MIT 3107
ADVANCED INTERNET TECHNOLOGIES

CHAPTER 1

Introduction to Internet Technologies

Chapter Objectives

- By the end of this chapter, the learner should be able to:

  – Differentiate Web from Internet.

  – Describe the history of Internet.

  – Discuss Web Applications and services.

  – Describe facilities offered by Web browsers.

Introduction

- The World Wide Web has a massive and permanent influence on our lives.

- Economy, industry, education, healthcare, public administration, entertainment – there is hardly any part of our daily lives that has not been pervaded by the World Wide Web, or Web for short.

Introduction

- The reason for this omnipresence lies especially in the very nature of the Web, which is characterized by global and permanent availability and comfortable and uniform access to often widely distributed information producible by anyone in the form of Web pages.

Introduction

- While originally the Web was designed as a purely informational medium, it is now increasingly evolving into an application medium.

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Introduction

- Web applications today are full-fledged, complex software systems providing interactive, data intensive, and customizable services accessible through different devices; they provide a facility for the realization of user transactions and usually store data in an underlying database.

Internet

- The Internet is a huge network of computers, which links many different types of computers all over the world.

- The Internet is basically a collection of computers, all connected together in a big network.

Internet

- This topography provides a delivery mechanism in which a piece of information can take multiple routes from one point to another.

- These multiple routes make the network fairly robust i.e. if one part is missing, information can still travel as long as there are alternative routes.

Internet

- This information typically takes the form of:

  – Requests for information or service

  – Responses containing that information or the result of a service

  – Informational responses i.e. reasons why the service or information could not be delivered

Internet

- The information is exchanged in a client/server model; in other words, clients (users) connect to servers on the Internet and use their resources by placing requests with or without data.

Internet

- Typically, many clients can connect to each server at the same time (concurrently) and cause it to carry out operations on their behalf i.e. as long as the server has capacity.

Internet

- Capacity is measured in two ways:

  – The power of the server and

  – The amount of network resources (bandwidth) available to it.

- Both of these factors will affect the number of users who can connect at the same time while still being able to deliver the services required of it.

Internet

- In the beginning, the Internet was powered by less capable servers than are available today, both in terms of network capacity and computing power.

- Subsequently, most of the content was text only.

Internet

- The servers were not capable of delivering anything more complex, and the interconnected networks were neither fast enough nor reliable enough to allow for the transfer of anything other than plain text.

History of Internet

- The Internet has its root in the ARPANET system of the Advanced Research Project Agency of the U.S department of defence.

- ARPANET was the first Wide Area Network and had only its four sites in 1969.

History of Internet

- The Internet evolved from the basic ideas of ARPANET for interconnecting computers, and was initially used by research organizations and universities to share and exchange information.

History of Internet

- In 1989, the U.S. Government lifted restrictions on the use of the Internet, and allowed it to be used for commercial purposes as well.

History of Internet

- Since then, the Internet has rapidly grown to become the world's largest network.

- It now interconnects more networks, thus allowing many countries around the world to communicate with each other.

Basic Internet Services

- There are 4 basic types of services provided by the Internet to its users:

  – Electronic Mail (E-Mail).

  – File Transfer Protocol (FTP).

  – Telnet.

  – Usenet News.

E-Mail

- Email was one of the first Internet applications to be made available to the general public, and was text only.

- It revolutionized communication possibilities; it had the immediacy of a phone call, but was asynchronous, like a letter.

Electronic Mail (E-Mail)

- It was also cheap, something that mass mailing companies, and less scrupulous individuals, quickly took advantage of.

- It allows an Internet user to send a mail (message) to another Internet user in any part of the world in a near-real-time manner.

Electronic Mail

- The message takes anywhere from a few seconds to several minutes to reach its designation, because it must be passed from one network to another, until it reaches its destination.

Electronic Mail

- E-mail service has many similarities with the postal mail service, which all of us are familiar with.

- All Internet users have an e-mail address, just like postal address.

Electronic Mail

- Each internet user has a logical mailbox.

- When sending a mail to another user, the sender specifies the e-mail address of the receiver.

Electronic Mail

- The e-mail service delivers an already sent mail into the receiver's mail box.

- The receiver extracts the mail from the mailbox and reads it at his/her own convenient time.

Electronic Mail

- After reading the message, the receiver can save it, delete it, pass it on to someone else (forward), or respond by sending another message back (reply).

Advantages of Electronic Mail

- As compared to paper mail, and fax, e-mail is preferred by many because of the following advantages:

  - It is faster than paper mail.

  - Unlike the telephone, the persons communicating need not be available at the same time.

  - Unlike fax documents, e-mail documents can be stored in a computer, and can be easily edited using editing programs.

File Transfer Protocol (FTP)

- Allows an Internet user to move a file from one computer to another on the Internet.

- A file may contain any type of digital information (text, image, artwork, movie, sound, software).

File Transfer Protocol

- Moving a file from a remote computer to ones own computer is known as downloading the file.

- Moving a file from ones own computer to a remote computer is known as uploading the file.

