Extraction of User Behavior Profiles for Software Modernization

Master’s Thesis

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Outline

1. Motivation
2. Foundations and Technologies
3. Monitoring
4. Analysis
5. Evaluation
6. Conclusions and Future Work
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2. Foundations and Technologies

3. Monitoring

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6. Conclusions and Future Work
Motivation

- b+m bAV-Manager to be modernized
- b+m gear platform update
  - Frontend: Vaadin framework
  - New DSL for the User Interface
- Dynamic analysis of user behavior with Kieker
- TeeTime for record processing and user behavior analysis
- Screen- and workflow improvements for the software
- Suggestions for the software modernization process
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Monitoring

- Update of Kieker in the old b+m gear platform
- Definition of a custom record in Kieker IRL
- General Spring interceptor for b+m gear applications
- Specific interceptor for the b+m bAV-Manager
- Platform service for workflow information retrieval
Custom record definition in Kieker IRL:

```java
package de.bmiag.gear.util.monitoring

@author "Gunnar Dittrich"
entity ScreenEntryRecord {
    string userName
    long loginTime
    string screenName
    string flowName
    string processName
    string processExecutionId
    long entryTime
    string eventName
}
```
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Instrumenting the b+m bAV-Manager

<table>
<thead>
<tr>
<th>Monitoring node</th>
<th>Analysis node</th>
</tr>
</thead>
<tbody>
<tr>
<td>b+m bAV-Manager</td>
<td>TeeTime</td>
</tr>
<tr>
<td>Kieker</td>
<td>SessionExtractor</td>
</tr>
<tr>
<td>Spring Interceptor</td>
<td>Session Log Files</td>
</tr>
<tr>
<td>ScreenEntryRecord</td>
<td></td>
</tr>
<tr>
<td>TCP</td>
<td></td>
</tr>
</tbody>
</table>

- TeeTime
- SessionLogFiles
- BehaviorModelExtractor
- Graphviz (*.gv)
- GraphML (*.graphml)
- XMI (*.xmi)
- Summary (*.csv)
Architecture of the SessionExtractor:

- TCPReaderStage
- MultipleInstanceOfFilter<IMonitoringRecord>
- SessionAnonymizingStage
- SessionExtractorStage
- SessionLogWriterStage
Architecture of the `BehaviorModelExtractor`:

```
InitialElementProducer<File> --> Directory2FileFilter --> LogFile2RecordListFilter

BehaviorModelAnalysisStage <-- BehaviorModelExtractorStage <-- RecordListFilterStage

Distributor<BehaviorModel> --> XMIExportStage

GraphvizExportStage <-- GraphMLExportStage <-- SummaryStage
```
Meta-model for user behavior:
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Experiment

Evaluation

- Experiment instrumenting the b+m bAV-Manager (unreleased version 3.11)
- Goal: "Identifying abnormal use of screen- and workflows in the application"
- Demonstration processes as tasks for the participants
- Focus on realistic usage (not software test)
- Five participants took at least one hour time each
Results

Evaluation

- 53 session logs, 2381 recorded user activities
- Many views with less than 10 visits!
- 23 views without any visits!
- Most visits on *WorkflowClientTasks* (963), *AuftragBearbeiten* (313), *FirmaFindenWF* (143)
- Longest think time on view *GutachtenVerifizieren*
- 11 visits on *WorkflowEskalation*
- Processes with the most interruptions: *Stammdaten bearbeiten*, *Stammdaten betrachten*, *Gutachten*
Presentation of example graphs in yEd
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Conclusions

Conclusions and Future Work

- Implemented tool for session extraction
- Implemented tool for behavior model analysis
- Visualization of user behavior with Graphviz/GraphML
- Instrumentation of b+m gear and the b+m bAV-Manager
- Experiment with software professionals
- Suggestions for the software modernization
Future Work

Conclusions and Future Work

▶ Repeat experiment on production system(s)
▶ Analysis of single users or user groups (roles)
▶ Implementation of the suggestions
▶ Improvement of the SessionExtractor and the BehaviorModelExtractor
  ▶ Visualization (colors, highlighting, layout, etc.)
  ▶ Filter, statistics
  ▶ Unused views