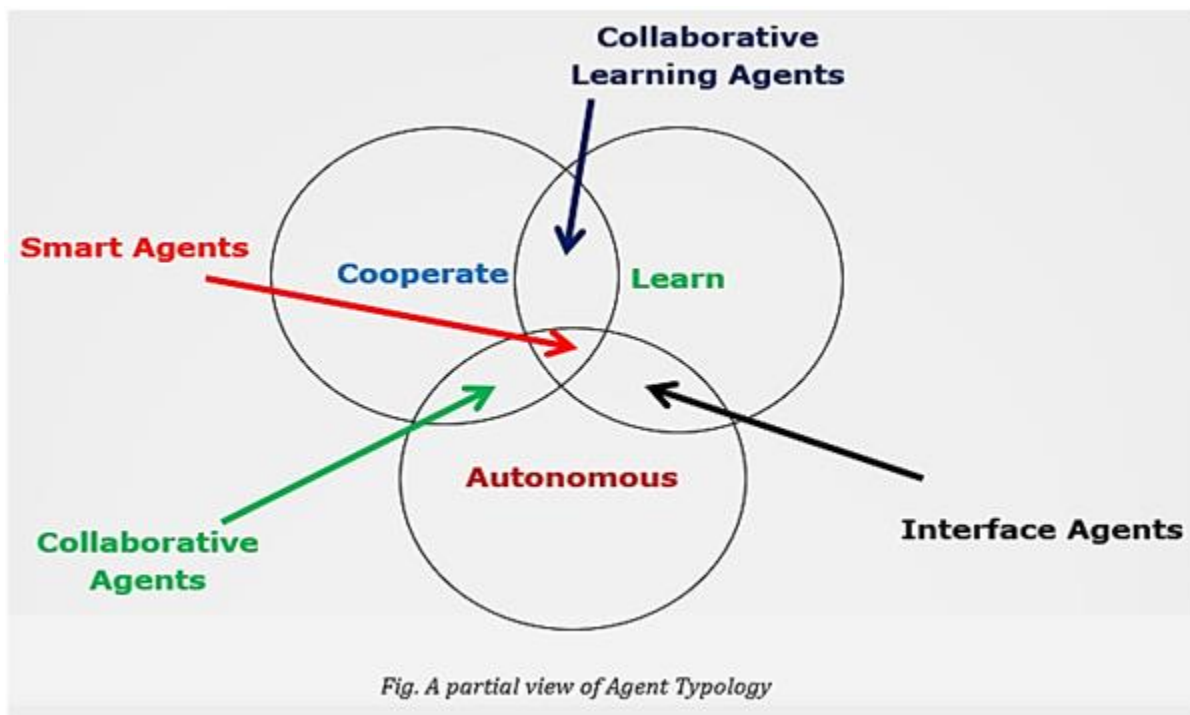
Some of them are Autonomy, Cooperation and Learning:

a. Autonomy refers to the principle that agents can operate on their own without any need for human guidance, even though this would sometimes be invaluable. A key element of autonomy is their **Proactiveness** i.e. an ability to take the initiative rather than acting reactive.

b. Cooperation with other agents is also of great importance. For cooperation, agents need to possess a social ability to interact with other agents and possibly humans via some communication language. It involves multiple agents rather than single agent.

c. Lastly, for agent systems to be truly smart, they need to **Learn** as they react and/or interact with their external environment. **Learning** is a key attribute for any intelligence. Intelligence is gained through ability to learn and learning could further increase the performance as well.

These three minimal characteristics (autonomy, cooperation & learning) could be used to derive four types of agents; *Collaborative Agents*, *Collaborative Learning Agents*, *Interface Agents* and *Truly Smart Agents*.



A Panoramic Overview of the Different Agent Types:

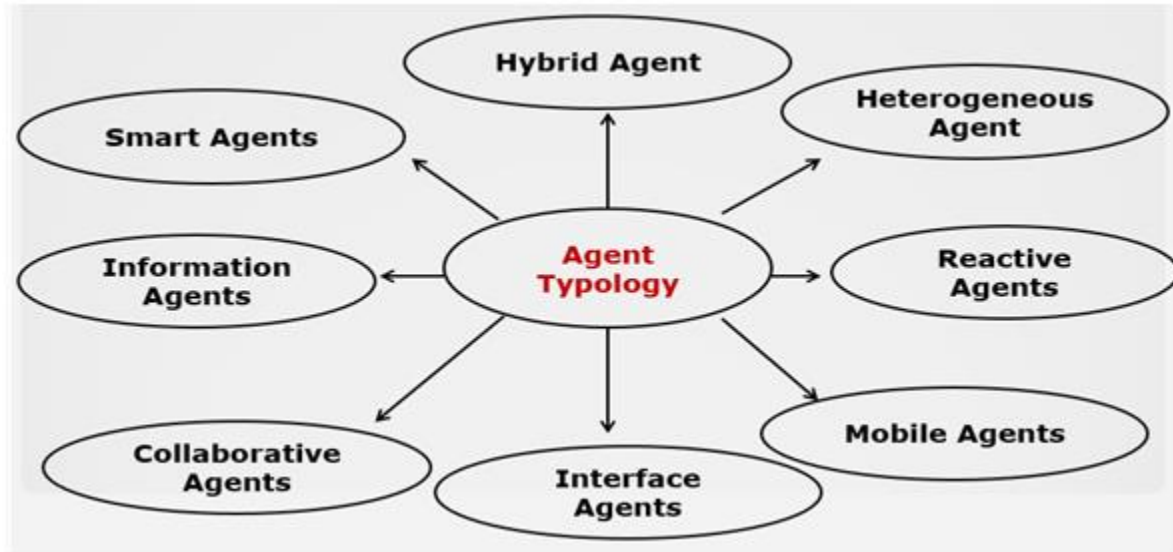


Fig: Classification of Software Agents

1. Collaborative Agents:

Emphasize autonomy and cooperation (with other agents) to perform tasks for their owners. To have a coordinated set up of collaborative agents, they may have to *negotiate* to reach mutually acceptable agreements on some matters. The key general characteristics of these agents include **autonomy**, **social ability**, **responsiveness** and **pro-activeness**. They can act rationally and autonomously in an open and time-constrained multi-agent environment. They tend to be static and large.

The motivation for having collaborative agent systems may include one or several of the following:

- a. To solve problems that are too large for a centralized single agent to do due to resource limitations or the risk of having one centralized system.
- b. To allow interconnecting and inter-operation of multiple existing legacy systems, e.g. expert systems, decision support systems, etc.
- c. To provide solutions to inherently distributed problems, e.g. distributed sensor networks or air-traffic control.
- d. To provide solutions in the form of distributed information sources, e.g. for distributed online information sources.
- e. To provide solutions where the expertise is distributed, e.g. in healthcare provisioning.

f. To enhance **modularity** (which reduces complexity), **speed** (due to parallelism), **reliability** (due to redundancy), **flexibility** (i.e. new tasks are composed more easily due to the more modular organization) and **re-usability** at the knowledge level (hence share-ability of resources).

g. To research into other issues, e.g. understanding interactions among human societies.

2. Interface Agents:

Emphasize autonomy and learning to perform tasks for their owners. The key concept underlying interface agents is that of a *personal assistant* who is *collaborating with the user* in the same work environment, *which is in contrast to the Collaborative Agents which collaborate with other agents*. Collaborating with a user may not require an explicit agent communication language as one required when collaborating with other agents.

Interface agents support and provide assistance, typically to a user learning to use a particular application such as a spreadsheet or an operating system. As for learning, interface agents learn typically to better assist its user in four ways:

- By observing and imitating the user (i.e. learning from the user).
- Through receiving positive and negative feedback from the user (learning from the user).
- By receiving explicit instructions from the user (learning from the user).
- By asking other agents for advice (i.e. learning from peers).

