Topic 02

Web Generations.

Web Engineering.

Web Systems Characteristics

World Wide Web (Web) Generations
Web 1.0, Web 2.0, Web 3.0, Web 4.0 …
Web-Based Education/Learning 1.0, 2.0, 3.0, 4.0…

1) Rich multimedia Web applications and learning content
2) Web2.0-based communication tech.

2000
Web 1.0
Information Web
Web Learning/Reading (1.0)
- Mostly read only Web
- Millions of users
- Home pages
- Owning content
- HTML, portals
- Web forms
- Directories (taxonomy)
- Ex: Britannica Online

2010
Web 2.0
Social Web
Collaborative RMM Web Learning (2.0)
- Mostly read-write Web
- Billions of users
- Blogs, wikis
- Sharing content
- XML, RSS
- Web applications
- Tagging ("folksonomy")

2020
Web 3.0
Semantic Web
Personalized Web Learning (3.0)
- Mobile and personal Web
- Focus on individual user
- Integrated on-demand dynamic content
- Semantic web and content objects
- Widgets, mashups, metadata, dynamic web services, ontology
- User behavior
- User engagement

2030
Web 4.0
Intelligent Web
Intelligent Web Learning 4.0
- Self-learning and self-organizing Web
- Focus on Individual User + Subject Domain + Level of Knowledge

http://www.labnol.org/internet/web-3-concepts-explained/8908/

Web2.0 in Education (from about 2001…)

EDUCATIONAL USES OF SECOND LIFE

If the term web 1.0 refers to the original, informational web, web 2.0 refers to the social web. It’s a loose grouping of newer generation social technologies, whose users are actively involved in communicating and collaborating with each other as they build connections and communities across the web. The term itself was coined by Dale Dougherty in 2004 and popularized by Tim O’Reilly. These pages briefly discuss the educational applications of a number of web 2.0 and related technologies, drawing on insights from Ev Williams’s social communities, Firefox mozillians’s community of practice, and Randy Garren’s community of inquiry model. There are lots of good examples of educational practice, as well as links you can follow to set up your own pages. There is a considerable convergence between some of the individual technologies, a trend that is likely to continue. Note that if you’re looking for open source (and generally freeware) alternatives to commercial software, you might like to check out OpenSource4Us.

Source: http://e-language.wikispaces.com/web2.0
Web2.0 – “Read/Write/Communicate” Web -- Technologies in Education: A Summary
http://e-language.wikispaces.com/web2.0

Web2.0 Technologies

Web3.0 – “Read/Write/Collaborate at any time, at any place”

Web 3.0 in education

Web3.0 Drivers:
1. Smart Mobile Technology (ubiquitous access to tools, technologies, knowledge and learning objects, etc.)
2. Personalization (of learning, of teaching, of learning environment, user, etc.)
3. Advanced Software Engineering Technologies
4. Telepresence in 3D

Source: http://e-language.wikispaces.com/web3.0

PLE – personal learning environment, IM – instant messaging, RSS – real simple syndication, machinima – machine cinema or machine animation, microblogging – Web service for mobile phone, MMO – massively multiplayer online game, VLE – virtual learning environments, etc.
Web4.0 – Intelligent Web
“World’s Personalized Knowledge and Computational Resources Available for Everybody on-Demand”

Web4.0 Drivers:
1. Internet – planetary powerful computer (easy to simulate human brain)
2. Highly intelligent applications and interactions (they understand and satisfy requests of people and machines)

Dr. Uskov as Web Systems’ Practitioner and Developer:
Evolution of Developed Web-Based Courseware

Continuous evolution of developed educational Web-based systems

- 1996: Lecture notes in PDF format (articles, textbooks, etc.)
- 1997: PPT slides + graphics
- 1998-2002: Recorded Computer Screen technology
- 2003: Videotaped lecture + White Board=Smart Board Technology (dynamic writing)
- 2005-present: Video + Audio + PPT slides + animation + Web-based simulation
- 2010-present: m-Learning
Bradley University: Streaming Technology
(Video, Audio, Data) + Simulations at Bradley University

Video/Audio

Email
Bulletin B.
Chat
Whiteboard
Video-conf.
Audio-conf.

Data-driven App. + Availability (24/7)

Text
PPT slides
Pictures

Web-based Animation

Web-based programming and simulation

Towards Web 3.0
(Mobile and Personalized Web Learning)

Web 3.0:
- Mobile and personal Web
- Focus on individual user
- Integrated on-demand dynamic content
- Based on user behavior (profile)
- Semantic Web and learning objects

Recent Software Engineering Technologies:
- Syndication technology
- Mashup technology
- AJAX technology
- Web services
- Metadata, folksonomy, ontology
- Hypermedia technologies
- Location-aware technology
- Recommendation engines
- etc.