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Telnet

- This service allows an Internet user to log in to another computer somewhere on the Internet.

- That is, a user can execute the telnet command on his/her local computer to start a login session on a remote computer.

- This action is also called remote login.

Telnet

- To start a remote login session, the user types the command telnet and the IP address of the remote computer on the terminal of his/her local computer.

Telnet

- The user then receives a prompt asking him/her to enter a login term (userID) and a password to ensure that the user has the access rights for accessing the remote computer.

Telnet

- If a user specifies a correct login name and password, he/she gets logged in to the remote computer.

Telnet

- Once the login session is established with the remote computer, telnet enters the input mode, and anything typed on the terminal of the local computer by the user is sent to the remote computer for processing.

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Usenet News

- This service allows a group of Internet users to exchange their views/ideas/information on some common topic, which is of the interest to all the members belonging to the group.

- Several such groups exists on the Internet and are called newsgroups.

Usenet News

- A newsgroup is like a large notice board, which is accessible to all the members belonging to the group.

The World Wide Web (WWW)

- The World Wide Web (WWW or just Web) is a collection of linked resources.

- This is the most popular and promising method of accessing the Internet.

- The Web is a system of interlinked hypertext documents that are accessed via the Internet

WWW

- Documents (called pages), images, videos, interactive applets (mini applications), and music (MP3s, for example) are just a few of the resources available to surfers.

WWW

- The main reason for its popularity is the use of a concept called hypertext.

- Hypertext is a new way of information storage and retrieval, which enables authors to structure information in novel ways.

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WWW

- An effectively designed hypertext document can help users rapidly locate the desired type of information from the vast amount of information on the Internet.

- Hypertext documents enable this by using a series of links.

WWW

- A link can be shown on the screen in multiple ways, such as labelled button, highlighted text, or different colour text than normal text, or author-defined graphic symbols.

WWW

- *A* link is special type of item in a hypertext document, which connects the document to another document that provides more information about the linked item.

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WWW

- Hypertext documents on the Internet are known as Web Pages.

- Web pages are created using a special language called HyperText Markup Language (HTML).

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Servers and Protocols

- www doesn't work by magic, and it is useful to have a handle on the underlying technologies to better understand how Web programming works in practice.

- The Web is still a client/server environment, based on requests and responses.

Servers and Protocols

- These conversations between the browser and the server needed a standard framework for communication, and some protocols were established in order to provide a standard way to exchange information.

Servers and Protocols

- Most frequently used protocols are:

  - HTTP (HyperText Transfer Protocol).

  - FTP (File Transfer Protocol).

  - MIME (Multipurpose Internet Mail Extensions) for the exchange of emails.

Servers and Protocols

- The WWW uses the client-server model, and an Internet protocol called HyperText Transport Protocol (HTTP) for interaction between the computers and the Internet.

Servers and Protocols

- Any computer on the Internet, which uses the HTTP, is called a Web Server, and any computer, which can access that server, is called a Web Client.

Servers and Protocols

- The Web server itself is just a piece of software that runs on the machine and processes the requests through the network interface.

- Usually, the Web server software (Apache, Microsoft IIS, and so on) and associated applications are the only things running on the server.

Servers and Protocols

- Other applications might include an email server and an FTP server.

- FTP (File Transfer Protocol) is used for browsing the file system of a remote store and downloading from or uploading items to that store.

- FTP client applications can be graphical (looking like Windows Explorer) or text based.

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Servers and Protocols

- To be used as a web client, a computer needs to be loaded with a special software tool, which is known as WWW browser (or simply browser).

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Servers and Protocols

- The protocols also provide for a set of standard responses that allow the browser to display appropriate information in the event that the requests cannot be fulfilled.

Servers and Protocols

- Surfing is the process of navigating the Internet to search for useful information.

- Browsers normally provide navigation facilities to help users save time when they are jumping from server to server while surfing.

Servers and Protocols

- An HTTP server, for example, provides facilities for storing and retrieving documents and other artifacts based on their URL (Universal Resource Locator).

- It can reply to a request in a number of ways, usually with a numerical code.

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Servers and Protocols

- The most common of these codes are:
  - 200—Everything okay, usually followed by the information requested
  - 404—Resource not found, usually an incorrect URL
  - 500—Server error, a problem on the server

Servers and Protocols

- There are secure variants on the HTTP and FTP protocols, called HTTPS (HTTP Secure) and SFTP (Secure FTP).

- These allow the exchange of information through an encrypted channel rather than the plain text usually employed between the client and server applications.

Search Engines

- Given the sheer volume of documents and artifacts on the Web, it became imperative that users had a way to find out what was available.

- This required that there was some kind of service capable of both indexing and retrieving locations for information based on their content.

- These became known as search engines.

Search Engines

- A search engine is a Web based service that allows consumers to locate artifacts on the Internet as a whole.

  – E.g. Google, Yahoo, MSN, Altavista, e.t.c

Search Engines

- Historically, searching the Internet started out as a way to search through catalogs of possible information based on the filenames and directory entries in the Gopherspace, which was based around hierarchical menus.

