INTERNET TECHNOLOGY AND APPLICATIONS (CO308)

D. P. Rana

Internet

- An indispensable technology
  - In virtually every aspect of modern living
- A transformative technology
  - Changes the way we do things
  - Changes the way we acquire and disseminate information
- An evolving technology
- Bottom line—high impact on everyone in the modern world

Internet Application

- Encompasses
  - Everything from a simple Web page that might help a consumer to compute an automobile lease payment to a comprehensive website that provides complete travel services for business people and vacationers
  - Included within this category are complete websites, specialized functionality within websites, and information-processing applications that reside on the Internet or on an Intranet or Extranet

Trends of Internet

- 1989, Tim Berners-Lee, a computer scientist at the CERN particle physics laboratory in Switzerland, invented the World Wide Web
- 1994 sees the founding of Amazon.com
  - Its young creator dreamt of a store to sell everything
  - Amazon's model, which would come to set the standard for Internet sales, is built on automated personalized recommendations—a store that can make suggestions
- 1998, two Stanford programmers created Google
  - Their algorithm echoes the language of Amazon, it treated links as recommendations, and from that foundation powered the world's most effective search engine

Trends of Internet

- 1999, TiVo transformed television by unshackling it from the constraints of time—and commercials
  - That year, a dot-com start-up named Pyra Labs unveils Blogger, a personal publishing tool
- 2002, a launch of Friendster and hundreds of thousands of young people rushed to populate it with an incredibly detailed map of their lives, their interests and their social networks
- Also in 2002, Google launched GoogleNews, a news portal
  - GoogleNews is edited entirely by computers

Trends of Internet

- 2003 - the Year of the Blog
- 2004 would be remembered as the year that everything began
  - Reason Magazine sent subscribers an issue with a satellite photo of their houses on the cover and information custom-tailored to each subscriber inside
  - Sony and Philips unveiled the world's first mass-produced electronic paper
  - Google unveiled GMail, with a gigabyte of free space for every user
  - Microsoft unveiled Newsbot, a social news filter
  - Amazon unveiled A9, a search engine built on Google's technology that also incorporates Amazon's trademark recommendations
  - And then, Google went public, and bought TiVo
- 2005—Microsoft bought Friendster

Trends of Internet

- 2006—Google combined all of its services—TiVo, Blogger, GMail, GoogleNews and all of its searches into the Google Grid
  - A universal platform that provided a functionally limitless amount of storage space and bandwidth to store and share media of all kinds
  - Always online, accessible from anywhere
  - Each user selects her own level of privacy
    - Store content securely on the Google Grid, or publish it for all to see
  - It has never been easier for anyone, everyone to create as well as consume media

Trends of Internet

- 2007—Microsoft responded to Google's mounting challenge with Newsbotster, a social news network and participatory journalism platform
  - Newsbotster ranked and sorted news, based on what each user's friends and colleagues were reading and viewing and allowed everyone to comment on what they see
  - Sony's ePaper is cheaper than real paper in that year
    - It's the medium of choice for Newsbotster

Trends of Internet

- 2008, the alliance that challenged Microsoft's ambitions
  - Google and Amazon joined forces to form Googlezon
  - Google supplied the Google Grid and unparalleled search technology
  - Amazon supplied the social recommendation engine and its huge commercial infrastructure
  - Together, they used their detailed knowledge of every user's social network, demographics, consumption habits and interests to provide total customization of content—and advertising

Trends of Internet

- The News Wars of 2010 were notable for the fact that no actual news organizations took part
  - Googlezon finally checkmated Microsoft with features the software giant couldnot match
  - Using a new algorithm, Googlezon's computers constructed news stories dynamically, The News stripping sentences and facts from all content sources and recombining them
  - The computer wrote a news story for every user

Trends of Internet

- 2014, Googlezon unleashed EPIC
  - "Evolving Personalized Information Construct (EPIC)" the system by which our sprawling, chaotic mediascape is filtered, ordered and delivered
  - Everyone contributes now—from blog entries, to phone-cam images, to video reports, to full investigations
  - Many people get paid too—a tiny cut of Googlezon's immense advertising revenue, proportional to the popularity of their contributions
  - Produces a custom contents package for each user, using his choices, consumption habits, interests, demographics, social network—to shape the product
  - A new generation of freelance editors has sprung up, people who sell their ability to connect, filter and prioritize the contents of EPIC
  - We all subscribe to many Editors; EPIC allows us to mix and match their choices however we like
  - EPIC is a summary of the world—deeper, broader and more nuanced than anything ever available before