Toshiba e805 Pocket PC
- 4" + VGA (480x640 pixels); standard – 3.5" + 320x240 pixels
- Voice over IP is great
- Video window only
- Acceptable for “Talking Head” teaching technology (for courses in Sociology, Psychology, Business, History, etc.)

Good Achievements in AI area
- Intelligent tutoring systems
- Intelligent agents
- etc.
Web Systems

Early Web-Based Systems

- In the early days of the Web, we built systems using informality, urgency, intuition, and art.
  - Informality leads to an easy work environment—one in which you can do your own thing.
  - Urgency leads to action and rapid decision making.
  - Intuition is an intangible quality that enables you to “feel” your way through complex situations.
  - Art leads to aesthetic form and function—to something that pleases those who encounter it.
- Problem is that this approach can and often does lead to problems.
Next Generation of Web Systems

- As WebApps become larger and more complex,
  - Informality remains, but some degree of requirements gathering and planning are necessary
  - Urgency remains, but it must be tempered by a recognition that decisions may have broad consequences
  - Intuition remains, but it must be augmented by proven management and technical patterns
  - Art remains, but it must be complemented with solid design
  - Technology-focused (mobile Web, mobile devices, protocols, …)

- Bottom line—we must adapt the old-school approach to the realities of modern Web

... and what is the response?

Web Systems Engineering

= Web Engineering (WebE)
Web-based systems = Web systems

- The term *Web system or Web application* (WebApp) encompasses:
  
- everything from a simple Web page (that might help a consumer compute an automobile lease payment) to a comprehensive (very complex and very powerful) compound website (for ex., that provides complete e-business for various companies or 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.

Web Engineering Process: Framework (main) Activities & Actions (development cycle based on incremental models)
Web Systems Engineering Process (WebE)

- **Analysis Modeling** helps you to understand the nature of customer’s requirements or the problem being addressed and the “shape” of the WebApp that will allow you to address that problem.
- **Design Modeling** is about understanding the internal structure of the WebApp to-be-developed and how this creates the shape of the WebApp that was identified by the analysis model.

**WebE Models: Goals and Outputs/Diagrams**

<table>
<thead>
<tr>
<th>WebE Models</th>
<th>Goal</th>
<th>Diagrams to be used to reflect analysis models</th>
<th>Tools to be used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction Model</td>
<td>Describes the manner in which users interact with the WebApp.</td>
<td>Use Cases (UCs)</td>
<td>UMLet</td>
</tr>
<tr>
<td></td>
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<td>User Interface prototypes</td>
<td>MS Expression Studio</td>
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<td>Visual Paradigm</td>
</tr>
<tr>
<td>Information model (or, Content Model)</td>
<td>Identifies the full spectrum of content to be provided by the WebApp. Content includes text, graphics and images, and video and audio data.</td>
<td>Content Objects (including, Data Objects)</td>
<td>Microsoft Visio</td>
</tr>
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<td>Data Flow Diagrams (DFDs)</td>
<td>IBM Rational Software</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Content Model Trees (CMTs)</td>
<td>SmartDraw</td>
</tr>
<tr>
<td>Functional Model</td>
<td>Defines the operations that will be applied to WebApp content and describes other processing functions that are independent of content but necessary to the end user.</td>
<td>State Transition Diagrams (STDs)</td>
<td>UMLet or SmartDraw</td>
</tr>
<tr>
<td></td>
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<td>Activity Diagrams (ADs)</td>
<td>UMLet</td>
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<tr>
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<td>Sequence Diagrams (SDs)</td>
<td>SmartDraw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SwimLane Diagrams (SLDs)</td>
<td>SmartDraw</td>
</tr>
<tr>
<td>Configuration Model</td>
<td>Describes the environment and infrastructure in which the WebApp resides.</td>
<td>Components:</td>
<td>UMLet or SmartDraw</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hardware, operating systems</td>
<td>MS Visio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Software</td>
<td>IBM Rational Software</td>
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<tr>
<td></td>
<td></td>
<td>Internet, browsers</td>
<td>SmartDraw</td>
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<td>Data Protocols</td>
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<td></td>
<td></td>
<td>Security considerations etc.</td>
<td></td>
</tr>
</tbody>
</table>
Web Systems Engineering

Must take into consideration Web systems’ characteristics

Web Systems Characteristics

- Network intensiveness
- Concurrency
- Unpredictable load
- Performance
- Availability
- Data driven
- Content sensitive
- Continuous evolution
- Immediacy
- Security
- Aesthetics
**WebApp Attributes (details)**

1. **Network intensiveness.** A WebApp resides on a network and must serve the needs of a diverse community of clients.
   
   *) professionals and kids, young and aged people with various backgrounds, various computers, various cultures, various technology and browsers, etc.