- In the beginning, searching relied on the descriptions given by the authors.

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Search Engines

- When full-text search was introduced, the search mechanism become a little more accurate, allowing everything from library catalogs to documentation repositories to be searched by anyone with an Internet connection.

Search Engines

- Finally, Web searching became more sophisticated i.e. searching deeply in sites by indexing them in their entirety.

- This allowed consumers to find information based on the content, rather than just a loose description of what the author intended the page to contain.

Search Engines

- Given the volume of information available on the Web, the search engine has become a vital part of the producer-consumer relationship.

- Search engines are the only way that surfers (the consumers) can often locate information that interests them.

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Search Engines

- Ideally, you might want these searches to happen in real time, but since this is not really feasible, searches results are based on pre-indexed copies.

- Each indexing session builds a database that can be searched on demand, with pages returned that fit the query made by the surfer—based on the evaluation of an algorithm usually proprietary to the search engine itself

Search Engines

- In order to keep the database fresh, search engines need to update their databases from time to time.

- This is either done automatically, by a robot that trawls the Web for changes (the Google approach), or when producers informs the search engine that they have added something to the collection of pages that make up the Web.

Search Engines

- This is known as site submission, and has grown from being a formality into something of a commercial opportunity.

- SEO (Search Engine Optimization) consultants can charge a premium fee to help individuals and companies obtain a good ranking in the results pages.

Search Engines

- These rankings are based on the evaluation of the algorithm with respect to the rules that the search engine applies to evaluate the relevancy of the information contained in the database.

- With such a large number of pages, honing the submission and content submitted has become somewhat scientific.

Search Engines

- With the popularity of the Web, getting found has become increasingly difficult; more often than not, pages find themselves pushed down the Search Engine Result Pages (SERPs) and therefore not immediately visible to consumers.

- So, search engines are important.

Search Engines

- However, visibility in the search engines is only part of the marketing strategy that gets the page the attention it deserves.

- Marketing Web pages also includes creating other ways to attract traffic, if that is the aim of the site.

- Unsurprisingly, it usually is (the Web is), for many people, first and foremost a business opportunity.

Internet Service Providers (ISPs)

- The first to really benefit from the opportunity might arguably have been the Internet service providers (ISPs).

- Without them, there would be no email, Web hosting, or even Web surfers to try to attract.

Internet Service Providers (ISPs)

- The ISP's role is to give Web surfers the possibility to access the Internet using equipment that is available off the shelf.

- Running a network capable of tapping into the Internet is an expensive proposition; not many people can afford to run a network connection directly to their home.

Internet Service Providers (ISPs)

- The backbone of the Internet relies on connecting ISPs and other entry points together using a variety of different networking solutions.

- ISPs provide an entry point as well as, usually, a routing point for network traffic.

Internet Service Providers (ISPs)

- Originally, the role of the ISP was just to provide basic connectivity and email.

- The ISP would run an email server (receiving and storing email), and possibly offer a gateway into other services.

Internet Service Providers (ISPs)

- For example, Usenet newsgroups were among the first mass communication and publishing platform (or forum).

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Web Hosting

- Web hosting providers (Web hosts) provide a place for consumers to store pages designed to be consumed by the Web surfing public.

- ISPs often offer Web hosting services along with their standard connectivity packages.

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Web Hosting

- The kind of package that you will receive will be, as a minimum, an all-in-one HTTP and FTP server with email i.e. HTTP gives you the possibility to offer Web pages over the Internet, and FTP gives you the possibility to upload pages to the server so that they can be shared with the Web at large.

Web Hosting

- In the early days, having a domain name (the bit commonly ending in .com, .net, or .org) was an expensive and technically challenging proposition.

- However, the price and ease with which the domain can be registered and used has reduced dramatically.

Web Hosting

- Domain names are centrally managed and distributed under license.

- Different countries have different policies and registrars, all working to set rules, but all charging different fees for the privilege.

Web Hosting

- All that you need to make sure of is that the registration happens in your name, and that you have the right to update the DNS record at will.

Web Hosting

- The DNS record points your domain name to your Web hosting provider.

- The DNS system is a distributed database that is updated automatically by propagation.

Web Hosting

- This means that specific servers (DNS servers) maintaining lists of domain names and IP addresses are propagated across the Internet, thus allowing traffic to be correctly directed.

- Without the IP address, it is impossible to correctly send data to, or receive data from, a server on the Internet.

Web Hosting

- But a IP dotted number is not very user friendly, so we also need some way to connect a friendly name (the domain name) to the IP address.

- That is the role of the DNS (email has a similar mechanism known as MX—mail exchange) and the final IP address that the domain name resolves to is the address of the Web host.

Web Hosting

- One host can have many domain names pointing to it; that is all part of the service.

- It is important to realize that, under normal circumstances, one server hosts many different sites.

- This helps to keep the price reasonable, while providing a good range of services.

Web Hosting

- Client machines then connect to the host either to download or upload files.