Need

- The Internet has become an indispensable technology for
  - Business, Commerce, Communication, Education, Engineering, Entertainment, Finance, Government, Industry, Media, Medicine, Politics, Science, and Transportation—
    - In short here listed few areas that impact life of everyone
- Reasonable to engineer the Internet Applications which are used every day in rich, diverse, and important ways

Evolution of the Web

- Earlier Web was a tool just for disseminating TEXT information
- Evolved as better and with more robust content to increase more sophisticated functionality
  - WebApp such as Google Maps, a WebApp that couples a vast collection of graphical satellite imagery with sophisticated manipulation functionality (Web 1.0)
- Today's Web is evolved as
  - Blogs, Wikis, Social networking sites, File sharing services (Web 2.0)

Evolution of the Web

- Not only the speed
- Web has provided enormous benefits to end users
- But,
  - Has also created many questions hazards like content accuracy, legality, accessibility, and its overall worth

Evolution of the Web

- Opening up opportunities for content delivery that has value in real time
- For example, you stand in front of a restaurant you've never been to before and want to find out how good it is
  - You access a "restaurant reviews"
  - WebApp via your mobile phone, key in the name of the eatery, and check the reviews before you enter
  - If you don't like what you see, you ask for another recommendation in the vicinity

Evolution of the Web

- As mash-ups continue to grow in sophistication and power
- Again consider the restaurant example, What can be the further step in the development of the “restaurant reviews”
  - Automatically know your location [by using data from the built-in global positioning system (GPS) receiver]
  - To correlate with GPS data and business registry information to recognize identity of a particular restaurant, and automatically provide you with relevant information (e.g., reviews, menu, pricing, alternatives) without the need for an explicit search on your part
  - It may even know your particular tastes and search for reviews of that restaurant by other people who have a history of having similar views

Goal

- The Web has become an indispensable technology for
  - Business, Commerce, Communication, Education, Engineering, Entertainment, Finance, Government, Industry, Media, Medicine, Politics, Science, and Transportation—
    - In short here listed few areas that impact life of everyone
- Reasonable to engineer the Web Applications which are used every day in rich, diverse, and important ways

Technologies

- For the applications Wikipedia, Blogger, Flickr, BitTorrent, YouTube
  - **Blogs and wikis**
  - **Mash-ups**
  - **Ajax**
  - **Syndication**
  - **Web services**
  - **Metadata, Ontologies, and Folksonomies**
  - ***Voice over IP (VoIP)***
  - **Location-aware applications**
- These are only a few of many other emerging technologies that play a part in the future of the Web
- Some will become a small part of the large and evolving Web landscape
- Others are likely to be more crucial in fundamentally reshaping the Web

Technologies

- **Blog** ***(a shortened form of Web log)***
  - A commentary or diary that allows a Web user to share personal information, observations, or experiences
  - The content typically evolves continuously and helps in providing a degree of freshness and dynamism to many sites
  - Support tools enable unsophisticated users to create their own blog with little effort, build/edit their blog entries, create an archive of entries over a period of months or years, and encourage interaction among users by enabling them to respond to or annotate blog content
  - From a design perspective, blogs can be used to add a communication channel into an otherwise static application and play a crucial role in establishing a social network
  - From a business perspective, they are powerful marketing tool

Technologies

- ***Wiki*** (best-known Wiki is **www.wikipedia.org**)
  - *A website that supports user editing of the site content*
  - *The resultant* collaborative authoring process can result in the emergence of sites that are developed communally, and hence can reflect a rich set of experiences and views
  - Wikis are often used either to support a specific team in some activity (e.g., as a project documentation tool) or as a way of supporting social networking

Technologies

- **Mash-ups**
  - A *hybrid Web application that integrates content from* multiple (usually third-party) sources in order to provide a novel synergistic outcome
  - Mash-ups usually access the content-rich environment of major providers (such as Google, Amazon, and eBay) using a simple public interface
  - Even when there is no public interface, it is often possible to utilize third-party data through simple "screen-scraping" of the data available on websites
  - The rich interactivity of many mash-ups typifies the evolving direction of Web 2.0

Technologies

- **Ajax (*Asynchronous JavaScript and XML*)**
  - Another technology that contributes to rich interactivity
  - *Actually a set of complementary technologies* that, when used together, can create highly interactive Web applications that feel more like a desktop application than a WebApp
  - Uses JavaScript to download XML data continuously in preparation for the potential use of that data
  - The result is a more responsive application
  - The best-known Ajax application is googleSuggest, **maps.google.com, Gmail**
  - Numerous Ajax tool kits[3] have emerged that make constructing Ajax applications much simpler