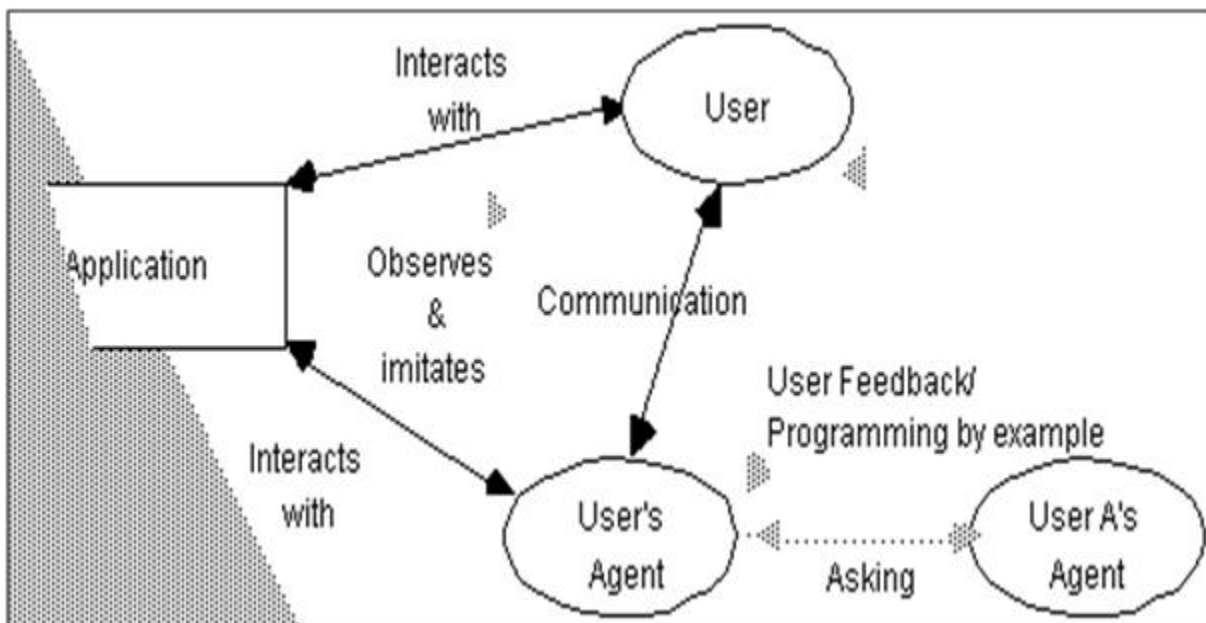


Fig: Interface Agent

3. Mobile Agents:

Mobile agents are computational software processes capable of roaming through WANs such as the *WWW*, *interacting with foreign hosts*, *gathering information on behalf of its owner and coming back home*, *having performed the duties set by its user*. These duties may range from a flight reservation to managing a telecommunications network. Mobile agents are autonomous and cooperative, however, different from collaborative agents.

Benefits:

1. Reduced Communication Costs:

There may be a lot of raw information that need to be examined to determine their relevance. Transferring this raw information can be very time-consuming and clog of the networks. It obviates the need for costly network connections between remote computers. It provides a much cheaper alternative as we pay increasingly for network bandwidth and time.

2. Limited Local Resources:

Processing power and storage on the local machine may be very limited thereby necessitating the use of mobile agents.

3. Easier Coordination:

It may be simpler to coordinate a number of remote and independent requests and only collate all the results locally.

4. Asynchronous Computing:

We can set off our mobile agents and do something else and the results will be back in our mailbox, say, at sometime later. They may operate when we are not even connected.

5. Natural Development Environment:

Provides a natural development environment for implementing free-market trading services. New services can come and go dynamically and much more flexible services may co-exist with inferior ones, providing more choices for consumers.

6. A Flexible Distributed Computing Architecture:

Provides for a unique and innovative way of doing distributed computation.

7. Rethinking On Design Process:

Following on from the latter, it turns the conventional design process on its head, and some truly innovative products should/would emerge out of mobile agent technology.

4. Information / Internet Agents:

Manage the explosive growth of information we are experiencing currently. Information agents perform the role of managing, manipulating or collating information from many distributed sources.

The *motivation* for developing information/internet agents is at least twofold. **Firstly**, there is simply a desired need/demand for tools to manage such information explosion. **Secondly**, there are vast financial benefits to be gained.

They Have Varying Characteristics:

- a. They may be static or mobile;
- b. They may be non-cooperative or social; and
- c. They may or may not learn.

Hence, there is no standard mode to their operation.

5. Reactive Software Agents:

Reactive agents represent a special category of agents which do not possess internal, symbolic models of their environments; instead they act/respond in a stimulus-response manner to the present state of the environment in which they are embedded.

In its simplest form, an agent can react with a direct, predetermined response to a particular event or environmental signal. Typically, the behaviour of a reactive agent is expressed in the form: WHEN event, IF condition(s), THEN action.

They are more robust and fault-tolerant than other agent-based systems. Include flexibility and adaptability.

6. Hybrid Agents:

This approach brings together the strengths of both the deliberative and reactive paradigms. Rather than just sticking to any one of the agent types, hybrid agents refer to those whose constitution is a combination of two or more agent philosophies within a singular agent.

