WebApp Design

Slide Set to accompany

Software Engineering: A Practitioner's Approach, 7/e

by Roger S. Pressman

Design & WebApps

"There are essentially two basic approaches to design: the *artistic ideal* of expressing yourself and the *engineering ideal* of solving a problem for a customer."

Jakob Nielsen

- *When should we emphasize WebApp design?*
  - when content and function are complex
  - when the size of the WebApp encompasses hundreds of content objects, functions, and analysis classes
  - when the success of the WebApp will have a direct impact on the success of the business

Design & WebApp Quality

- *Design* is the engineering activity that leads to high-quality product.
- ***What is quality?***
- *How is WebApp quality perceived?*
- *What attributes* must be exhibited to achieve goodness in the eyes of the end-users, and at the same time exhibit the technical characteristics of quality that will enable us to *correct, adapt, enhance, & support* the application over the long term?

Design & WebApp Quality

- Consider the following set of technical attributes, offered by **Olsina & colleagues, 1999,** that lead to high-quality WebApps:

1. Usability – Global site understandability.
   Online feedback & help features.
   Interface & aesthetic features.
   Special features.
2. Functionality - Search & retrieval capability.
   Navigation & browsing features.
   Application domain related features.

Design & WebApp Quality

3. Reliability - Correct link processing.
   Error recovery.
   User input validation & recovery.
4. Efficiency - Response time performance.
   Page generation speed.
   Graphic generation speed.
5. Maintainability - Ease of correction.
   Adaptability.
   Extensibility.

Design & WebApp Quality

Consider the following additional attributes, suggested by **Offutt, 2002:**

- Security
  - Rebuff external attacks
  - Exclude unauthorized access
  - Ensure the privacy of users/customers
- Availability
  - The measure of the percentage of time that a WebApp is available for use
- Scalability
  - Can the WebApp and the systems with which it is interfaced handle significant variation in user or transaction volume
- Time to Market
  - Business perspective measure of quality.

Quality Dimensions for End-Users

Consider the following "dimensions of quality" offered by **Miller, 2000,** that represent a view of quality that is more visible to end-users:

- ***Time***
  - How rapidly does the WebApp change?
  - How do you highlight the parts that have changed?
- ***Structural***
  - How well do all of the parts of the WebApp hold together.
  - Are all links inside and outside the WebApp working?
  - Do all of the images work?
  - Are there parts of the WebApp that are not connected?
- ***Content***
  - Does the content of critical pages match what is supposed to be there?
  - Do key phrases exist continually in highly-changeable pages?
  - Do critical pages maintain quality content from version to version?

Quality Dimensions for End-Users

- ***Accuracy and Consistency***
  - Are today's copies of the pages downloaded the same as yesterday's? Close enough?
  - Is the data presented accurate enough? How do you know?
- ***Response Time and Latency***
  - Does the Web site server respond to a browser request within certain parameters?
  - In an E-commerce context, how is the end-to-end response time after information is submitted?
  - Are there parts of a site that are so slow that the user becomes frustrated?
- ***Performance***
  - Is the Browser-server connection quick enough?
  - How does the performance vary by time of day, by load, and usage?
  - Is performance adequate for E-commerce applications?

WebApp Design Goals

- Consider the following set of design goals, suggested by **Jean Kaiser, 2002,** that are applicable to virtually every WebApp, regardless of application domain, size, or complexity:
- Simplicity – All things in "moderation"
  - *Content* should be informative, but succinct and use a delivery mode that is appropriate, e.g. text, video, audio.
  - *Aesthetics* should be pleasing, but not overwhelming.
  - *Architecture* should achieve WebApp objectives in simplest possible manner.
  - *Navigation* should be straightforward; mechanism should be intuitively obvious to end user.
  - *Functions* should be easy to use & easier to understand.

