CSC 402 – Internet Technology

Recap

- Benefits and drawbacks of Intranets
- Protocols, Structure and Scope of Networks
- Intranets Resource Assessments: Network Infrastructure, Clients and Server Resources
- Intranet Implementation Guidelines
- Tunneling Protocols: VPN
- Tunneling Protocols: VPN Taxonomy
- Tunneling Protocols: VPN Security Protocols

General Application

- General Application
  - Email
  - WWW
- Email: Electronic mail
  - Different email services available that allow you to create an email account and send and receive email and attachments.
  - Most popular: Gmail, Hotmail, and Yahoo!

General Application

- Email pros:
  - It's fast: Most messages are delivered within minutes – sometimes seconds – around the world without the inconvenience and cost of using a postal service.
  - Postal service is often referred to as "snail mail" by email users.
  - It's personal: While the nature of email is informal, its efficiency is an excellent substitute for telephone conversations.
  - You can think through your response. Like a letter, you can type your reply and make changes before sending.
  - The sender and the receiver don't have to be working at the same time. Email avoids problems such as telephone tag or tying to contact someone in a different time zone.
  - You can reach a lot of people at once. It is possible to send one message to hundreds of recipients at once, or you can send a private message to one individual.
  - Email makes it easy to keep a record of your communication. You can save and refer to later copies of the emails you send as well as those you receive.

General Application

- Email cons:
  - Junk Mail (also referred to as spam). This is as annoying in email as it is with traditional mail.
    - Most email services now filter incoming mail and sort email messages that are most likely advertisements or scams into a folder called “spam.”
  - Friendly spam: Unnecessary messages to friends who may not appreciate hearing the latest list of “Top Ten Things…”
  - Ads: The reason you can get free email services like Gmail and Yahoo! Mail is because of advertisements.
    - You pay the price of having to click around them to read your mail.
  - Misinterpretation: Email arrives without tone or facial expressions, which can lead to misunderstanding.
  - Email messages can be passed on to others. You should always count on the possibility of your message ending up in the inbox of someone it wasn't intended for.
  - You can hide behind email. It's tempting to use email instead of facing a person when you have to deal with an unpleasant situation.
    - Not always the best means of communication.
- Email etiquettes: Might differ from organization, corporation, company, etc.

General Application

- WWW: World Wide Web
  - Story begun in 1966 at DARPA (originally ARPA which states for Advanced Research Projects Agency which is changed to DARPA as Defense Advanced Research Projects Agency in 1971).
  - They created the ARPANET, the first packet switching network for host-to-host communication.
  - ARPANET was funded by the United States military after the cold war with the aim of having a military command and control center that could withstand nuclear attack.
  - The point was to distribute information between geographically dispersed computers.
  - ARPANET created a communications standard (Network Control Protocol (NCP)), which defines the basics for the data transfer on the Internet today.
  - The original ARPANET grew into the Internet.

General Application

- Internet embodies Open Architecture Networking.
- In this approach, the choice of any individual network technology was not dictated by a particular network architecture but rather could be selected freely by a provider and made to interwork with the other networks through a meta-level "Internetworking Architecture".
- In an open-architecture network, the individual networks may be separately designed and developed and each may have its own unique interface which it may offer to users and/or other providers.
- Think about wired and wireless network solutions to get an imagine of it.
  - The original communication standard, NCP did not have the ability to address other solution than the original ARPANET, so it needed to be replaced.
  - The new protocol was termed the Transmission Control Protocol/Internet Protocol (TCP/IP) and appeared in 1972.
  - However, the widespread presence of the Internet is dated into the mid of the '80s when the presence of PCs and workstations are started growing.

General Application

- A major shift occurred as a result of the increase in scale of the Internet and its associated management issues which resulted in hosts being assigned names, in order to minimize the use of numeric addresses.
- The DNS (Domain Name System) permitted a scalable distributed mechanism for resolving hierarchical host names into an Internet address.
- The increase in the size of the Internet also challenged the capabilities of the routers.
- New approaches for address aggregation, in particular classless inter-domain routing (CIDR), have been introduced to control the size of router tables.
- Nowadays, after thirty years, there are still several researches for making these algorithms much more better, reliable and faster.
- RFC (Request for Comments), a documentation technique, played a key role in sharing feedback between researchers.
- At first the RFCs were printed on paper and distributed via snail mail.
- As the File Transfer Protocol (FTP) came into use, the RFCs were prepared as online files and accessed via FTP.
- Now, of course, the RFCs are easily accessed via the World Wide Web.