Some criticisms labelled against hybrid software agents and their architectures are: **Firstly**, there are too few applications based on them. **Secondly**, hybrid architectures tend to be very application-

specific, mainly to games and simulations. **Thirdly**, the theory which undermines the hybrid systems is not usually specified.

7. Heterogeneous Agents:

Heterogeneous agent refers to an integrated set-up of at least two or more agents which belong to two or more different agent classes. It may also contain one or more hybrid agents. Incorporates inter-operation of multiple software agents. For inter-operation amongst heterogeneous software agents, it requires an Agent Communication Language (ACL).

Benefits:

- a. Standalone applications can be made to provide value-added services to participate and inter-operate in cooperative heterogeneous set-ups.
- b. The software legacy problem may be amended since it could avoid the need for costly software rewrites, as they are given new leases of life by their inter-operation with other systems.
- c. Agent-based software engineering provides a radical new approach to software design, implementation and maintenance in general, and software interoperability in particular.

8. Smart Agents:

Smart agents are those agents which can learn, cooperate and are autonomous. Though all agents may be called smart, any agent should combine the above three qualities to be called as Smart.

Automotive Network Exchange:

The **Automotive Network Exchange** is the private extranet initially set up and maintained by the Automotive Industry Action, Telcordia, General Motors, Ford, and Chrysler. Built as a private network for the auto industry in 1995 to provide consistent, reliable speed and guaranteed security for data transmissions between the automakers and their suppliers.

Allows trading partners to collaborate electronically on product design and development; request and process orders, and facilitate just-in-time manufacturing and post shipping schedules. In 1999 the Automotive Industry Action Group sold the ANX Network to the Science Applications International Corporation (SAIC). During the next six years, over 4,000 companies joined the ANX Network making it one of the largest extranets in the world.

Intranet & Extranet:

An intranet is a private computer network that uses Internet protocols, network connectivity, and possibly the public telecommunication system to securely share part of an organization's information or operations with its employees. The same concepts and technologies of the Internet such as clients and servers running on the Internet protocol suite is used to build an intranet.

It is not available to the world outside of the Intranet. *If the Intranet network is connected to the Internet, the Intranet will reside behind a firewall.* The firewall helps to control access between the Intranet and Internet to permit access to the Intranet only to people who are members of the same company or organization. Thus an intranet can be understood as "a private version of the Internet", or as a version of the internet confined to an organization.

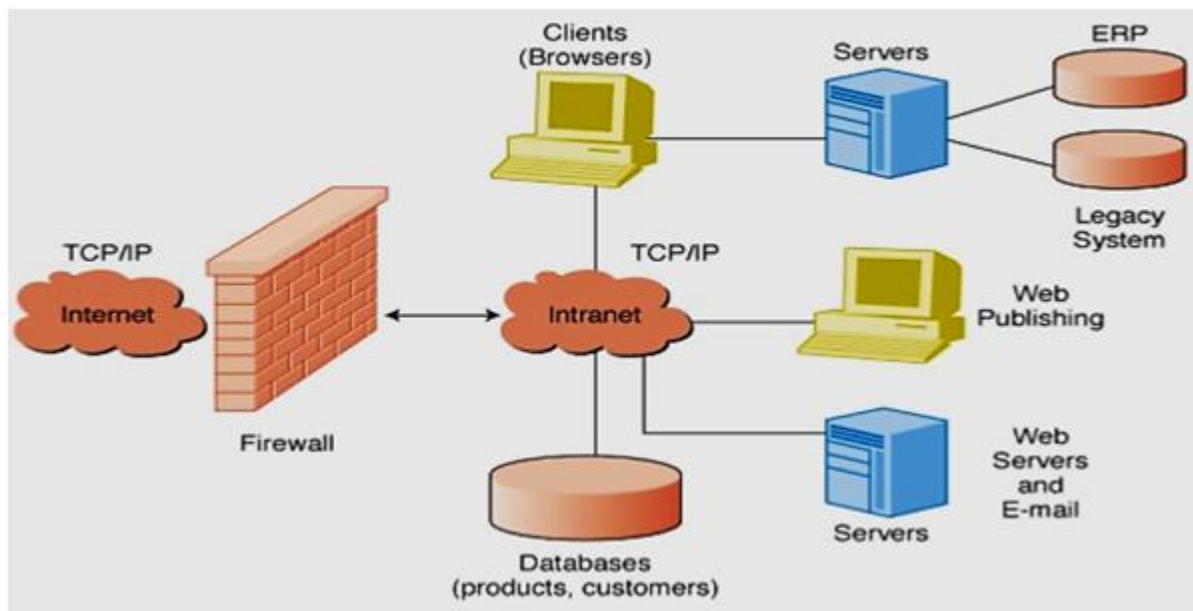


Fig: Architecture of Intranet

An extranet is a private network that uses Internet protocols, network connectivity, and possibly the public telecommunication system to securely share part of an organization's information or operations with suppliers, vendors, partners, customers or other businesses. An extranet can be viewed as part of a company's Intranet that is extended to users outside the company (e.g. normally over the Internet). Thus, it is a private external network.