WebApp Design Goals

- Consistency
  - *Content* should be constructed consistently, e.g. text formatting, font styles same for all documents.
  - *Graphic design (aesthetics)* should present a consistent look, colour-scheme, style across all parts of the WebApp
  - *Architectural design* should establish templates that lead to a consistent hypermedia structure.
  - *Interface design* should define consistent modes of interaction, navigation and content display.
  - *Navigation mechanisms* should be used consistently across all WebApp elements

WebApp Design Goals

- Identity – The *aesthetic, interface and navigation design* of WebApp must be consistent with the application domain for which it is to be built.
  - Establish an "identity" that is appropriate for the business purpose, e.g. financial services, entertainment services, travel services. . . .
- Robustness
  - The user expects *robust content and functions* that are relevant to the user's needs. If such elements are missing or insufficient, it is likely that the WebApp will fail.

WebApp Design Goals

- Navigability
  - Navigation should be designed in a manner that is *intuitive and predictable*, i.e. user should understand how to move about the WebApp without having to search for navigation links or instructions. *Live links* should be identified / highlighted.
  - Should be *simple and consistent*.
  - Position links to major WebApp content & functions in a predictable location on every Web page. *Links at both top and bottom of page* makes user's navigation tasks easier, especially where page-scrolling is required.

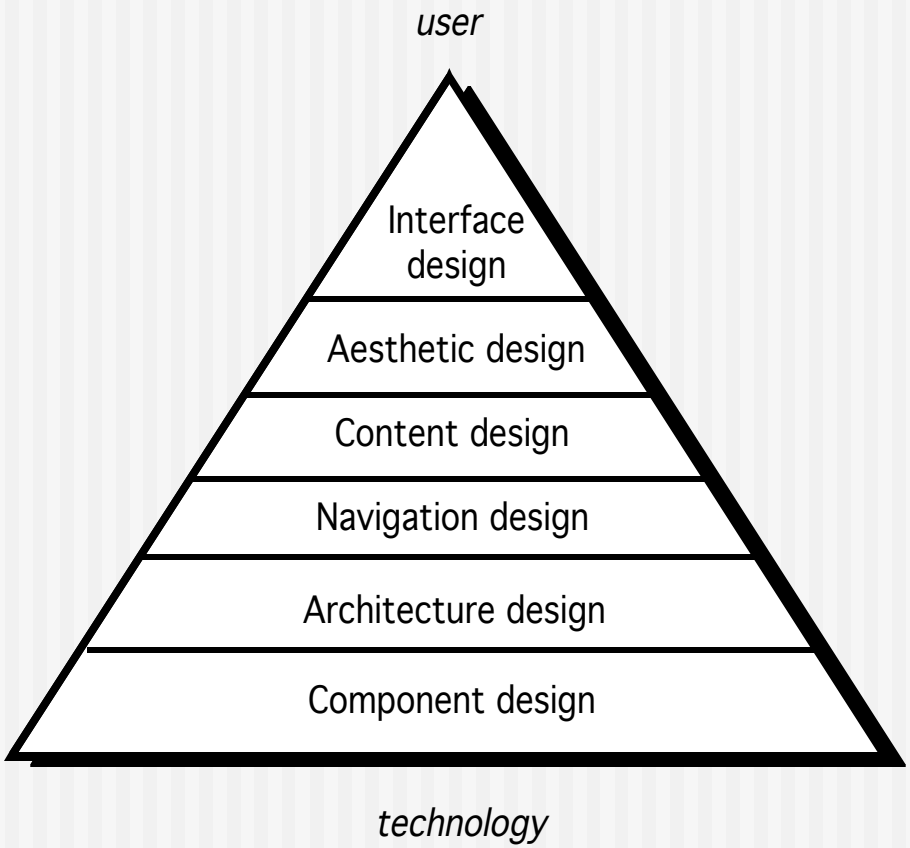
WebApp Design Goals

- Visual appeal – Of all software categories, WebApps are the most visual, the most dynamic, and the most unapologetically aesthetic.
  - The look and feel of content, interface layout, color coordination, the balance of text, graphics and other media, navigation mechanisms *must appeal to end-users.*
- Compatibility
  - With all appropriate environments and configurations.

Note:

A design that achieves each of the above-listed goals will be pleasing to the end-user.