General Application

- WWW is a virtual space that provides a number of resources accessed by identifiers.
- In 1945, Vannevar Bush authored the article "As We May Think“ in which he first proposed his idea of the Memex machine.
  - This machine was designed to help people sort through the enormous amount of published information.
- His article described a Memex as a "device in which an individual stores his books, records and communications and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.“
  - This is about 30 years before the invention of the personal computer and about 50 years before the appearance of the World Wide Web.
- After 22 years later, a proposal for information management was appeared and referenced Nelson's "Getting it out of our system" work and established the basic concept of a system which is currently known as the World Wide Web.
  - The proposal estimated 6 to 12 month to realize the first phase of the project with only two people.
  - The work was started in October 1990, and the program "WorldWideWeb" first made available within CERN in December, and on the Internet at large in the summer of 1991. Tim Berners-Lee introduced this project to the world on the alt.hypertext newsgroup.
  - In the post he said the project "aims to allow links to be made to any information anywhere".

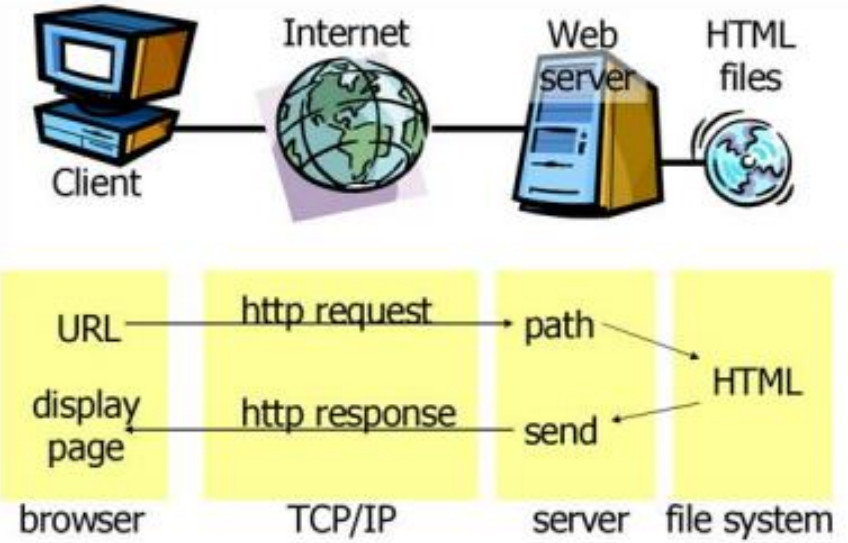
General Application

- WWW is the idea of sharing and organizing information from any computer system in any geographical location by using a system of hyperlinks (simple textual connections that "linked" one piece of content to the next) and established three key technology to manifest it:
  - Hypertext Transfer Protocol (HTTP), a way that computers could receive and retrieve Web pages.
  - HyperText Markup Language (HTML), the markup language behind every Web page.
  - URL (Uniform Resource Locator) system that gave every Web page its unique designation.

General Application

- Web 1.0 pages are characterized by the following:
  - Static pages instead of dynamic HTML.
  - The use of framesets.
  - The use of tables to position and align elements on a page. These were often used in combination with "spacer" GIFs (1x1 pixel transparent images in the GIF format).
  - Proprietary HTML extensions, such as the <blink> and <marquee> tags (introduced during the first browser war).
  - Online guestbooks.
  - HTML forms sent via email.
- First Phase of web 1.0 as shown in figure.

