Overview

What is Web 2.0?

Sites use technologies beyond static pages of earlier websites.

❖ Users interact and collaborate with one another
  ➢ Rich user experience with dynamic content
  ➢ Users participate and contribute
  ➢ Social networking sites, blogs, wikis, video sharing sites
Examples

❖ Social Networking
  ➢ Facebook, Twitter, LinkedIn

❖ Photo and Video Sharing
  ➢ Flickr, Youtube

❖ Other
  ➢ Google Docs, Google Maps, Google Calendar
Client/Server Model

Client
- Mac OS
- PDA
- Laptop
- PC

Web Server
- UNIX
  (Apache Web Server)

INTERNET
System Architecture

- Resource tier: backend systems, files, and databases
- Service tier: connects resources to web through frameworks including PHP, Rails, ASP
- Client application tier: client-side views such as web browsers
- Design, development, and governance tools: tools to build the web applications including IDEs, xCode, Adobe Dreamworks

Source: www.oreilly.com
System Architecture

Client-Server Model

Data Object Library
- Interfaces for Access/Edit
- Basic Queries
- AQI Execution System
- Data XML Generation

Server
- Web Site
  - HTML User Interface
  - AJAX Response Handler
- Web Service
  - Query Interfaces
  - XML Data Access
  - Object Access
- Data XML

Client
- Web Browser
  - HTML Display
  - Javascript /AJAX Interaction
  - Java Interactive Graph Applet

Sample Database
KEGG Database

HTTP
Client-Server Model

Client and Database

- **Client:** web browser
  - Google Chrome, Internet Explorer, Mozilla Firefox
  - HTML5, CSS3, JavaScript, AJAX

- **Server**
  - Apache, Microsoft IIS, lighttpd

- **Database:** backend data
  - MySQL, Oracle Database
Client-Server Model

Server

- Server: web server
  - Apache, IIS
    - PHP
    - Python (Django)
    - Rails (Ruby)
    - JavaScript (jQuery, Node.js)
    - ASP (Asp.Net, C#)
    - JSP (Java/EJB)
    - Flash
    - CGI/Perl
Evolution of Web Technologies

Flash to HTML5

Flash: Adobe’s product for website engine

- Search engines do not like Flash
- Ignores user needs
  - Splash sites, site intros
  - Disabled back-button
- Requires a lot of bandwidth
- Better uses than for website engine:
  - Ads & banners, games, video streaming
- Stores data on the client
Evolution of Web Technologies

*Flash to HTML5*

**HTML5**
- Mobile web application development
- All browsers can use it
- Game development
  - Alternative to Flash!
- Dynamic web applications
  - Drag and drop capabilities, browser history management, document editing
- Cleaner, descriptive semantics / code
Client-Side Languages

*Popularity*

<table>
<thead>
<tr>
<th>Language</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>11.7%</td>
</tr>
<tr>
<td>JavaScript</td>
<td>88.1%</td>
</tr>
<tr>
<td>Flash</td>
<td>13.5%</td>
</tr>
<tr>
<td>Silverlight</td>
<td>0.2%</td>
</tr>
<tr>
<td>Java</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Percentages of websites using various client-side programming languages

Note: a website may use more than one client-side programming language

<table>
<thead>
<tr>
<th>Markup</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTML</td>
<td>55.0%</td>
</tr>
<tr>
<td>XHTML</td>
<td>45.7%</td>
</tr>
</tbody>
</table>

Percentages of websites using various markup languages

Note: a website may use more than one markup language
## Server-Side Languages

### Popularity

<table>
<thead>
<tr>
<th>Language</th>
<th>Popularity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHP</td>
<td>82.2%</td>
</tr>
<tr>
<td>ASP.NET</td>
<td>17.3%</td>
</tr>
<tr>
<td>Java</td>
<td>2.7%</td>
</tr>
<tr>
<td>ColdFusion</td>
<td>0.8%</td>
</tr>
<tr>
<td>Perl</td>
<td>0.6%</td>
</tr>
<tr>
<td>Ruby</td>
<td>0.5%</td>
</tr>
<tr>
<td>Python</td>
<td>0.2%</td>
</tr>
<tr>
<td>JavaScript</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

Percentages of websites using various server-side programming languages

Note: A website may use more than one server-side programming language

W3Techs.com, 10 July 2014
Comparing Different Web Technologies

- **JavaScript**: absolutely necessary to know for front-end development.
  - Necessary to build the UI
  - Also should know HTML5/CSS3
  - Reference/tools: [http://www.w3schools.com/](http://www.w3schools.com/)
  - Not necessary to use Node.js or jQuery frameworks to use JavaScript (more on that later)
Comparing Different Web Technologies

- **Ruby On Rails**: Ruby is a programming language and Rails is the framework that uses Ruby
  - Popular blackbox platform today
  - Nice, clean language to use
  - Steep learning curve
  - Getting started with Rails: [http://guides.rubyonrails.org/getting_started.html](http://guides.rubyonrails.org/getting_started.html)
Comparing Different Web Technologies

❖ **PHP**: one of the most common back-end, server-side languages

➢ Easiest to learn, especially for beginner programmers
➢ Very common => several libraries and APIs already exist
➢ Not a very good language though
  ■ Performance one of the slowest
  ■ Reputation for security issues
➢ Reference/tools: [http://www.w3schools.com/](http://www.w3schools.com/)
Comparing Different Web Technologies

