INTERNET & WEB APPLICATION DEVELOPMENT SWE 444

Fall Semester 2008-2009 (081)

Module 6: Web Engineering Fundamentals

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Objectives/Outline

- Objectives
  - Understand the role of web engineering
  - Learn a systematic process for web applications development
- Outline
  - Introduction
  - Requirements Analysis
  - Web Modeling
  - Web Design and Architecture
  - Web Accessibility

Resources

- Books
  - Roger S. Pressman, David Lowe (2009). *Web Engineering: A Practitioner's Approach*, McGraw-Hill. http://highered.mcgraw-hill.com/sites/0073523291/
  - Roger Pressman (2005). *Software Engineering: A Practitioner's Approach*, 6/e, McGraw-Hill Higher Education. Chapters 16-20. http://highered.mcgraw-hill.com/sites/0072853182/information_center_view0/
  - G. Kappel, B. Pröll, S. Reich, and W. Retschitzegger (eds), *Web Engineering - The Discipline of Systematic Development of Web Applications*, John Wiley & Sons, 2006. http://www.web-engineering.at/eng/
- Online material
  - INFSCI 2955: Web Engineering
  - Department of Information Science and Telecommunications, University of Pittsburgh http://www.sis.pitt.edu/~jgrady/

6.5 WEB USABILITY & ACCESSIBILITY

Outline

- The Case for Usability
- Defining Web Usability
- General Design Guidelines
- Usability Engineering
- Web Accessibility in Depth

Top 7 Gripes

- Contact information – address or phone number is buried
- Search function is not visible or unclear as to functionality
- No easy way to get back to critical points
- Pages that should load fast don't (e.g. Main page or key link page)
- Slow page loads are not incremental
- "What's new" is old!
- Back button requires a repost of data

Usability Defined

- "A quality attribute that assesses how easy user interfaces are to use. The word 'usability' also refers to methods for improving ease-of-use during the design process." (Nielsen 2003).
- The 5 Es of usability (Quesenbery 2002):
  - Provide a more robust definition.
  - Include effectiveness, efficiency, engaging, error tolerant and easy to learn.
- ISO 9421:
  - "Usability is a measure of the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in a particular environment."
- Usability engineering is an ongoing, but critical process
  - Define user and task models
  - Iteratively test and reevaluate
  - User-based vs. expert methods

Defining Usability in Web Apps

- Traditional software usability specifics do not necessarily carry over to the Web:
  - People use your application *immediately*.
  - No manual or trainers
  - No salespeople
- How to categorize users?
  - First-time or returning?
  - Expert or novice?
  - Broadband or dial-up?
  - Desktop or mobile?

What is accessibility?

- "The power of the web is in its universality. Access by everyone regardless of disability is an essential aspect." (Tim Berners-Lee, W3C 2005)
- Web Content Accessibility Guidelines (WCAG):

> "These guidelines explain how to make Web content accessible to people with disabilities... The primary goal of these guidelines is to promote accessibility. However, following them will also make Web content more available to all users, whatever user agent they are using (e.g., desktop browser, voice browser, mobile phone, automobile-based personal computer, etc.) or constraints they may be operating under (e.g., noisy surroundings, under- or over-illuminated rooms, in a hands-free environnent, etc.). (Chisholm, et al. 1999) »

What is accessibility? (cont.)

- Ensuring systems and interfaces can be visited, understood and interacted with by all users through:
  - Access to hardware and software
  - Use of appropriate assistive technology
  - Ensuring information can be interpreted by the user and the technology.
- Accessibility between technologies
- Accessibility between technology and humans
- Accessibility between humans and the context where technology is used
- Information increasingly being provided in electronic formats via PCs, smart phones, TV, hand held computers etc
- The business case: accessibility = commercial success
- Inclusive society - information for all

What is accessibility? (cont.)

- Accessible design helps people to independently access and interact with web-based content
  - With disabilities e.g. visual, mobility, learning, hearing.
  - Working in a noisy environment
  - Using a PC with a slow connection
  - Using small screen web-based devices e.g. smart phones, hand-held computers etc

Why is Usability Important?