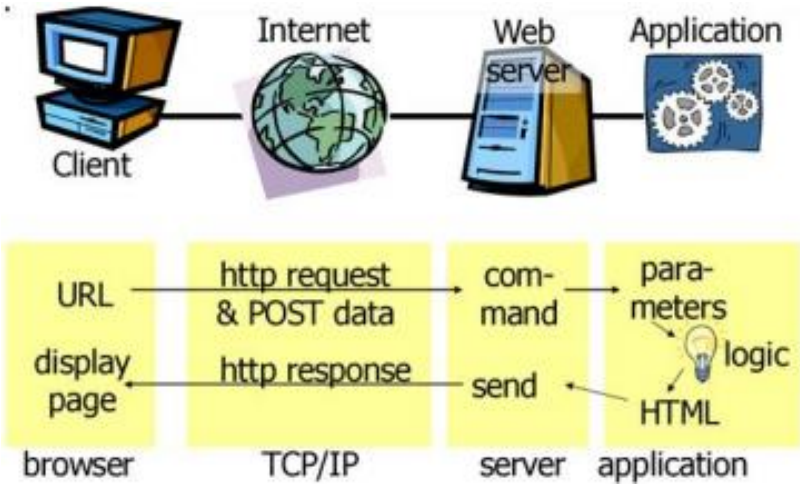
Phase 1 of Web 1.0



General Application

- The disadvantages of web 1.0:
  - lack of interactivity and personalization.
- Static pages are transformed to dynamic ones.
- The most relevant keyword for them were: HTTP-POST, CGI (Common Gateway Interface), SSI (Server-side Include) and Perl.
  - An example of a CGI program is one implementing a wiki, where the user agent requests the name of an entry. The program retrieves the source of that entry's page (if one exists), transforms it into HTML, and sends the result. If the "Edit this page" link is clicked, the CGI populates an HTML text area or other editing control with the page's contents, and saves it back to the server when the user submits the form.
  - SSI are directives that are placed in HTML pages, and evaluated on the server while the pages are being served.
  - Apache, nginx, lighttpd and IIS are the four major web servers that support this language.

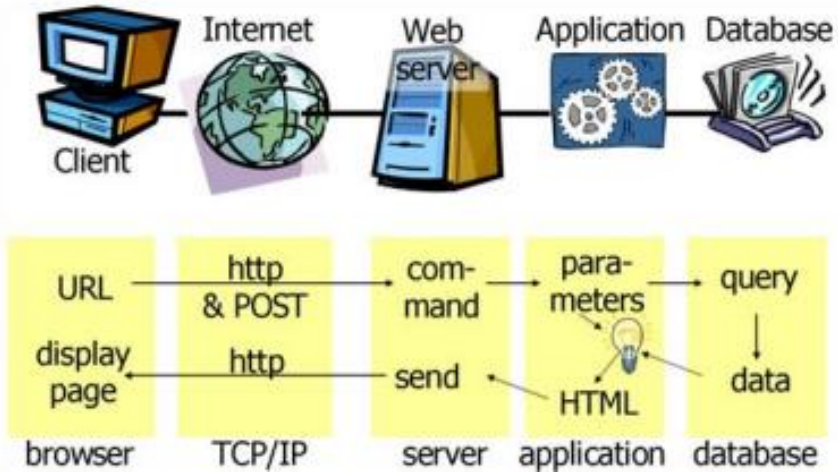
Phase 2 of Web 1.0



General Application

- A cookie, also known as an HTTP cookie is a small piece of data sent from a website and stored in a user's web browser while the user is browsing that website.
  - Advertising companies use third-party cookies to track a user across multiple sites. In particular, an advertising company can track a user across all pages where it has placed advertising images or web bugs.
- Naturally, cookies at the first time were a wonderful solution to overcome of the stateless manner of the HTTP protocol.
- It made available to handle workflows, introduce shopping carts on websites and made authentication easier.
- Drawbacks included:
  - They do not always accurately identify users, they can be used for security attacks, and they are often at odds with the Representational State Transfer (REST) software architectural style.
- Embedding information into URLs.
  - The query string part of URL.
- HTTP POST, which causes the form information, including the hidden fields, to be appended as extra input that is neither part of the URL, nor of a cookie.

Phase 3 of Web 1.0



General Application

- Centralized software could reach millions of users with one simple installation without the update process's nightmare.
- Just a simple client is needed, i.e. a web browser only.
- Its based on simple solutions:
  - Core Web Features: HTML, HTTP, URI
  - Newer Technologies: XML, XHTML, CSS
  - Server-Side Scripting: ASP, PHP, JSP, CGI, PERL
  - Client-Side Scripting: JavaScript, VBScript, Flash
  - Downloadable Components: ActiveX/Java

General Application

- Centralized software could reach millions of users with one simple installation without the update process's nightmare.
- Just a simple client is needed, i.e. a web browser only.
- Its based on simple solutions:
  - Core Web Features: HTML, HTTP, URI
  - Newer Technologies: XML, XHTML, CSS
  - Server-Side Scripting: ASP, PHP, JSP, CGI, PERL
  - Client-Side Scripting: JavaScript, VBScript, Flash
  - Downloadable Components: ActiveX/Java
- The Dotcom Bubble Burst: January 14, 2000
  - The dotcom bubble had been growing since 1997.
  - The excitement surrounding the web caused share prices to soar. Cisco became the world‘s largest company, worth $400 billion (now $100 billion). $1 billion per week of Venture Capital money flowed into Silicon Valley. AOL took over Time Warner for $200 billion.