2. **Concurrency.** A large number of users may access the WebApp at one time; patterns of usage among end-users will vary greatly.
   
   *) 0, 1 …, 10,000+ users simultaneously

3. **Unpredictable load per day.** The number of users of the WebApp may vary by orders of magnitude from day to day.
   
   *) 0, 1 …, 1,000,000+ users per day – leads to various server infrastructure, broadband requirements, and mirroring servers

4. **Performance.** If a WebApp user must wait too long (for access, for server-side processing, for client-side formatting and display), he or she may decide to go elsewhere.
   
   *) text-based, graphic-based, animation-based, streaming video-based

5. **Availability.** Users of popular WebApps often demand access on a "24/7/365" basis.
   
   *) airlines, hotels, etc. Maintenance and updates/upgrades is an issue

6. **Content sensitive.** The quality and aesthetic nature of content remains an important determinant of the quality of a WebApp.
   
   *) especially, for educational and governmental web sites

7. **Data driven.** The primary function of many WebApps is to use hypermedia to present text, graphics, audio, and video content to the end-user (to make Web content more comfortable and convenient for users)
   
   *) especially, for educational web sites (see example below)

8. **Continuous evolution.** Unlike conventional application software that evolves over a series of planned, chronologically-spaced releases, Web applications evolve continuously.
   
   *) especially, for educational web sites (see example below)
Main Components of a Virtual School System

WebApp Attributes (details)

WebApps often exhibit a time to market that can be a matter of a few days or weeks. With modern tools, sophisticated Web pages can be produced in only a few hours. *) auctions, online tests, etc.

10. Aesthetics.  
When an application has been designed to market or sell products or ideas, aesthetics may have as much to do with success as technical design. *) online shops (Bad design – I will not buy anything here)

In order to protect sensitive content and provide secure modes of data transmission, strong security measures must be implemented throughout the infrastructure that supports a WebApp and within the application itself. *) military apps, patients’ medical records, etc.
How many computers are infected RIGHT NOW in the world?

What are new viruses?

Jan 27, 2013, 9:00 AM
http://home.mcafee.com/virusinfo/global-virus-map
Web Systems Types

- Informational
- Download
- Customizable
- Interaction
- User input
- Transaction-oriented
- Service-oriented
- Portals
- Database access
- Data warehousing

(see http://digitalenterprise.org/models/models.html for examples)

Main Categories of Web Systems (1)

1. Informational  
   read-only content is provided with simple navigation and links  
   (ex: cnn.com)

2. Download  
   a user downloads information from the appropriate server  

3. Customizable  
   the user customizes content to specific needs (good web sites)

4. Interaction  
   communication among a community of users occurs via IM, chat rooms, bulletin boards

5. User input  
   forms-based input is the primary mechanism for communicating need (like, send a request)

6. Transaction-oriented  
   the user makes a request/purchase (e.g., places an order) that is fulfilled by the WebApp (online shopping)
Main Categories of WebApp (2)

7. Service-oriented  
the application provides a service to the user, e.g., assists the user in determining a mortgage payment

8. Portal  
the application channels the user to other Web content or services outside the domain of the portal application

9. Database access  
the user queries a large database and extracts information

10. Data warehousing/data mining  
the user queries a collection of large databases and extracts information (stand-alone database and online database – are two different types of databases)

11. Action-based  
Web-based games (one player, many players, etc.)

12. Educational Web-based simulators, animators, etc. (that require very high Internet speed)

Internet-2: Collaboration of 200+ U.S. Universities on D&D of 100+GBps = 100,000+MBps Network
What is current Internet speed record ??

Internet2 Land Speed Record

The Internet2 Land Speed Record (16 Gb/s) competition for the highest bandwidth enclosed network is an open and ongoing event.

"We hope this competition gets people thinking about what the next evolutionary internet application will be.
- Jon Stan

"To realize Internet's full potential, end to end network performance needs to soon be at least 100 Gb/s"  
- Director 360

Current Records

IP6 Category

Single Stream Class: 250 Gb/s is expected to be set by a team consisting of members from the University of Tokyo, the RICCS Project, NICT Communications, and others. They are expected to reach 250 Gb/s in 2020, with a goal of 300 Gb/s in 2030.

Multiple Streams Class: 225 Gb/s is expected to be set by a team consisting of members from the University of Tokyo, the RICCS Project, NICT Communications, and others. They are expected to reach 225 Gb/s in 2019, with a goal of 250 Gb/s in 2020.

IP6 Category

Single Stream Class: 1 Tbit/s is expected to be set by a team consisting of members from the University of Tokyo, the RICCS Project, NICT Communications, and others. They are expected to reach 1 Tbit/s in 2020, with a goal of 1.5 Tbit/s in 2025.