WebE Design Pyramid



WebApp Interface Design

Consider the following questions that should be answered by the WebApp interface, for end-users **[Dix, 1999]:**

- *Where am I?* The interface should
  - provide an indication of the WebApp that has been accessed
  - inform the user of her location in the content hierarchy.
- *What can I do now?* The interface should always help the user understand his current options
  - what functions are available?
  - what links are live?
  - what content is relevant?
- *Where have I been, where am I going?* The interface must facilitate navigation.
  - Provide a "map" (implemented in a way that is easy to understand) of where the user has been and what paths may be taken to move elsewhere within the WebApp.

Effective WebApp Interfaces

- Bruce Tognozzi [TOG01] suggests…
  - Effective interfaces are visually apparent and forgiving, instilling in their users a sense of control. Users quickly see the breadth of their options, grasp how to achieve their goals, and do their work.
  - Effective interfaces do not concern the user with the inner workings of the system. Work is carefully and continuously saved, with full option for the user to undo any activity at any time.
  - Effective applications and services perform a maximum of work, while requiring a minimum of information from users.

Interface Design Principles-I

Consider the following set of design principles for Webapp interface design **[Tognozzi, 2001]**

- Anticipation—A WebApp should be designed so that it anticipates the use's next move.
- Communication—The interface should communicate the status of any activity initiated by the user
- Consistency—The use of navigation controls, menus, icons, and aesthetics (e.g., color, shape, layout) should be consistent throughout WebApp.
- Controlled autonomy—The interface should facilitate user movement throughout the WebApp, but it should do so in a manner that enforces navigation conventions that have been established for the application.
- Efficiency—The design of the WebApp and its interface should optimize the user's work efficiency, not the efficiency of the Web engineer who designs and builds it or the client-server environment that executes it. → ***empower efficient users!***

Interface Design Principles-II

- Focus—The WebApp interface (and the content it presents) should stay focused on the user task(s) at hand. Avoid routing user to *loosely-related content!*
- Fitt's Law—"The time to acquire a target is a function of the distance to and size of the target."
- Human interface objects—A vast library of reusable human interface objects has been developed for WebApps. Use them!
- Latency reduction—The WebApp should use multi-tasking in a way that lets the user proceed with work as if the operation has been completed.
- Learnability— A WebApp interface should be designed to minimize learning time, and once learned, to minimize relearning required when the WebApp is revisited.

Interface Design Principles-III

- Maintain work product integrity—A work product (e.g., a form completed by the user, a user specified list) must be automatically saved so that it will not be lost if an error occurs, i.e. autosave all user-specified data.
- Readability—All information presented through the interface should be readable by young and old → enhance contrast.
- Track state—When appropriate, the state of the user interaction should be tracked and stored so that a user can logoff and return later to pick up where she left off.
- Visible navigation—A well-designed WebApp interface provides "the illusion that users are in the same place, with the work brought to them."