General Application

- The Dotcom Bubble Burst: January 14, 2000
  - The dotcom bubble had been growing since 1997.
  - The excitement surrounding the web caused share prices to soar. Cisco became the world‘s largest company, worth $400 billion (now $100 billion). $1 billion per week of Venture Capital money flowed into Silicon Valley. AOL took over Time Warner for $200 billion.
  - In January 2000 it reached its peak when the Dow Jones Industrial Average closed at a record level never reached before or since. On March 10, the NASDAQ Composite Index also reached an all-time high.
  - Soon after, the markets began to crash and with it went many of the start up companies bankrolled during the dotcom boom.
  - Between March and September 2000, the Bloomberg US Internet Index lost $1.755 trillion!
  - Where Web 1.0 went wrong was the misunderstood of the Web's dynamics. All of the development was relied on the old software business models, users were locked to APIs. Software was sold as an application and not as a service, so they were sold to the Head and not to the Tail as Web 2.0 solutions are do.
  - The dynamics underlying the Web contains the Long Tail, the social data, the network effects and wisdom of the Crowds.

General Application

- Web 2.0 was introduced in 2004 as a second generation of the World Wide Web that is focused on how information is shared among people.
- The word 2.0 comes from the software industry, which describe the transition from static HTML pages to dynamic webpages organized based on serving the web application users. Web become much more dynamic and interactive e.g. Wikipedia, Google, and Facebook etc.
- Concept of Web 2.0 can be divided into three main parts:
  - Rich Internet application (RIA)
    - It defines the experience brought from desktop to browser whether it is from a graphical point of view or usability point of view. Some buzzwords related to RIA are Ajax, Flash, Java FX (and the retired Silverlight as well). However, GWT, Vaadin and ExtJS are also related buzzes.
  - Web-oriented architecture (WOA)
    - It defines how Web 2.0 applications expose their functionality so that other applications can leverage and integrate the functionality providing a set of much richer applications. Examples are feeds, RSS, Web Services, mash-ups. (discussed detailed in the next chapter)
  - Social Web
    - Defines how Web 2.0 tends to interact much more with the end user and make the end-user an integral part. In other words, let your users create your data, filter the data and create their own apps using your data.

General Application

- Rich Internet application
  - **Performance impact**: RIA increases performance. However most application avoids round trip to the server by taking data and processing it locally on the client.
  - **Better feedback**: Most application using the RIA provides users with fast and accurate feedback. Due to their ability to change a part of the application without reloading, users can get to know more about the real time confirmation of an action, information and error messages. etc.
  - **Partial page updating**: Some web application pages are loaded once. If another user is updating something on the page; it will be automatically be sent to the server which makes the changes more easier and then resend the entire page known as real - time streaming.
  - **Direct interaction**: In a traditional Web application, interaction are limited to a small group of standard controls e.g. radio buttons, checkboxes and form fields. An RIA can use a wider range of controls that allow greater efficiency and enhance the user experience. In RIAs, for example, users can interact directly with page elements through editing or drag-- and-- drop tools. They can also do things like pan across a map or other image.
- The most well-known tools used for RIAs are Adobe Flash / Flex, Adobe Air, Java Script, Struts, PHP, JQuery, AJAX, HTML 5.0 & CSS3.

General Application

- Social Web
- The social Web developed in three stages from the beginning of the '90s up to the present day, transforming from simple one-way communication web pages to a network of truly social applications.
  - "one-way conversation“: storing information as well as displaying it.
- Social networking sites were introduced prior to social media sites. A social networking site is an online plate form that is usually created by an individual, describing his/her interest to public.
- LinkedIn falls under social networking category while Youtube falls in social media. [It’s better to know the difference]. Whereas, Twitter and Facebook falls under both.
- Major types of websites:
  - Blog
  - Wiki
  - Social Network/Media

General Application

- Summarizing social side of Web 2.0:
  - Users are creating data:
    - Amazon's reviews, Flickr's photos, Yahoo and Google's indexed web pages, Wikipedia's information
  - Users are creating data from your data:
    - Programmatic access to data (Web Services, RSS, etc.). Apps showing how useful your data is compared with your competitor's. Adds value to your data.
  - Data filtering based on user behavior:
    - Recommendation engines, ranking algorithms, tagging.