- Downloading is usually associated with browsing the Websites, and uploading is, as mentioned, the act of placing those files (pages) on the server for others to browse.

Web Hosting

- Static pages make up a large proportion of the content available on the Web, but increasingly producers are taking advantage of other Web hosting services that allow for interactive sites to be built.

Web Hosting

- Web hosts vary enormously in terms of interactive services provided and the quality of those services.

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Web Hosting

- Not all of these facilities will be available on all Web hosts. Even where they are, there are different levels of service that are provided.

- Some might limit the bandwidth (amount of data that can be transferred in a given month), others might allow only a single database of a limited size, and many don't provide scripting or databases at all.

Web Hosting

- To get a good mix of services that can be used in a production environment i.e. expecting to have a certain volume of data transfer and a robust service, it is often necessary to pay a monthly fee.

Web Hosting

- Free Web hosts exist, usually requiring that the user suffer some form of advertising, which is perfectly acceptable for learning purposes.

- Advertising is as much a part of the Web ethos as search engines are.

Browser Navigation Facilities

- No remote login.

- A user specify Uniform Resource Locator (URL).

- Personal hotlist of favourite URLs.

- History Feature.

- Downloading.

No Remote Login

- Unlike FTP and Telnet, browsers do not require a user to remotely log in to a server computer, and then to log out again when the user has finished accessing information stored on the server computer.

Uniform Resource Locator (URL)

- Browsers allow a user to specify an URL address of a server computer to facilitate the user to directly visit the server computer's site, and to access information stored on it.

- URL is an addressing scheme used by WWW browsers to locate sites on the Internet.

Personal Hotlist of favourite URLs

- Browsers allow a user to create and maintain a personal hotlist or favourite hotlist of favourite URL addresses of server computers, which the user is likely to frequently visit in future.

- A user's hotlist is stored on his/her local web client computer.

Personal Hotlist of favourite URLs

- Browsers provide hotlist commands to allow the user to add, delete, update URL addresses in the hotlist, and to select an URL address of a server computer from the hotlist, when the user wants to visit that server computer.

History Feature

- Many browsers have a "history" feature.

- These browsers maintain a history of the server computers visited in a surfing session.

History Feature

- That is, users save (cache) in the local computer's memory, the URL addresses of the server computers visited during a surfing session, so that if the user wants to go back to an already visited server later on (in the same surfing session), the link is still available in the local computer's memory.

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Downloading Information

- Browsers allow a user to download (copy from a server computer to the local computer's hard disk) information in various formats.

- The download information can be later (not necessarily in the same surfing session) used by the user.

Uses of Internet

- Online Communication.

- Software sharing.

- Exchange of views of topics of common interest.

- Posting of information of general interest.

- Product promotion.

Uses of Internet

- Feedback about products.

- Customer support service.

- Online journals and magazines.

- Online shopping.

- Worldwide video conference

Online Communication

- The Electronic mail service on the internet is extensively used by computer users around the world to communicate with each other.

- With this facility, the Internet has proved to be a rapid and productive communication tool for millions of users.

Software Sharing

- The Internet provides access to a large number of shareware software development tools and utilities.

- A few examples of such shareware tools are compilers, code libraries, mail servers, and operating systems.

Exchange of views on topics

- The Internet has a number of newsgroups.

- Each allows a group of users to exchange their views on some topic of common interest.

Posting of information of general interest

- The Internet is also being extensively used as a large electronic bulletin board on which information of general interest can be posted to bring it to the attention of interested users around the world.

Posting of information of general interest

- Some commonly posted information includes:

  – Career opportunities.

  – Conference and event announcements, and

  – Calls for papers and journals.

Product Promotion

- Several commercial organizations are effectively using the Internet services for promoting their products.

- These organizations make use of www server sites, which are focussed on disseminating timely information about corporate happenings, product announcements, recent strategic alliances, press releases, and other information of potential interest to existing and prospective customers.

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Feedback about Products

- Commercial organizations are also using the internet to gather information about user satisfaction of existing products, market opportunities of new products, and ideas for potential new products.

Customer Support Service

- Many organizations are also using the Internet to provide timely customer support.

- The combined electronic mail, FTP, and other services on the Internet provide all of the enabling tools necessary to provide such first-rate customer support.

Online Journals and Magazines

- The Internet has now literally thousands of electronic subscriptions, which can be found both for free and low cost.

- There are many WWW sites on the Internet, which deal with electronic versions of many journals and magazines.

Online Shopping

- The Internet has also facilitated the introduction of a new market concept, which consists of virtual shops.

- These shops remain open 24 hours all the year round, and are accessible to purchasers all round the world.

- They provide information about products or services for sale through WWW servers.

Online Shopping

- Using the Internet services, customers submit specific product queries and request specific sales quotes.

Online Shopping

- Through a well-defined authorization and authentication scheme, the Internet Services are then used to accept orders placed by customers, to handle order payments, and to track orders to fulfilment E.g amazon.com

Worldwide Video Conferencing

- This is an emerging service on the Internet, which allows a group of users located around the globe to talk and interact with each other as if they were sitting and discussing in a single room.