Technologies

- **Syndication**
  - ***Makes a fragment of a WebApp available for inclusion*** elsewhere
  - For example, you might choose to embed a short one-line “latest news” item, a short “weather report” fragment, or a recent forum post, within a new Web-App
  - The use of syndicated content can benefit both the provider (through greater exposure) and the receiver (through access to richer content)
  - There are numerous syndication technologies, but undoubtedly the best known is RSS (*Really Simple Syndication)*
  - *RSS is an XML data format for encapsulating content that* can be syndicated
  - The RSS feed can then be used either to directly embed the feed content into another page, or it can be used by an aggregator to collect syndicated content together for users to view
  - The end result in both cases will be content that is more up to date and more relevant to specific users

Technologies

- **Web service**
  - **A *software component (possibly remote) that provides*** some defined functionality using a specified interface
  - Might support something as simple as validating a telephone number to ensure it is in a correct format or as complex as processing a credit card payment
  - The Web services architecture allows Web services to register with a service broker and then allows clients to locate and then utilize relevant services
  - Indeed, complex WebApps can be built up by combining rich sets of services

Technologies

- **Web service**
  - Collection of the standards and technologies that comprise the Web services architecture
    - *Web services description language (WSDL) is* used to describe Web service interfaces
    - SOAP is a protocol for communicating with Web services
    - A range of other related standards are then built on top of this
  - For example, WS-BPEL (*Web Services—Business Process Execution Language) describes* the state transition interactions that occur in business processes and how these map to Web service operations
  - Web services do not focus on specific types of Web applications, but rather, define an architecture that supports the creation of applications
  - To facilitate the simpler implementation of rich applications
  - For example, many mash-ups are enabled by providers making their content available through a Web service

Technologies

- **Metadata, Ontologies, and Folksonomies**
  - A *folksonomy is a collaboratively generated taxonomy, which uses user generated* tags and metadata to describe content (the labeling process is often referred to as *tagging)*
  - *This means that rather than having a single taxonomy, we* end up with a rich multifaceted set of metadata. Because part of the metadata includes the author, users can identify subsets (created by selected individuals) that have categorized information in ways that make the most sense to them

Technologies

- **Metadata, Ontologies, and Folksonomies**
  - Effective use of content can be facilitated by using *metadata—information about the content*
  - *The simplest form of* metadata is information embedded directly into Web pages
  - A richer representation is possible using RDF (Resource Description Framework)—an XML format for making *statements about resources*
  - *Ontologies (a representation of a domain that* can be used as the basis of reasoning) can then be built on top of the RDF and can result in languages such as OWL (Web Ontology Language) that can be used to publish and share data that describes a particular domain
  - They can be used to create highly structured information that can then be analyzed and processed in a variety of different ways
    - For example, FOAF (Friend of a Friend) is used to describe relationships between people
    - Information about each friend can be used to build adaptive applications that customize information based on who your friends are

Technologies

- ***Voice over IP (VoIP)***
  - ***Enables the transmission of voice data over the Internet*** (rather than via conventional telephone networks)
  - Today, VoIP is having a major impact on telecommunications through applications such as *Vonage and Skype,* and over time, it is also likely to have a major impact on the design of WebApps
  - For example, VoIP enables WebApps to support podcasting and rich customer service experiences
  - In addition, it will enable less obvious aspects such as automated switching between different media forms based on the delivery hardware (e.g., text when viewed on a large screen could be automatically converted to a VoIP voice stream when a mobile phone or PDA with limited screen space is being used)

Technologies

- **Location-aware applications**
  - **As GPS receivers become more common, it becomes** increasingly feasible for Web clients to have available to them information on the location of the client
  - Once location is known, it is possible to develop Web-Apps so that the user experience can be appropriately customized to where the user is at the moment
  - Today, a limited version of this approach is used when a WebApp changes the advertisements that are presented, depending upon the location of the user inferred from the IP address
  - As Web access becomes more ubiquitous and users start accessing WebApps from a more diverse set of locations (and devices), everything from localized advertising (“If you’re in the mood for a snack, visit Dom’s bakery . . . you’ll be passing us in less than a minute”) to traffic warnings (“There is a traffic problem a quarter mile ahead”), to general assistance (“The nearest hospital is . . .”).