- "Mission critical" Web applications
- Poor design leads to lost time, productivity
- Your website speaks for your organization
  - Customers have choices
  - Easy come, easy go
- Diverse contexts
  - Proliferation of web-enabled devices
  - Increasing adoption by special needs groups – ex. seniors

Human Information Processing

- Human cognition places a critical role in user interface design.
  - Perception
    - Positioning, grouping, arranging
    - Perceiving shapes and relationships
  - Memory
    - Limitations of working memory
    - Chunking, 7 ± 2 (Miller)
  - Attention
    - Focusing on one aspect
    - Movement, color schemes

General Design Guidelines

- Design guidelines represent best practices
- OK for "general" users
  - Normal cognitive ability
  - Normal audiovisual abilities
- Some guidelines may be inappropriate for audience members with special needs.
  - Ex. Navigation elements for schizophrenics
- More rigorous usability engineering techniques should be employed (later in lecture.)

Guidelines – Response Times

- As response times increase, user satisfaction decreases
  - Anything greater than 3 seconds, and the user becomes aware he/she's waiting
  - After 10 seconds, user gives up
- Optimize, or minimize graphics
- Consider breaking up large pages.
- <img> - use "width" & "height" attributes
- Don't forget your dial-up audience!
  - Home page size should be < 50Kb
  - Provide warnings (MPG – 2.5Mb)
- Website Optimization
  - http://www.websiteoptimization.com/services/analyze/wso.php

Guidelines – Efficiency

- Minimize distance between clickable elements (while keeping effective sizing)
- Avoid frequent changes between mice and keyboards
- Tab-friendly for text-based browsers
- Minimize clicks to accomplish tasks (rule of thumb: no more than 4 clicks)
- Not so good: http://www.brown.edu

Guidelines – Colors

- Colors have different meaning depending on your audience
  - Cultural differences
  - Domain-specific meanings
  - Warm vs. cool colors
- Minimize the number of colors
- Avoid extreme hues, highly saturated colors
- How does your site look on a CRT? LCD?
- Supplement colors with other visual aids for those with limited color vision.

Guidelines – Text Layout

- Screen vs. Paper
- Consider different window sizes
  - Avoid multiple columns
  - Avoid fixed width
- Readability
  - Sans-serif for screen, serif for print
  - Avoid patterns, low-contrast background
  - Short paragraphs
- Allow for user-selected font-sizes

Guidelines – Page Structure

- Display considerations
- Use relative positioning over absolute.
- Vertical scrolling is fine; horizontal scrolling is NOT.
- Important elements should ALWAYS be visible.
- Make page print-friendly or provide alternative style and print button.
- Not-so-good: http//www.arngren.net

Guidelines – Navigation

- Provide your user with a mental model of the site ASAP.
  - Intuitive navigation elements
  - Site map
  - Breadcrumbs
- Pulldown menus?
  - Pros: Efficient use of space
  - Cons: Key information is hidden
- Not-so-good: Brown Univ. (circa 2005)

Guidelines – Multicultural

- Location is typically not a constraint on the Web.
- "Lowest common denominator" applies:
  - Avoid over-expressive colors
  - Symbols
  - Language
  - Information representation (date/time formats)
- Present form elements consistently
- Self-selection?

Guidelines – Establishing Trust

- Loyalty is fleeting, but instilling confidence during a transaction is highly critical
- Ways to build trust:
  - About us
  - Easy-to-access Contact Information
  - Interaction mechanisms (FAQ, chat rooms)
  - Security & privacy policies
  - Exchange and warranty policies
  - Customer relations management

Guidelines – Animations & Icons

- Remember human attention – animations are typically distracting
  - Draw attention to an important function
  - Explain something
- Iconography should be used to support navigation understanding
  - Map to commonly-known metaphors
  - Use redundant text and "alt" text!
  - Not appropriate for (some) cognitive-impaired users
- Not-so-good: http://www.globalaigs.org/

Guidelines – Consistency

- Consistency keeps learning to a minimum; users don't want to have to think!
- Identity can be set by consistent components
  - Header: home, logo, navigation, search, help
  - Footer: author, modification, contact
- Consistent design helps users avoid getting lost, especially when jumping to different sub-units of an organization.