❖ **Django**: web development framework written in Python
  ➢ Popular blackbox platform today
  ➢ Python has strong support with non-web aspects
    ■ System administration, data analytics
  ➢ Steep learning curve if not familiar with Python or the framework
Comparing Different Web Technologies

❖ **Node.js & jQuery:** JavaScript based
  ➢ Good for strong background in JavaScript
  ➢ Growing in popularity
  ➢ Node.js isn’t good for large CPU tasks
  ➢ jQuery has simple architecture
  ➢ Both are compatible with JavaScript, which is anyway used for the front-end

➢ Tools/References:
  ■ jQuery: [http://www.w3schools.com/jquery/](http://www.w3schools.com/jquery/)
Comparing Different Web Technologies

❖ **ASP.NET:** language for Microsoft’s ASP technology.
  ➢ Can also use C# and Visual Basic
  ➢ Class library system => good maintainability
  ➢ Uses large amount of web server resources than PHP and other languages
    ■ Runs on IIS
  ➢ Documented bugs and vulnerabilities
Where are these technologies used today?
Web Technologies Used

Google

- **Server-side:**
  - Mainly Python
  - Also Java, C++

- **Client-side:**
  - JavaScript
  - HTML, CSS

- **Database:**
  - BigTable

- **Web Server:**
  - Google Web Server
Web Technologies Used
Facebook

❖ Server-Side:
➢ Mainly PHP
➢ Also C++, Java, Python

❖ Client-Side:
➢ JavaScript
➢ HTML/CSS

❖ Database:
➢ MySQL, HBase
Web Technologies Used

Twitter

- **Server-Side:**
  - C++, Java, Ruby on Rails
  - Also Scala

- **Client-Side:**
  - JavaScript
  - HTML, CSS

- **Database:**
  - MySQL
Web Technologies Used

Youtube

❖ Server-Side:
  ➢ C/C++
  ➢ Also Java, Python

❖ Client-Side:
  ➢ Flash
  ➢ JavaScript

❖ Database:
  ➢ MySQL
  ➢ BigTable
Web Technologies Used

**Bing**

- **Server-Side:**
  - ASP.NET

- **Client-Side:**
  - JavaScript
  - HTML, CSS

- **Database:**
  - Microsoft SQL Server
Now, for selecting your web technology

Here are some things to consider...
Selecting Your Web Technology

Factors to Consider

❖ Needs vs. Strengths
➢ Figure out what strengths you need most; ignore the other strengths
➢ Decide whether it saves time or not

❖ Testing
➢ Testable with unit testing and integration testing?
   ■ Lecture on testing to come in future…

❖ Documentation
➢ Choose technology with well-written and easy-to-understand documentation
➢ Sample code and tutorials available
Selecting Your Web Technology

Factors to Consider

❖ Servability
  ➢ Speed, hosting, and operation costs matter!

❖ Security
  ➢ Check track record of common vulnerabilities, such as database injections
  ➢ Check track record of maintainance

❖ Longevity
  ➢ Compare how long technology has been around or will be around moving forward
Selecting Your Web Technology

Factors to Consider

❖ Learning Curve and Hireability

➢ Know if the technology is difficult to learn at first and easy to master later, or vice versa
➢ Know if the skills needed are easy to find today
How do we implement?
Hardware
Server Hardware

Compute Server

Storage - SAN
Data Center
Data Center
Cloud Services

Can Provide Scalability without capital investment

Cloud Clients
- Web browser, mobile app, thin client, terminal emulator, ...

SaaS
- CRM, Email, virtual desktop, communication, games, ...

PaaS
- Execution runtime, database, web server, development tools, ...

IaaS
- Virtual machines, servers, storage, load balancers, network, ...
Platform as a Service (PaaS)

● Provides computing platforms as a subscription service
● No need to know how to maintain/administer the platform - OS, Development Environment, Database, Server
● Automatic provisioning
● Example - Heroku
  ○ Originally, Ruby
  ○ Now, Java, Node.js, Scala, Clojure, Python and PHP
Infrastructure as a Service (IaaS)

- Provides physical or virtual machines along with resources such as storage in a subscription model
- More control, but more administrative/maintenance overhead
Rackspace

- Cloud Sites: web application hosting
  - PaaS
  - Fixed, monthly payment
  - Supports most application frameworks, but not Java (server-side) at this time
- Cloud Files: cloud storage
  - Unlimited online storage
  - Online control panel to manage
- Cloud Storage: virtual, private servers
  - IaaS
Amazon AWS

- Amazon Elastic Cloud Compute (EC2) is central part of cloud computing platform
  - Users create, launch, and terminate server “instances” as needed (instances = VMs)
  - Pay by the hour ($0.013/hr)

- Amazon Simple Storage Service (S3) is online file storage web service
  - Web hosting, image hosting, storage for backup systems
  - Stores more than 2 trillion objects as of 2013
  - Pay $0.15 per gigabyte per month
Examples

- Netflix
- DropBox
- Reddit
- Foursquare
Microsoft Azure

- PaaS and IaaS services for Microsoft-specific and third party systems
  - Web hosting for PHP, ASP.NET, Node.js, and Python (PaaS)
  - Virtual Machines run Windows and some Linux distributions (IaaS)
Google

- Google Cloud Storage for developers, Google Drive for non-developers (personal)
  - Can integrate both together
  - PaaS: Google App Engine
  - IaaS: Google Compute Engine
- User-friendly GUI to manage projects and objects (all your data)
- Used by Snapchat, Khan Academy, Pulse, and more