Worldwide Video Conferencing

- The parties interacting can see each other on their computer screens and can hear each other's voice through a special audio-device fixed in their computers.

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World Wide Web Consortium (W3C)

- This is an organization devoted to developing nonproprietary, interoperable technologies for the WWW.

- One of the W3C primary goals is to make the web universally accessible, regardless of ability, language or culture.

World Wide Web Consortium (W3C)

- W3C is also a standardization body.

- Web technologies standardized by W3C are called Recommendations.

World Wide Web Consortium (W3C)

- Recommendations:

  – Extensible Hypertext Markup Language (xHTML).

  – Cascading Style Sheets (CSS).

  – HyperText Markup Language (HTML).

  – Extensible Markup Language (XML).

Hardware Trends

- The Internet community thrives on the continuing stream of dramatic improvements in hardware, software and communication technologies.

- Generally, people expect to pay at least a little more for most products and services every year.

Hardware Trends

- The opposite generally has been the case in the computer and communications fields, especially with regard to hardware costs of supporting these technologies.

- Recently, hardware has been moving more and more toward mobile, wireless technology.

Hardware Trends

- Small hand-held devices are now more powerful than the supercomputers of the early 70s.

- Portability has become a major focus for the computer industry.

Hardware Trends

- Wireless data transfer speeds have become so fast that many Internet users' primary access to the Web is through local wireless networks.

Key Software Trend

- Hardware costs have been declining rapidly in recent years, to the point that personal computers have become a commodity.

Key Software Trend

- Unfortunately, software development costs have been rising steadily as programmers develop even more powerful and complex applications without significantly improving the underlying technologies of software development.

Key Software Trend

- Objects are essentially reusable software components that model real-world items.

- Software developers are discovering that using a modular, object-oriented design and implementation approach can make software development groups much more productive than was possible with previous popular programming techniques.

Browser Portability

- Ensuring a consistent look and feel on client-side browsers is one of the great challenges of developing Web-based applications.

- Currently, a standard does not exist to which software developers must adhere when creating Web browsers.

Browser Portability

- Although browsers share a common set of features, each browser might render pages differently.

- Browsers are available in many version and on many different operating systems platforms.

Browser Portability

- Vendors add features to each new version that result in increased cross-platform incompatibility issues.

Web Applications

- Web-based systems and applications now deliver a complex array of functionality to a large number of diverse groups of users.

- As our dependence and reliance on the Web has increased dramatically over the years, their performance, reliability and quality have become paramount importance.

Web Applications

- As a result, the development of Web applications has become more complex and challenging than most of us think.

- The World Wide Web and the Internet have drawn the general populace into the world of computing.

Web Applications

- We purchase stock and mutual funds, download music, view movies, get medical advice, book hotel rooms, sell personal items, schedule airline flights, meet people, do our banking, take college courses, buy groceries—we do just about anything and everything in the virtual world of the Web.

Web Applications

- Arguably, the Web and the Internet that empowers it are the most important developments in the history of computing.

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Categories of Web Applications

- Web applications have varying degrees of complexity.

- They may be purely informational or handle full-size/full-fledged 24/7 e-commerce applications.

- Web applications can be categorized depending on their development history and their degree of complexity.

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Categories of Web Applications

- There is a correlation between the chronology of development and complexity.