Multiple Streams Class: 900 Gb/s is expected to be set by a team consisting of members from the University of Tokyo, the RICCS Project, NICT Communications, and others. They are expected to reach 900 Gb/s in 2019, with a goal of 1 Tbit/s in 2020.

Examples of Internet2 Synchronous Applications in Education

- Uncompressed Video with high-possible quality
- Live (synchronous) e-Learning (2-way interactive video+ audio)
- Interactive Video Conferencing and Collaboration (Team Working, Design, Development)
- On-Demand Video
- Content Streaming
- Tele-immersion
- Virtual Scientific Labs
- Remote Instrumentation
- Distributed Computing and Simulation
- Virtual Reality
- and many other applications
Topic 02


Additional information.

Dr. Uskov’s Evolution of Web-Based Courseware

Continuous Evolution of educational web sites

Learners can HEAR, SEE, SAY WRITE and DO (RF: 65%-95%)

Learners can HEAR and SEE (RF: 40%-70%) 2001

Learners can SEE (RF: 40%-50%)

Learners can READ (e-learning by e-reading: 20-40% retention factor)
Web 2.0 ???

Web, Web 1.0, Web 2.0, Web 3.0 …

- Web 1.0 was about reading          Web 2.0 is about writing
- Web 1.0 was about companies        Web 2.0 is about communities
- Web 1.0 was about client-server    Web 2.0 is about peer to peer
- Web 1.0 was about HTML             Web 2.0 is about XML
- Web 1.0 was about home pages       Web 2.0 is about blogs
- Web 1.0 was about portals          Web 2.0 is about RSS
- Web 1.0 was about taxonomy         Web 2.0 is about tags
- Web 1.0 was about wires            Web 2.0 is about wireless
- Web 1.0 was about owning           Web 2.0 is about sharing
- Web 1.0 was about IPOs             Web 2.0 is about trade sales
- Web 1.0 was about Netscape         Web 2.0 is about Google
- Web 1.0 was about web forms        Web 2.0 is about web applications
- Web 1.0 was about screen scraping  Web 2.0 is about APIs
- Web 1.0 was about dialup           Web 2.0 is about broadband
- Web 1.0 was about hardware costs   Web 2.0 is about bandwidth costs

Web, Web 1.0, Web 2.0, Web 3.0 …


The Web

- An indispensable (crucial, vital, central) 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
Other possible classifications:
Main Categories of WebApps from “business point of view”

- Brokerage
- Advertising
- Infomediary
- Merchant
- Manufacturer (Direct)
- Affiliate
- Community
- Subscription
- Utility

Source: http://digitalenterprise.org/models/models.html

Examples of business-oriented WebApps (1)

<table>
<thead>
<tr>
<th>Type of Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brokerage Model</td>
<td>Provide exchange venues for buying/selling (B2B, B2C, C2C). Conduct or mediate transactions on behalf of commerce. Brokerage models include:</td>
</tr>
<tr>
<td></td>
<td>- Auction/Bidding - Conduct auctions for trade (individual or collective). Broker charges the seller a fee and keeps the money charged until the sale closes.</td>
</tr>
<tr>
<td></td>
<td>- Subscription - Conduct auctions for multiple (individual or collective). Broker charges the seller a fee and keeps the money charged until the sale closes.</td>
</tr>
<tr>
<td></td>
<td>- Virtual Markets - In virtual markets, a marketplace is created for exchange.</td>
</tr>
</tbody>
</table>

Source: http://digitalenterprise.org/models/models.html
Examples of business-oriented WebApps (2)

Source: http://digitalenterprise.org/models/models.html

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Examples of business-oriented WebApps (3)

Source: http://digitalenterprise.org/models/models.html
Examples of business-oriented WebApps (4)

Source: http://digitalenterprise.org/models/models.html

CS593 Homework 1
Homework Assignment:
Provide at least 3 (better 5) well-known examples (WebApp name, Web address, and snapshot) for each group of WebApp

1. Informational: read-only content is provided with simple navigation and links (ex: cnn.com)
3. Customizable: the user customizes content to specific needs
4. Interaction: communication among a community of users occurs via IM, chat rooms, bulletin boards)
5. User input: forms-based input is the primary mechanism for communicating need (like, Search Bradley Course)
6. Transaction-oriented: the user makes a request/purchase (e.g., places an order) that is fulfilled by the WebApp (online shopping like amazon.com)
7. Service-oriented: the application provides a service to the user, e.g., assists the user in determining a mortgage payment
8. Portal: the application channels the user to other Web content or services outside the domain of the portal application
9. Online Databases: the user queries a large database and extracts information
10. Data warehousing/data mining: the user queries a collection of large databases and extracts information (stand-alone database and online database – are 2 different types of databases)
11. Action-based: Web-based games (one player, many players, etc.)
12. Educational: Web-based simulators, animators, etc. (that require very high Internet speed).