An Extranet is actually an Intranet that is partially accessible to authorized outsiders. The actual server (the computer that serves up the web pages) will reside behind a firewall. The firewall helps to control access between the Intranet and Internet permitting access to the Intranet only to people who are suitably authorized. Further security is maintained through cryptography & VPN.

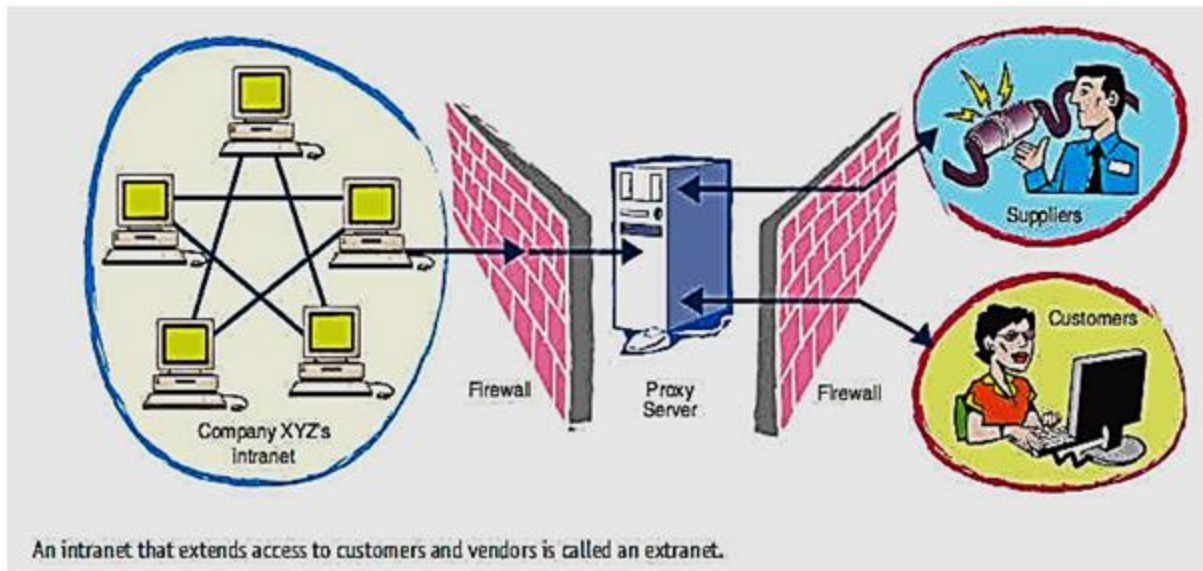


Fig: Structure of Extranet

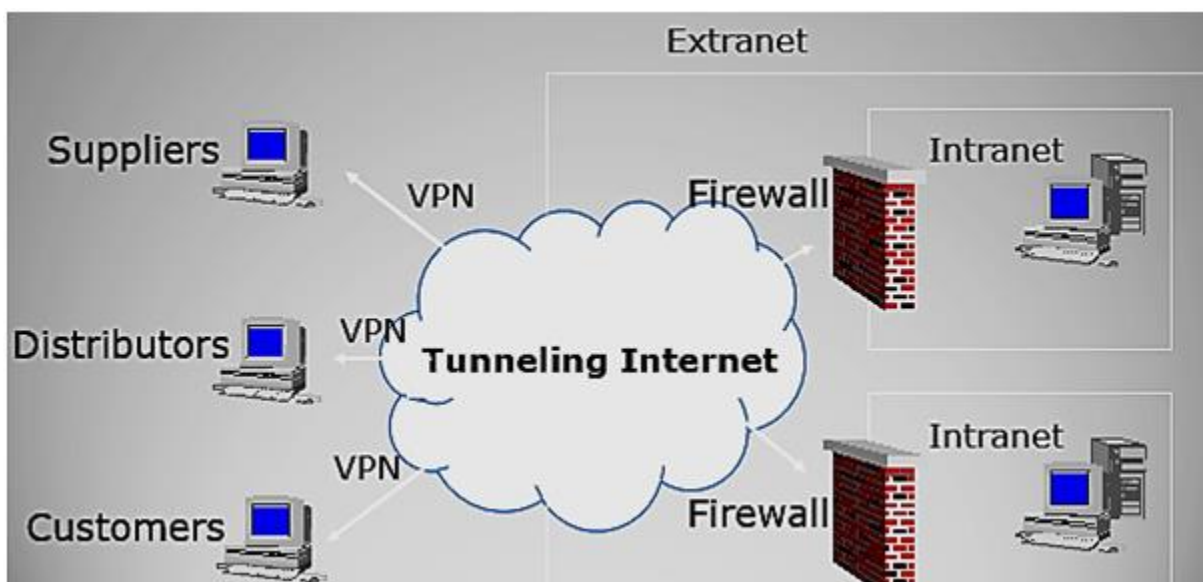


Fig: Architecture of Extranet

Intranet Software:

An intranet is often hosted and maintained on company servers and can only be accessed by internal employees. Companies have the following options to create a company intranet.

Custom Built Intranet:

The first option is to create a customized, in house intranet. Although this approach allows companies to build a highly specialized intranet, it involves;

- a. Huge costs and effort, which makes it unsuitable for growing companies.
- b. Maintenance and upgrade costs that are recurring and very unpredictable.
- c. Expert technical support staff is needed to deploy application code and data backup, software evaluations and upgrades, and bug and security checks.

ASP (Application Service Provider):

The second approach is the *ASP (Application Service Provider) or Software-As-A-Service Approach*. Rather than having to set up in house servers or hire expert staff, and undertake months-long implementation, users can simply access all the tools they need to build their company intranet over the web. This is commonly known as an "**asp intranet**" or "**hosted intranet**" or "SAAS intranet".

Some Of These ASPs Are:

1. HyperOffice:

It is a privately held American corporation based in Rockville, Maryland, that offers web collaboration, online meeting, web conferencing, online database and email marketing applications to the small and mid-sized business segment.

2. Microsoft SharePoint:

SharePoint is a web application framework and platform developed by Microsoft. First launched in 2001, SharePoint integrates intranet, content management, and document management. SharePoint is mostly used by midsize businesses and large departments. By default, SharePoint has a Microsoft Office-like interface, and it is closely integrated with the Office suite.

3. Drupal:

It is a free and open-source content-management framework written in PHP and distributed under the GNU-General Public License. It is used as a back-end framework for around 2.1% of all Web sites worldwide ranging from personal blogs to corporate, political, and government sites including WhiteHouse.gov and data.gov.uk.

4. WordPress:

It is a free and open-source blogging tool and a Content Management System (CMS) based on PHP and MySQL. Features include a plugin architecture and a template system. WordPress was used by more than 23.3% of the top 10 million websites as of January 2015. WordPress is the most popular blogging system in use on the Web, at more than 60 million websites.

Considerations in Intranet Deployment:

Each organization has a unique business, application, and system requirements as well as a unique network infrastructure. So each Intranet is a custom implementation. Deploying an Intranet for our organization should involve many factors such as:

1. Planning:

Good Intranet Implementation requires good planning. For instance, it would be appropriate to decide, the information that is to be made available; the users who would access; content of the home page since the home page represents the organization; the role of administrator; the services that an organization wish to offer and so on.

2. Infrastructure:

Evaluate the Infrastructure of our current systems and design an infrastructure to support the Intranet deployment. One of the greatest advantages of Intranet is that we can split and Share the load on multiple server machines.

For example, we can have our application data on one server, web server on another machine and Mail server on one more machine. The users would be transparent in accessing either of the systems.

We can select the required front-end software like browsers and mail client. We need to have a network operating system that supports TCP/IP, as this protocol is needed for the clients and the servers to get connected to the Intranet. We need to Allocate IP addresses to all the systems that are getting connected to the Intranet as planned.

3. Value Addition:

As we see value through Intranet, we can add features like a Proxy server, a Firewall Server, a DNS Server, Certificate Server, Mailing list server and so on. On the Client side, we shall install HTML editors and Web-enabled office suites of software.

4. The People:

Deploying an Intranet is more of teamwork. It is not the responsibility of any single department's job. Team spirit, openness, trust and sense of sharing contribute to the successful deployment of an Intranet.

