Dynamic User Interfaces

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Outline

- Why Graphical User Interfaces (GUI)?
- Human-Computer Interaction
- Modeling GUIs
- Dynamic Web-Based User Interfaces
- Dynamic Web Page Authoring
  - PEGASUS
  - PERSEUS
  - DESK
- Conclusions
Why GUI?
Why GUI?

Interaction

End-User  Graphical User Interface  Computer
Why GUI?

- The GUI is a chief component in mostly today’s software development projects.
- It determines the success or failure of any software application.
- Almost 48% uptake of code lines correspond to GUI.

[Myers, 92]
Why GUI?

70% uptake of total software development effort concerns GUI design.
Human-Computer Interaction

- GUI increasing led the CS world to get more involved in GUI design as time goes by
  - New discipline appears: HCI
    - Psychology
    - Sociology
    - Design
    - Artificial Intelligence
    - Software Engineering
    - Ergonomics
    - ...

- Main Topics
  - Cognitive Aspects of Interaction
  - Usability
  - Accessibility
  - User-Centered Design
  - Devices
  - AI applied to new interaction algorithms
  - ...

Modeling GUIs

- Creating and maintaining GUIs takes too much time
- Same problem than past software crisis about amounts of GUI code to manage
- Then appear Interface Builders and GUI programming libraries
  - These tools manage the Interface information all together
  - The GUIs are still difficult to maintain
  - GUI programming results complex, and some aspects cannot be managed very well
    - User’s Tasks
    - User’s Interaction Models
    - …. In general: Interaction Behavioral information
Modeling GUIs

Solution

- Split up the GUI information into different conceptual levels
- Create specifications for GUIs creation, independent of the programming language
- Provide with automatic mechanisms for GUI generation and maintenance

Model-Based User Interface Approach
Modeling GUIs

- Dialog Model
- Task Model
- Presentation Model
- Domain Model
- User and Platform Models

Runtime System

Graphical User Interface
Modeling GUIs

- MBUI Approach
  - Allows for defining, separately
    - Interface knowledge
    - Interface presentation
  - Is more efficient regarding the production cycle
  - Allows for reserve engineering processes
Dynamic Web-Based User Interfaces

- Dynamic User Interfaces concern all kind of automatically generated user interfaces
  - Dynamic Web Pages
- The Web
  - Navigation-oriented Universal GUI
  - More used even than desktop GUIs
  - Easy to use for most of end-users
  - Easy to deal with for most of programmers
    - Available collections of widgets and programming languages
Dynamic Web-Based User Interfaces

- The World Wide Web
  - 1st Generation
  - 2nd Generation
  - 3rd Generation

Web Structure

80% uptake of dynamically generated web pages
Dynamic Web-Based User Interfaces

- Increasing necessity, by non-expert-in-CS users, in creating and modifying their own web pages
  - Designers, creative jobs
  - Administrative staff working on DB-based web pages
  - Occasional programmers creating their own small web pages for different purposes
  - ... and, in general terms, people who need to go beyond usual web page navigation
Dynamic Web-Based User Interfaces

80% uptake of dynamically generated web pages

Non-expert-in-programming web author
Dynamic Web-Based User Interfaces

How one can easily author dynamic Web-based pages?
Dynamic Web Page Authoring

- Most of existing Authoring tools provide partial solutions
  - Mostly focused on static authoring
  - It is not easy to split up knowledge and procedural information regarding generation
    - Procedural behavior is hard to be depicted visually
- The provided solution should be end-user-based
  - Gentle Slope of Complexity
    - Tradeoff between expressivity and ease-of-use
    - Avoid the user from facing up to programming and specification languages
      - WYSIWYG Environments
      - Non-intrusive user assistance during interaction
  - Compatibility, reuse and integration
Dynamic Web Page Authoring

1) Dynamic generation mechanisms
   - Splitting up contexts and presentation
     - MBUI approach
   - Defining complex relationships between components and knowledge units
     - High level domain and presentation knowledge

2) Authoring dynamic web documents
   - Direct manipulation environment
   - Artificial Intelligence techniques to infer the user’s intents
   - Automatic changes and modifications to underlying models
### Dynamic Web Page Authoring

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEGASUS</td>
<td>Presentation modelling Environment for Generic Adaptive hypermedia Support Systems</td>
</tr>
<tr>
<td>DESK</td>
<td>Dynamic web documents by Example using Semantic Knowledge</td>
</tr>
<tr>
<td>PERSEUS</td>
<td>Presentation ontology builder for Custom Learning Support Systems</td>
</tr>
<tr>
<td>HADES</td>
<td>Hypermedia Adaptive Educational Server</td>
</tr>
</tbody>
</table>
An example of dynamic web page generation by PEGASUS

PEGASUS Presentation

Domain Model

Presentation Model

PEGASUS Underlying Models

An example of dynamic web page generation by PEGASUS

<HigherCategory id="Internet">
    <subCategories>
        <HigherCategory ref="Connectivity"/>
        <HigherCategory ref="Communications"/>
        <HigherCategory ref="E-Mail"/>
        ...
    </subCategories>
</HigherCategory>

<HigherCategory id="E-Mail">
    <subCategories>
        <LowerCategory ref="E-Mail Clients"/>
        <LowerCategory ref="E-Mail Parsers"/>
        ...
    </subCategories>
</HigherCategory>

<span if (availableSpace > 5) { %}
    <widget type="Table" columns="3" dataflow="wrap">
        <list> <%= subcategories %></list>
    </widget>
</span>

<span } else { %>
    <table>
        <tr><td> <%= id %></td></tr>
        <tr><td> <%= subcategories %></td></tr>
    </table>
</span>

<%= } %>

...
Creating domain knowledge with PERSEUS

DomainObj

Topic

Painter

Fragment

Artwork

Atomic Fragment

Perseus

Perseus Presentation Assistant for Web-based Digital Collections

By: X. Made and J. C. Gahy
Ver. 2.0 March 2001, GMG Dept., ETS, U.A.M.
**DESK**

- **WYSIWYG environment for dynamic web page design**
  - Allow for changes to page appearance
  - Allow for authoring domain knowledge

- **AI-based techniques**
  - The end user provides an example of what s/he expects, the authoring tool infers changes in page generation procedure
  - Detection of patterns by means of a specialised assistant (agent) that tracks the user’s actions

- **DESK runs under PEGASUS**
  - PEGASUS is the dynamic page generation system
  - DESK does the inverse path
  - Uses PEGASUS models for disambiguation
Conclusions

- GUIs have become an important concern as time goes by.
- It’s necessary to provide mechanisms and tools in order to specify, create and automatically maintain GUIs.
- MBUI techniques provide conceptual separation between the different aspects of a GUI.
- Dynamic User Interface is a result of information adaptivity and automatic generation.
- It’s hard to describe procedural information visually, so authoring Dynamic Web-Based User Interfaces become a complex task.
- Some authoring tool have been provided, mainly focused on static aspect.
- PEGASUS and DESK tools allow for automatic dynamic web page generation, providing also with easy-to-use mechanisms for dynamic web page authoring.
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- Authoring Tools and Papers
  - DESK
  - PERSEUS
  - PEGASUS
    - http://astreo.ii.uam.es/~castells/pegasus/