- Web Engineering

Teaching Scheme

- Theory –3 hours per week
- Practical -2 hours per week
- Credit -4
- Theory Exam –80 marks
- Class test –10 marks
- Attendance –10 marks
- Practical -50 marks
- **Total –150 Marks**

Reference Books

1. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, Pearson, 1/e, 2007
2. Web Engineering: A Practitioner's Approach, Roger Pressman, McGraw-Hill, 2008
3. Developing J2EE Applications with IBM WebSphere Studio, Howard Kushner, IBM Press 2004
4. Microsoft .NET XML Web Services: Step by Step, Adam Freeman and Allen Jones, Microsoft Press, 2003
5. Programming the Mobile Web, Maximiliano Firtman, O'Reilly, 2010

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services
  1. Look to add value to the aggregate Web of data
     - As a company with infrastructure that can scale to scan, retrieve, and analyze a significant portion of all the public on-line information in the world, think about how you can use those capabilities to improve the world
       - » What patterns can be found? What connections can be made? What can you simplify for people?
  2. Build for normal users, developers, and machines
     - Make whatever you build easy to use, easy to hack [in the open source sense], and make it emit useful data in a structured form
     - That means, need a usability geek, an API geek, and XML/RSS/JSON geek

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services
  3. Start designing with data, not pages
     - Figure out what data is important, how it will be stored, represented, and transferred
     - Figure out the generic services that one can build on top of that repository
     - Only then should you get the wireframe geeks and/or the photoshop geeks involved . . .

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services

4. Identify your first order objects and make them addressable
   - Figure out what your service is fundamentally about
   - If it's a social shopping application, you're probably dealing with people, items, and lists of items
   - Nail those before going farther
   - And make sure there's a way to access each object type from the outside world (a URL for fetching information about an item, a list, etc.)
   - These are the building blocks that you'll use to make more complex things later on

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services

5. Use readable, reliable URLs
   - If the URL is hard to read over the phone or wraps in email, you're not there yet
   - Simplicity and predictability rule here
   - Consider something like http://socialshopping.com/item/12345. You can guess what that URL does, can't you?
   - You may not grasp how important this is, but don't let that stop you from worrying about it

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services

  6. Build list views and batch manipulation interfaces
  - Make it easy to see all items of a given type and make it possible to edit them as a group
  - Flickr does this when you upload a batch of photos
  - Search, in its many forms, is the classic example of a “list view”

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services

  7. Create parallel data services using standards
     - Developers (and the code they write) will want to consume your data
     - Do not make this an afterthought
     - Get your engineers thinking about how they might use the data and make sure they design the product to support those fantasies
     - Again, always default to use an existing standard or extending one when necessary
     - Look at how flexible RSS and Atom are (Don’t reinvent the wheel)

To Achieve this Evolution

- To build this new generation of WebApps, requires to aggregate Web of data sources and services

  8. Make your data as discoverable as possible
  - The names and attributes you use should be descriptive to users and developers, not merely a by product of the proprietary internal system upon which they're built
  - This means thinking like an outsider and doing a bit of extra work

Web2.0

To Achieve this Evolution

- Web 3.0…..
- Web 3.0 referred as the semantic web
  - Semantic meaning data driven
  - The data will come from the user and the web will essentially adjust to meet the needs of the user
  - For example, if you do a lot of searching for ‘design blogs’, you’ll receive more advertisements related to design
  - Also, when you search for other things, for example, ‘computers’, the web will keep in mind that you often search for design and may pull up search queries that combine ‘design’ and ‘computers’

To Achieve this Evolution

- Web 3.0…..
- Web 3.0 referred as the semantic web
  - A huge benefit of Web 3.0 is the move towards being able to access data from anywhere
  - This is mainly being driven by the heavy usage of smart phones and cloud applications
  - The idea here is to make sure that the user can access as much data as possible from anywhere, not just their home
  - Technology is trying to expand this idea in ways that allow TV's to pick up on user data, and allowing smart phones to access data on your computer

- End

The Internet

- Technical origin: ARPANET (late 1960's)
- The network of networks connected via the public backbone and communicating using TCP/IP communication protocol

Internet Protocols

- Communication protocol: how computers talk
- Internet protocols developed as part of ARPANET research
- ARPANET began using TCP/IP in 1982
- Designed for use both within local area networks(LAN's) and between networks

Internet Protocol (IP)

- IPis the fundamental protocol defining the Internet
- IP address:
  - –32-bit number (in IPv4)
  - –Associated with at most one device at a time (although device may have more than one)
  - –Written as four dot-separated bytes, e.g. 192.0.34.166

Internet Protocol (IP)

- Transfers data from source device to destination device by creating a packet representing the data
  - Header: source and destination IP addresses, length of data, etc.
  - Data itself
- If destination is on another LAN, packet is sent to a gateway that connects to more than one network

Transmission Control Protocol (TCP)

- Limitations of IP
  - No guarantee of packet delivery (packets can be dropped)
  - Communication is one-way (source to destination)
- TCP adds concept of a connection on top of IP
  - Provides guarantee that packets delivered
  - Provides two-way (full duplex) communication