- Workflow-based applications, for example, are transaction-based, i.e. the higher level of development requires the previous development of a less complex category.
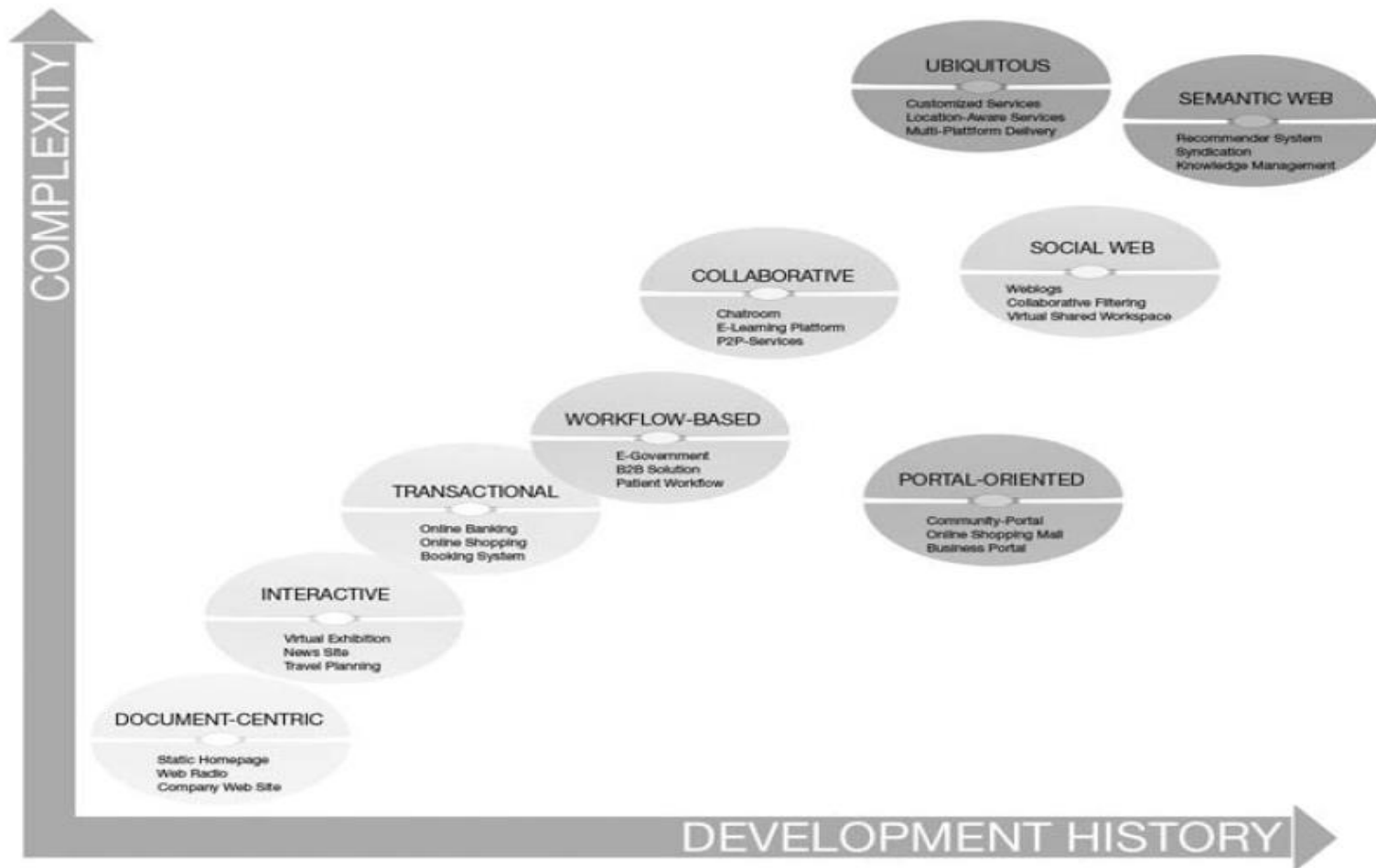
Categories of Web Applications

- However, there may be exceptions to that rule in that some of the categories (e.g. the portal-oriented applications) are historical rather recent while having a lower degree of complexity.

Categories of Web Applications

Categories of Web Applications

- The different categories of Web applications cover many traditional fields of application, such as online banking, but that at the same time completely new fields of application are created, such as location-aware services.

Categories of Web Applications

- Document centric Web sites

- Transactional Web applications.

- Workflow-based Web applications

- Collaborative Web applications.

- Portal-oriented Web applications.

- Ubiquitous Web Applications

- Semantic Web.

Document centric Web sites

- These Web sites are the ancestor to Web applications.

- Web pages are stored on a Web server as ready-made, i.e. static, HTML documents and sent to the Web client in response to a request.

Document centric Web sites

- These Web pages are usually updated manually using respective tools.

- Especially for Web sites requiring frequent changes or for sites with huge numbers of pages this is a significant cost factor and often results in outdated information.

Document centric Web sites

- Additionally, there is a danger of inconsistencies, as some content is frequently represented redundantly on several Web pages for easy access.

Document centric Web sites

- The main benefits are the simplicity and stability of such Web sites and the short response time, as the pages are already stored on the Web server.

- Static homepages, webcasts, and simple web presences for small businesses belong in this category.

Document centric Web sites

- A webcast is a media presentation distributed over the Internet using streaming media technology to distribute a single content source to many simultaneous listeners/viewers.

Document centric Web sites

- A webcast may either be distributed live or on demand.

- Essentially, webcasting is "broadcasting" over the Internet e.g. online Radio and TV

Document centric Web sites

- With the introduction of the Common Gateway Interface(CGI) and HTML forms, interactive Web applications emerged, offering a first, simple, form of interactivity by means of forms, radio buttons and selection menus.

Document centric Web sites

- Web pages and links to other pages are generated dynamically according to user input.

- Examples for this category are virtual exhibitions, news sites, or timetable information.

Transactional Web applications

- These Web applications were created to provide more interactivity, giving the user the possibility of not only interacting with the application in a read-only manner, but also by performing updates on the underlying content.

Transactional Web applications

- Considering a Tourism Information System this would allow, for example, to update the content in a decentralized way or make it possible to book rooms.

- The prerequisite for this are database systems that allow efficient and consistent handling of the increasing amount of content in Web applications and offer the possibility of structured queries.

Transactional Web applications

- Online banking,

- Online shopping, and

- Booking systems belong in this category.

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Workflow-based Web applications

- Workflow refers to a series of tasks to produce a desired outcome, usually involving multiple participants and several stages in an organization.

- Workflow describes the sequential steps that comprise a work process in the business environment.

Workflow-based Web applications

- In its most comprehensive form, workflow includes the procedures, people and tools involved in each step of a business process.