5. Administering:

Once the Intranet is deployed and running, we need to administer it effectively. This is a two-part function: First is the maintenance of Servers/nodes & the management of software and adding value by upgrading hardware and software to suit our requirements. Second is creating and updating content on the Intranet.

Applications of Intranet and Extranet:

1. Communication:

Article Publisher: Publishing key news articles to our intranet, extranet or portal audience.

Blogging: Provide regular news style articles to employees who can comment and provide feedback.

Micro-blogging: Just like Facebook and Twitter, display status updates on our intranet to our staff.

Polls: Gather opinions to get feedback on key issues affecting your organization.

Frequently Asked Questions (FAQ): Deliver a searchable bank of common questions by subject or category.

Promotions: Highlight the latest projects and campaigns with the facility to share audio, video and images.

Classifieds: Providing an online marketplace for the buying, selling and swapping of items or services.

RSS (Rich Site Summary) Feeds: Delivering approved RSS feeds of important information into our intranet, extranet or portal. *RSS is a format for delivering regularly changing web content.*

2. Productivity:

Contact Directory: Centrally manage and access our organization's contacts from one location.

Document Management: Manage our organization's documents in a centralized repository.

Forums: Share and collaborate with different employees through secure, internal forums.

Organization Charts: Mapping out our organization's structure delivering a clear hierarchy to our employees.

Event & Resource Manager: Schedule events and manage our organization's shared resources.

Media Library: A centralized repository for all our organization's rich media, including images and video.

Resources and Inventory: Improve the utilization of our shared assets with resource and inventory scheduling.

Site Stats: Providing key insights into the usage of our intranet, extranet or portal.

3. Processes:

CRM (Customer Relationship Management): Monitor, track and record customer related information within our intranet.

Helpdesk: Log, track and monitor both technical and non-technical support requests.

HR Manager: Securely record employee HR records, from the moment they start to the moment they leave.

E-Bulletins: Update staff on the latest intranet news via regular email communications.

E-Learning: Manage the progression of our staff's training through our intranet environment.

Absence Manager: Provide a searchable, self-service environment to record all employee absences.

Team Spaces: Share and collaborate with our teams from their own individual project areas.

Extranet Products & Services:

An extranet can add value to our company by helping us to communicate and collaborate more effectively with clients, customers, and partners. Particularly in the **Business-To-Business** market, an extranet can give our company an edge over the competition and save our money by streamlining traditional business functions and cutting overhead costs. Extranets offer small businesses many other advantages:

1. Increased Productivity:

As we automate processes that were traditionally done manually, bottlenecks will disappear and our company's productivity will increase. Critical information won't get lost in the mail or buried in an e-mail inbox, and busy employees won't miss or forget key events. An extranet can, for example, monitor business activities and trigger specific actions, such as automatically placing an order with a supplier when our inventory drops below a certain level.

2. Reduced Margin Of Error:

An extranet can reduce our margin of error, especially when we use it to give specific groups access to internal applications. This could involve something as simple as giving customers access to their order histories, or something as complex as processing orders from distributors and suppliers.

3. Flexibility:

When we use an extranet to make information and applications available to partners, clients, and customers, everyone can operate when and where it's most convenient. This self-serve approach

frees us from unnecessary meetings and phone tag, and it cuts down on the costs associated with in-person information exchanges. For example, an extranet may allow us to provide customer-service information outside of regular business hours.

4. Timely and Accurate Information:

On an extranet, we can instantly change, edit, and update sensitive information such as price lists or inventory information. Compared to typical paper-based publishing processes, an extranet offers a unique opportunity to get hot information into the right hands before it cools and before it's out-of-date.

5. Shorter Time to Market:

If our business is not moving at "Internet speed," we risk being left behind. An extranet can help us to get our products to market more quickly by making proposals and specifications available to suppliers, and giving clients and partners up-to-date information on current projects.

6. Reduced Inventory:

One of the hallmarks of a **Business-To-Business** extranet is its impact on supply-chain management. By linking our inventory system directly to a supplier, we can process orders as soon as the system knows we need them, thus reducing the stock we keep on hand and making the procurement process more efficient.

7. Build Customer Loyalty:

Extranets make business easier for our customers. The more we make timely, accurate information available to our customers, the more likely it is we will keep their business.

As these examples demonstrate, an extranet can help us spend less on supplies, staffing, and other overhead costs. Given the investment an extranet requires, it may take time for savings to become apparent. For weeks or months, however, eliminating even one paper-based process can yield dramatic savings.