Usability Engineering

- Consists of 4 phases that are essentially parallel to the Web Engineering process
  - Requirements Analysis
  - Design
  - Implementation
  - Operation

User-Centered vs. Usage-Centered

Phase	Focal Points	
	User-Centered *(Traditional)*	*Usage-Centered* *(Web)*
Requirements	Meetings, interviews, focus groups	Competitive analysis; Task analysis & models
Design & Implementation	User requirements Direct user participation	Models Inspection & remote testing
Operation	Training, evaluation of help-desk logs	Log file analysis; server stats; user feedback analysis

Requirements Analysis

- Systems Analyst & Usability Expert take the lead:
  - Competitive Analysis
  - Define qualitative/quantitative goals
    - Information, Entertainment, Exchange (Siegel)
    - Make them concrete and testable!
  - User-centered: build user profiles
  - Usage-centered
    - Task analysis
    - Ease-of-use or Ease-of-learning?

Interaction and Design

- Initially, the Interface Designer builds a *conceptual* model
  - Based on core use cases
  - Shows the basic structure
- Getting feedback from potential users
  - Storyboards & Paper Mock-ups
  - Card-sorting (Navigation)
- Usability expert provides input after this first round.

Interaction and Design

- Designer and coders can then elaborate on the details
- Additional user testing:
  - *Prototypes* – exhibit some functionality
  - *Usability Tests* – real context, real tasks.
- Remote usability testing
  - Sample of representative users
  - Client-Logging software
  - Web-cams if possible
  - Better external validity & lower costs(?)

Coding and Post-Deployment

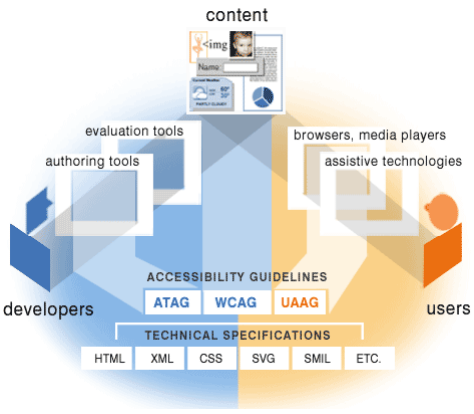
- Usability Expert assumes the role of the Quality Assurance manager.
  - Consistency?
  - Observed guidelines & standards?
  - Adhered to (current) requirements?
- Bring same users back in for testing, if possible.
- Document, document, document!

More on Web Accessibility

- People with disabilities are adopting the Web in greater numbers.
- Tim Berners-Lee stressed universal access to the Web as essential.
- 20% of the world's population have disabilities in at least one of the senses.
- *Key take-aways*:
  - Designing for special needs doesn't necessarily require reinventing your application.
  - Doing so can also help "general" users

Web Accessibility Initiative (WAI)

- Web Content Accessibility Guidelines 1.0 (WCAG, 1999) published by the W3C's WAI
- 3 Priorities
  - 1) Must
  - 2) Should
  - 3) May
- Defines Groups
- WCAG 2.0?



Special Needs Groups

- WAI identifies the following special needs groups:
  - Visual
  - Hearing
  - Physical (Motor)
  - Speech
  - Cognitive
  - Age-related

Visual Considerations

- High-contrast color schemes
- Large font sizes; ability to change fonts
- Use alt attributes!
- <label-for> tags in forms
- Avoid frames
- Access key attributes, and rapid tabbing
- Many software packages for text-to-speech
  - Some integrate with browsers
  - OK Firefox plug-in: FireVox
- Good example: http://www.afb.org

Aural Considerations

- Captioning audio and video
  - Synchronized Multimedia Integration (SMIL)
  - Good QuickTime, RealAudio Support
  - W3C standard
- Complement text with simple images
- Clear, simple language

Physical (Motor) Considerations

- May require specialized hardware
  - Mice
  - Keyboards
  - Voice Recognition
- Avoid elements that require time-dependent responses or precise mouse movements.
- Access key attributes
- Consistent tab ordering in forms.

Cognitive Considerations

- Most neglected of the groups
  - Little research in terms of Web usability
  - "Reinvent the wheel" mentality
- Typically have trouble dealing with abstractions – keep things concrete
- Still a relatively new research field
  - Approaches may vary.
  - No distracting elements
  - Emphasis on consistent navigation
  - High-contrast; large font sizes

Q & A

?

Other Helpful Tools & Resources

- Development
  - Firefox Developer Toolbar (http://chrispederick.com/work/web-developer/)
- Testing
  - http://webxact.watchfire.com (Bobby)
  - http://www.webaim.org (WAVE tool)
- Section 508 of the Rehabilitation Act
  - http://www.section508.gov