RAIDE: Engineering Architecture-Based Self-Adaptive Systems

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Motivation
- Systems are required to self-adapt in response to:
  - Variable resources, system errors, changing priorities
  - Maintaining user goals and properties
  - With minimal human oversight
- Today self-adaptation is costly to build:
  - Many man-months to develop or retrofit capabilities
  - Once added, difficult and costly to modify

Vision: an engineer could
- Take an existing system and specify objectives, conditions for change, strategies for adaptation
- Make system self-adaptive where it wasn’t before
- Achieve this in days, rather than months
- Maintain business goals
- Reuse and share adaptation expertise

Rainbow is a framework for self-adaptation empowering engineers to
- Define adaptation policies that are global in nature
  - Architecture model reflects states of executing system
- Incorporate business goals and quality attributes
  - Utility theory used to inform trade-offs
- Augment legacy systems, not rewrite from scratch
- Reuse adaptation policies across similar systems
- Combine multiple sources of expertise
- Support maintainability, evolution, and analysis

RAIDE:
- An integrated development environment for customizing Rainbow
- Allows engineers to customize, test, and deploy Rainbow

RAIDE components
- Workbench explorer: manage artifacts of customization project
- AcmeStudio plug-in: visualize and edit architecture model
- System properties to monitor
- Constraints to evaluate
- YAML plug-in: edit specifications of probes, gauges, effectors
- Stitch Editor: create adaptation strategies and tactics
  - Syntax highlighting
  - Simple code completion
  - On-save parsing
  - Outline view
- Utility Editor: manage biz objective profiles and preferences
- Rainbow SDK:
  - Rainbow runtime API
  - Communication event API
  - Basic target system simulation
  - Integration and testing

RAIDE: Adaptation Development

RAIDE: Adaptation Deployment and Monitoring

RAINBOW Customization Effort Data

<table>
<thead>
<tr>
<th>No</th>
<th>Customization Task</th>
<th>Znn.com</th>
<th>TalkShoe</th>
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<tr>
<td>1</td>
<td>Target system monitors and effectors</td>
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<td>56.1</td>
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<tr>
<td>2</td>
<td>Model capture</td>
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<tr>
<td>3</td>
<td>Stitch script</td>
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<td>21.3</td>
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<td>Roundtrip integration + modification</td>
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<td>Total customization time (man-hrs)</td>
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