- Workflow may either be sequential, with each step contingent upon completion of the previous one, or parallel, with multiple steps occurring simultaneously.

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Workflow-based Web applications

- These Web Applications allow the handling of workflows within or between different companies, public authorities, and private users.

- A driving force for this is the availability of appropriate Web services to guarantee interoperability.

Workflow-based Web applications

- The complexity of the services in question, the autonomy of the participating companies and the necessity for the workflows to be robust and flexible are the main challenges.

Workflow-based Web applications

- Examples for this category are Business-to-Business solutions (B2B solutions) in e-commerce, e-government applications in the area of public administration, or Web-based support of patient workflows in the health sector.

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Collaborative Web applications

- Whereas workflow-based Web applications require a certain structuring of the automated processes and operations, collaborative Web applications are employed especially for cooperation purposes in unstructured operations (groupware).

Collaborative Web applications

- Here the need for communication between the cooperating users is particularly high.

- Collaborative Web applications support shared information and workspaces in order to generate, edit, and manage shared information.

Collaborative Web applications

- They are also used to keep logs of many small entries and edits (as in Weblogs), to mediate meetings or make decisions (e.g. argumentation systems such as QuestMap (http://www.compendiuminstitute.org/) or simple chat rooms), as scheduling systems, or as e-learning platforms.

Collaborative Web applications

- While originally the Web was characterized by anonymity, there is an increasing trend towards a social Web, where people provide their identity to a (small) community of others with similar interests.

Collaborative Web applications

- Weblogs or collaborative filtering systems such as (http://friendster.com) for instance, which serve the purpose of not only finding related objects of interest but also finding people with similar interests, belong to that category of applications.

Portal-oriented Web applications

- These applications provide a single point of access to separate, potentially heterogeneous sources of information and services.

Portal-oriented Web applications

- Makers of browsers, such as Microsoft and Netscape, search engines such as Yahoo, online services such as AOL, media conglomerates, and other companies have become aware of the demand for this and now offer central hubs, so-called portals, as a point of access to the Web.

Portal-oriented Web applications

- In addition to these general portals, there are various specialized portals such as business portals, marketplace portals in the form of online shopping malls, and community portals.

- Business portals give employees and/or business partners focused access to different sources of information and services through an intranet or extranet.

Portal-oriented Web applications

- Portals are divided into horizontal and vertical market places.

- Horizontal marketplaces operate on the business-to-consumer market offering consumer goods directly to the general public, and in business-to-business, selling their products to companies from other sectors.

Portal-oriented Web applications

- Vertical marketplaces consist of companies from a single sector, e.g. suppliers on one side and manufacturing companies on the other.

- Community portals are directed at specific target groups, e.g. young people, and try to create customer loyalty through user interaction or to provide individual offers through appropriate user management (one-to-one marketing).

Ubiquitous Web Applications

- The increasingly important category of ubiquitous Web applications provides customized services anytime anywhere and for any device, thus facilitating ubiquitous access.

- An example of this would be displaying the menu of the day on the mobile devices of all users entering a restaurant between 11 am and 2 pm.

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Ubiquitous Web Applications

- For this type of system it is important to take into account the limitations of mobile devices (bandwidth, screen size, memory, immaturity of software, etc.) and the context in which the Web application is currently being used.

Ubiquitous Web Applications

- Based on this dynamic adjustments according to the users' situation can be made.

- Currently existing Web applications of this type usually offer a very limited form of ubiquity only supporting one aspect – either personalization or location-aware services or multi-platform delivery.

Semantic Web

- Current developments, however, especially the increasing convergence of the TIMES industry (Telecommunications, Information technology, Multimedia, Education and Entertainment, Security), will lead to a situation in the near future where ubiquitous applications will dominate the market.

- One of these developments is the *Semantic Web*.

Semantic Web

- The goal of the Semantic Web is to present information on the Web not merely for humans, but also in a machine-readable form.

- This would facilitate knowledge management on the Web, in particular the linking and reuse of knowledge (content syndication), as well as locating new relevant knowledge, e.g. by means of recommender systems.

Semantic Web

- Through increased interoperation on the semantic level and the possibility of automating tasks (via software agents), it is believed the Web will become even more ubiquitous and therefore relevant for everyday life.

Client/Server Programming

- In Web programming, people use the client/server model to deliver content to the visitor in a dynamic fashion i.e. they move away from serving up static Web pages of the kind that were produced in the past, and provide information that is customized to the needs of the producer-consumer relationship.

Client/Server Programming

- There is a split between remote and local processing, where both work together to produce the end result that helps to realize this.

- For example, the Web browser is a piece of client programming that requests information from the server and displays it to the user.

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Client/Server Programming

- The browser can also process scripts that form part of the response that is delivered to it, making it possible to offer additional features to the end user.

- As an example, you can use scripts on the side of the browser to detect the kind of browser being used and reflect that in the services offered (or perhaps the way that they are offered) to the end user.

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Client/Server Programming

- You can also ask for information (in forms) from the end user and use that information in a request to the server to elicit a certain response.