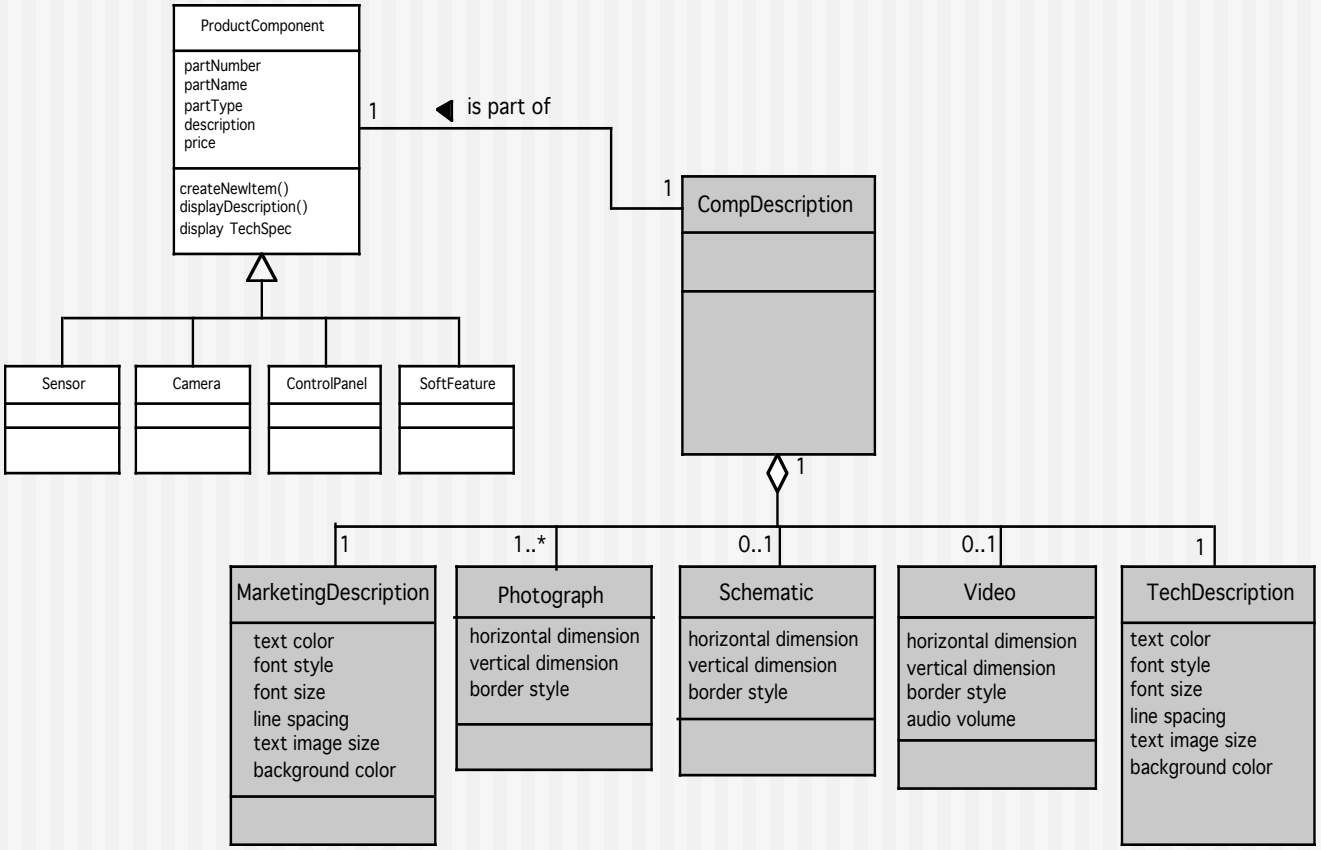
Aesthetic Design

- Don't be afraid of white space.
- Emphasize content.
- Organize layout elements from top-left to bottom right.
- Group navigation, content, and function geographically within the page.
- Don't extend your real estate with the scrolling bar.
- Consider resolution and browser window size when designing layout.

Content Design

- Develops a design representation for content objects
  - For WebApps, a content object is more closely aligned with a *data object* for conventional software
- Represents the mechanisms required to instantiate their relationships to one another.
  - The relationship between content objects is analogous to the relationship between analysis classes and design components.
- A content object has *attributes* that include content-specific information and *implementation-specific attributes* that are specified as part of design

Design of Content Objects



Architecture Design

- Architecture design is tied to the *goals* established for a WebApp, the *content* to be presented, the *users* who will visit, and the *navigation philosophy* that has been established.
- *Content architecture* focuses on the manner in which content objects (or composite objects such as Web pages) are structured for presentation and navigation.
  - The term *information architecture* is also used to suggest structures that lead to better organization, labeling, navigation, and searching of content objects.
- *WebApp architecture* addresses the manner in which the application is structured to manage user interaction, handle internal processing tasks, effect navigation, and present content.
- Architecture design is, typically, conducted in parallel with interface design, aesthetic design and content design.

Content Architecture

- Consider the following types of *content architectures* that are commonly encountered:
  1. *Linear structure*
  2. *Grid structure*
  3. *Hierarchical structure*
  4. *Networked structure*

Linear Structure

- Encountered when a *predictable sequence of interactions* is common.
- Consider the following examples:
  1. A tutorial presentation, in which the sequence of content presentation is predefined and generally linear.
  2. A product order entry sequence, in which particular information is required in a specific order.

Note:

As content & processing become more complex, the purely linear flow gives way to a more sophisticated linear structure in which *alternative content* may be invoked, or a diversion to acquire complementary content occurs.

Grid Structure

- An architectural option that can be applied when content can be organised categorically into two / more dimensions.
- Useful only when *highly regular content is encountered.*
- Consider the following scenario:

  An e-commerce site selling sports-goods.