Web 2.0 Tagcloud

General Application

- Web 3.0 - beyond the Semantic Web, a way to global SOA?
  - Semantic: relating to meaning of words and phrases in particular context.
  - SOA: Service Oriented Architecture
- You want to watch a movie and eat late night dinner in a restaurant.
  - Search online for movie trailers and restaurant (near your location) reviews.
- Web 3.0-the next generation of the web after Web 2.0- will make such task like searching for movies or restaurants quicker, faster and easier.
- Web 3.0 browser will act like a personal assistant.
- Keep record of your likes and dislikes, and also using your current location and geo-tagging, your browser would then suggest a list of possible nearby restaurants or eateries.

General Application

- Approaches to Web 3.0 - APIs, SOA, and semantics.
- API can be defined as an interface designed in a way that allows developers to create applications and take advantage of a certain set of resources. E.g. combining google maps with a hotel review site.
- The World Wide Web Consortium (W3C) for example refers to SOA as
  - A set of components which can be invoked, and whose interface descriptions can be published and discovered.
- Component Based Development and Integration (CBDI) forum's definition:
  - The policies, practices, frameworks that enable application functionality to be provided and consumed as sets of services published at a granularity relevant to the service consumer. Services can be invoked, published and discovered, and are abstracted away from the implementation using a single, standards-based form of interface.
- E.g. for SOA: Make service that provides the data that can be used in other parts of an application.

General Application

- Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries.
- Currently, the web is structured for humans and not computers. Computers are unable to interpret information on the web but with semantic web, computers can interpret information on the web using software agents crawling around the web searching for relevant information.
- Why use Semantic Web?
  - Previous example of movie and dinner; all done by user. In Semantic web search the web would suggest places based on your interest and experience. If you had a bad experience, it will not suggest you that particular place.
  - Search through its metadata (data which describes other data). Metadata sums up basic information about data thus making it easier to find and work with specific occurrence of data. For example, a metadata for a document would include title, author, file size, date created, etc. In webpages, metadata contain descriptions of the page‘s content as well as keywords linking the content to the page.
  - In Semantic Web, experts believe that the metadata of a page are not visible while the page is being read but visible to computers. Metadata, according to Tim Berners-Lee would let the web become a giant database.

General Application

- Gopher:
  - A distributed document search & retrieval protocol (RFC 1436).
  - Designed for distributing, searching, & retrieving documents over the Internet.
  - An alternative to the WWW in its early stages, but ultimately failed.
  - Follows a client-server model.
  - Assumes a reliable TCP data stream.
  - Documents reside on many autonomous servers on the Internet.
  - Users run client s/w, connecting to a server & sending the server a selector (a line of text) via a TCP connection at port 70.
  - Server responds with a block of text terminated by a period on a line by itself & closes the connection.
  - Client s/w presents users with a hierarchy of items & directories much like a file system
  - No state is retained by server.
  - Not natively supported by modern browsers.
  - Veronica is a system that queries titles in Gopher servers on the Internet.

General Application

- Online Systems
  - Provides on-line services giving access to information, entertainment, communications, and/or transaction services via telecommunications.
  - Includes e-finance or e-banking site, e-health site, e-government site, online shopping site, etc.
  - Many are both on-line service vendors & content providers.
  - Key distinction betn. on-line services & the Internet is that on-line services companies either provide content or have a close association with a content provider, while the Internet relies on distributed, usually nonaffiliated content providers, including individual corporate entities.
  - AOL, Prodigy were among pioneers online service providers.
  - Common services - message boards, chat services, electronic mail, file archives, current news and weather, online encyclopedias, airline reservations, and online games.

Multimedia and Digital Video/Audio Broadcasting

- Video conferencing
  - Video conferencing is two-way audio and video signal transmission.
  - Video and audio signals are compressed and transmitted over a digital phone line.
    - Advantage: interactive.
    - Drawback: picture quality.
    - Need to: vary and visualize .
  - Multimedia environment for live meetings, collaboration and presentations.
  - Digital compression of audio & video streams in real time.
  - Uncompressed audio & video consumes a great amount of storage & bandwidth; removing the inherent redundancies in digitized audio & video signals can reduce by orders of magnitude the amount the data that needs to be stored and transmitted.
  - Codec(coder/decoder)- h/w or s/w performs compression.