Business Model of Extranet Applications:

An extranet allows us to extend our company intranet to our supply chain. Extranets are an extension of the company network, a collaborative Internet connection to customers and trading partners designed to provide access to specific company information and facilitate closer working relationships.

The way we extend our company network to our extranet partners can vary. For instance, we can use a private network for real-time communication. Or we can leverage virtual private networks (VPNs) over the Internet for cost savings. We can also use a combination of both. However, it's important to realize that each solution has different benefits and security solutions.

A typical extranet solution requires a router at each end, a firewall, authentication software, a server, and a dedicated WAN line or VPN over the Internet.

Typical Extranet Applications:

- a. Supply-Chain Management
- b. Customer Communications
- c. Distributor Promotions
- d. Online Continuing Education/Training
- e. Customer Service
- f. Order Status Inquiry
- g. Inventory Inquiry
- h. Account Status Inquiry
- i. Warranty Registration
- j. Claims
- k. Online Discussion Forums
- l. Secure Connections Through VPNs

Extranet applications are as varied as intranet applications. Some examples are listed above. Extranets are advantageous anywhere that day-to-day operations processes that are being done by hand can be automated. Companies can save time and money in development, production, order processing, and distribution. Improving productivity increases customer satisfaction, which drives business growth.

Managerial Issues:

- a. Are there new business opportunities utilizing the intranet and extranet?**
- b. Consider whether the business requirements can best be met by the intranet or the extranet.**
- c. Consult the technical people inside and outside to find the most secure and economical implementation plan.**
- d. Review the current proprietary or leased network and decide whether it can be replaced by intranet and extranet.**
- e. If we are implementing the technologies of electronic commerce, find out the possible market of intranet and extranet technology, possibly with a business model.**

Architecture of the Internet:

It is by definition a meta-network, a constantly changing collection of thousands of individual networks intercommunicating with a common protocol. The Internet's architecture is described in its name, a short form of the compound word "inter-networking". This architecture is based on the very specification of the standard TCP/IP protocol, designed to connect any two networks which may be very different in internal hardware, software, and technical design. Once two networks are interconnected, communication with TCP/IP is enabled end-to-end so that any node on the Internet has the near-magical ability to communicate with any other no matter where they are. This openness of design has enabled Internet architecture to grow to a global scale.

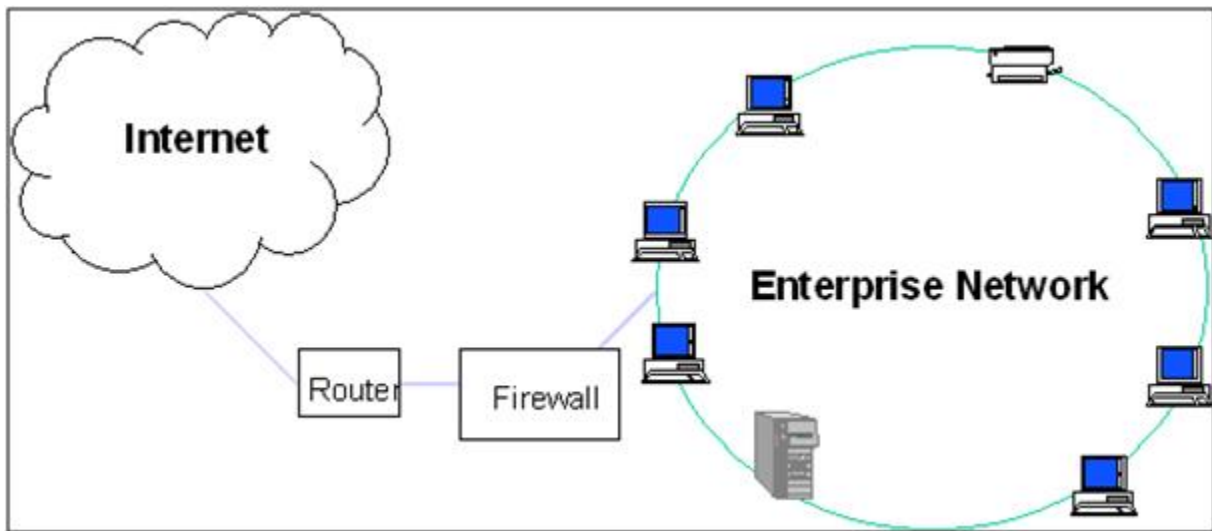


Fig: Architecture of the Internet