  The *horizontal dimension* of the grid represents the types of goods available.

  The *vertical dimension* represents the offerings from the various manufacturers.

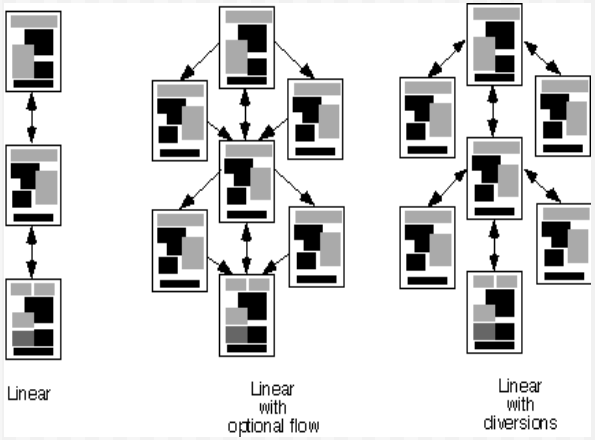
Hierarchical Structure

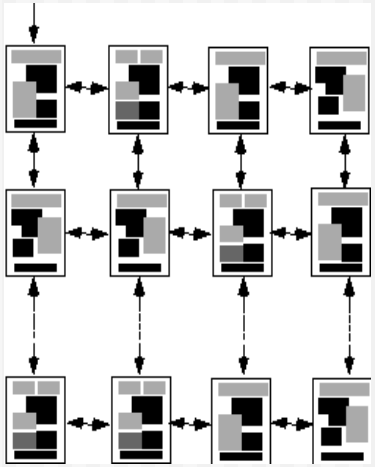
- The most-common WebApp architecture.
- WebApp hierarchical structure can be designed in a manner that *enables flow of control horizontally across vertical branches* of the structure, via hypertext branching. Consequently, content presented on the *far-left* can have hypertext links that lead directly to content in the *middle*, or *far-right* branches.

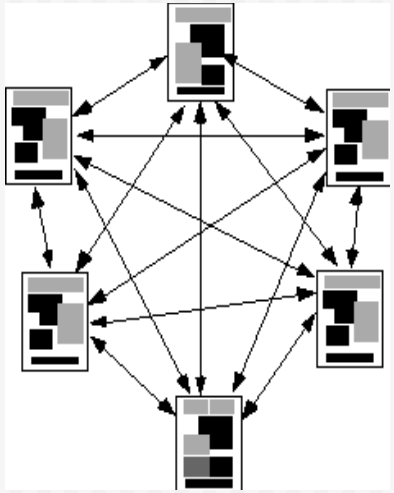
Network Structure

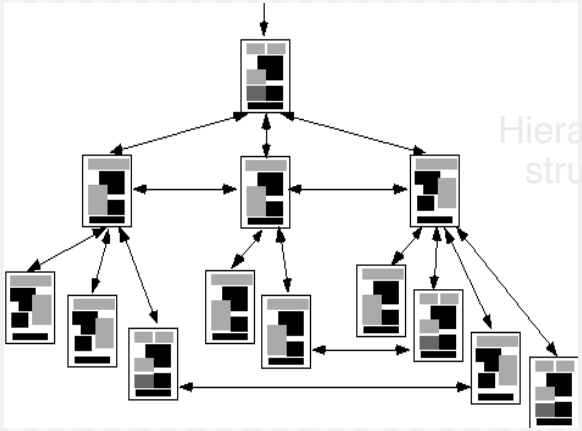
- Aka "*pure web*" structure.
- Similar to an OO architecture – Web pages, (architectural components), are designed so that they can pass control to (virtually) every other component in the system, via hypertext links.
- Allows considerable navigation flexibility.

Content Architecture









Navigation Design

- Begins with a consideration of the user hierarchy and related use-cases
  - Each actor may use the WebApp somewhat differently and therefore have different navigation requirements
- As each user interacts with the WebApp, she encounters a series of *navigation semantic units* (NSUs)
  - NSU—"a set of information and related navigation structures that collaborate in the fulfillment of a subset of related user requirements"