- These are all ways in which the client/server relationship can be used to enhance the producer-consumer relationship.

Client/Server Programming

- These kinds of interactions are at the core of the Web programming paradigm, which is based on a request and response mechanism.

- This request and response mechanism is largely synchronous.

- It happens in a fashion that is prescribed by the protocol being used.

Client/Server Programming

- You cannot have a response without a request, even if a single request elicits multiple response packages.

- A server does nothing until the client asks it to.

Client/Server Programming

- This can leads to infuriating waits for the whole page to be loaded before the browser can display the content that has been requested by the end user.

- This is much less of a problem since the advent of fast connections between servers, but at peak times the lag is still very noticeable.

Client/Server Programming

- Some tricks such as interlacing can be used for graphics, in these cases, the client/server model relies on the browser supporting this feature.

- Interlacing works because the image is downloaded in parts; in other words, the file contains a collection of smaller parts of the whole.

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Client/Server Programming

- The browser can display one part of the image while the next is loading, with the result that the image appears to materialize rather than appear.

- The first few frames allow a reasonably low quality image to be displayed, which is built upon as the data is downloaded by the browser.

Client/Server Programming

- Text and other information such as the layout of the page on the screen cannot be interlaced in this way very easily.

- For content, this means that the whole page has to be downloaded before the page can be displayed.

Client/Server Programming

- For the layout, is also important that as much information is conveyed with as little overhead as possible, and this is called the presentation layer.

Presentation Layer

- The presentation layer is the term given to the information that allows the browser to display the content.

- It controls the way that the content is presented, in terms of the font, colors, layout, interactive elements, and so forth.

Presentation Layer

- In order to keep some semblance of order, the presentation layer is structured according to specific standards.

- Managing the standards is a body known as the World Wide Web Consortium, or W3C.

Presentation Layer

- The role of the W3C is to make sure there are standards for the presentation layer, and that these are communicated, formulated, and extended appropriately according to the needs of its members.

Presentation Layer

- The standards, called recommendations, make up the open, non-proprietary standards that all Web authors should stick to when creating content.

- There are more than 400 members of the W3C, covering almost every company with a vested interest in the Web and the technology that drives it.

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Presentation Layer

- These companies (from Apple to Yahoo, Google, Microsoft, the BBC, Dow Jones & Company, several educational establishments, telecommunications operators, consulting companies, and many, many more) all work together to make sure that the Web continues to work for everyone.

Presentation Layer

- They do this through their work on standards consulting, mainly through the W3C Technical Team, which ''contributes to and coordinates the W3C's activities.''

Presentation Layer

- These standards are important, because you need to be sure that the layout can be communicated effectively to all client systems that might request the content.

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Presentation Layer

- The standards make sure that everyone, from producer to consumer, developer to Web service provider, are all using the same basis to develop the functionality that is required.

Presentation Layer

- However, despite the standards, each user agent (browser or something else) remains free to render the presentation layer differently.

- The presentation layer is not there to dictate how the resulting page should look, but rather the hierarchical relationship between the elements on the page.

Presentation Layer

- One example of this is the heading hierarchy.

- The presentation layer allows the content producer to designate headings of different levels.

- It is assumed that the levels adhere to strict rules:

  - They cannot overlap

  - They have to nest in order

  - They need to be presented with diminishing visual importance

Presentation Layer

- The exact choice of rendering (e.g. bold, italics, large font, small font) the font itself is left up to the browser or other client software application.

Presentation Layer

- There are other non-hierarchical elements which provide possibilities to exert more control over the rendering of the content, but by and large the presentation layer provides a fairly abstract level of control.

Presentation Layer

- The definition of the presentation layer takes the form of an abstract language (meta-language, or mark-up language) that allows one to describe the presentation without the content, as holders for the content without prescribing exact appearance.

- A top-level heading on one browser might be different from another in appearance while having the same hierarchical weight.

Presentation Layer

- The mark-up language also allows for you to specify exact rendering instructions so that it is possible, with some work, to make the content appear in the same way (within a margin of error) on multiple different browser platforms.

Presentation Layer

- The caveat is, of course, that in order to do this, you often need to know the platform (browser) and give slightly different mark-up in order to obtain the same result.

Presentation Layer

- This is the flexibility and power of the mark-up principle on the one hand, and possible disadvantage, as you need to test the implementation on many different platforms to be sure that the appearance is the same.

- Or, you can just trust that the browser developer has respected the philosophy of the mark-up laid out by the W3C.

Presentation Layer

- This also extends across non-visual and alternative rendering platforms.

- For example, if the user agent was a Braille device, that would render the same presentation layer and content mix differently than a text-only interface (such as Lynx) or a fully graphical one (such as IE, Firefox, Netscape, and so on).

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Presentation Layer

- The mark-up abstracts you away from the implementation details so that you can use the exact same presentation layer definition (within reason), no matter the target rendering platform.

- There are different flavors of mark-up, but the main language that people use to describe the presentation of content is called HTML.

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The End of Chapter 1