Human-Computer Interaction and Java

Graphical User Interface Building

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Outline

• Introduction
• Functional models for GUI, UML...
• GUI Design (Java)
• Implementation details
• Clients and technologies
• Concluding remarks
Resources


• *Programming Paradigms Course*, Faculty of Mathematics, University of Belgrade.

Introduction

• 1980s shifts in visual technology:
  • raster graphics,
  • specialized graphic memories, processors
  • I/O devices
• But, GUI design issues remained:
  • User happiness
  • Effectiveness
  • Complexity
  • ...
Design perspective

- User-centric vs development-centric design
- Focusing on human details is critical:
  - Perception
  - Memory
  - Learning capabilities
- Central issues:
  - User
  - Task
Standard abstract UI model

Layers

[Diagram showing layers of UI model]
Team

- QA expert
- Stakeholder
- UI designer
- Developers
- Analyze
- Client management
- Business domain expert
- Graphic designer
- Usability expert
- Application architect

GUI activities

Early design phase

- UML use case diagrams
- Typical (happy path) scenario analysis

Game User

- Log in with FB account
- Create game
- Play scheduled game
- Arrange friendly game
- Read notifications
Lifecycle approaches

- Rational Unified Process (RUP)
- User experience (UX) storyboards: enriching use cases with GUI design info
- Extreme programming and agile approaches
- Evolutionary prototyping
Skipping theoretical parts

- Short term memory and cognitive modelling
- System response time and user
- Compromising between human control and automation
- Presenting the user with internal state of application

User-centered design

Single rule:
“Know the user.”
GUI example

Component costs
Design guidelines

Iterative development

- Prototyping
- Refactoring
- User interface testing
- Software testing
- Usability testing
- Profiling
Prototyping

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Design patterns inside Java GUI
IMPLEMENTATION DETAILS
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Java GUI underlying patterns

Separation from the rest of code

- Look and Feel (how the components are drawn)
- Some interaction styles (one or two clicks)
- Fonts
- Color and themes
- Provided by Swing by pluggable look and feel
- SWT and AWT enforce certain modularization
- JavaFX uses separate FXML source files
Data Transfer Object (Data I/O)

- Holds business data in transactions between service providers and clients
- Single method to send and receive DTO
  - Decreases bandwidth
  - Simplifies communication
  - Usually contains only necessary information

Observer Pattern (Control)

- Event-based communication
- Publish and subscribe mechanism
Form-based, web-based, mobile clients

CLIENTS AND TECHNOLOGIES

Form-based rich clients (1)

- Microsoft technologies (Window Forms), Flash (Flex), Java based,...
- Java differences:
  - Full object-oriented approach
  - Multi-platform execution
  - Highly collaborative community
  - JRE
  - SWT sacrifices a part of portability for performances
Form-based rich clients (2)

- Usual strategy:
  - Content first
  - Data second (simulate moving back and forth)
    - Plain Old Java Object (POJO) object
  - Commands third
- AWT
- Swing
- SWT
- JavaFX

Web-based clients (1)

- Web environment
  - Client display size, connection types, different browsers
  - No state
  - Cannot operate when disconnected from server
  - Attention to bandwidth and interaction issues
  - Web pages are defined in non-object-oriented languages
  - No installation needed
Web-based clients (2)

- Typical business implementations:
  - Servlets
  - JSP
  - JSF (Spring, Struts,...)
- Example of online game scenario:
  - Data: Postgresql + JPA (Hibernate)
  - Logic: Tomee+ Rest Services
  - Presentation: JavaScript + AJAX + JQuery

Mobile based clients

- J2ME MIDlets
- Limitations:
  - Low hardware resources
  - Simplified application lifecycle
  - Cost-driven design
  - Other problems...
Concluding remarks

• HCI – design, implementation and evaluation of interactive systems for humans
• GUI building is its practical part: design, software architecture, code tactics
• Java has good GUI related stuffs:
  • Widely used and well documented
  • Architecture-neutral, available
  • High level GUI packages
  • Growing importance on the internet

THANK YOU FOR ATTENTION.

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