Gekko: A Metalayer for Adaptation in Nexus

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Introduction

• Gekko: an experiment in metalevel programming
  – Disciplined approach to adaptation

• Architecture for adaptable communication using metalevel techniques
Outline

• Metalevel Programming and Reification
• Nexus and Multi-Method Communication
• The Gekko Metalayer
Metalevel Programming

- Disciplined Software Engineering technique
- Seeks to separate functional and non-functional concerns
  - Functional concerns (purpose) implemented as baseobjects at the baselevel
  - Non-functional concerns (fitness for purpose) implemented as metaobjects at the metalevel
- Metaobject Protocol documents a metalevel
Reification

• Process of converting some component of baselevel state into a value
  – Metalevel intercepts baselevel behaviour
  – Compute upon the reified value to control baselevel behaviour
• Opens the baselevel to customization
Nexus

- Communications library for Globus
- Low-level, asynchronous message passing
Multi-Method Communication

• Automatic and manual selection of communication method
Gekko

• Take advantage of relative strengths of communication method
  – Application decides which resources to use
• Nexus code is difficult to customize
• Experimental, adaptive metalayer for Nexus
  – Fix broken MMC in NexusJava
  – Extend MMC model to distinguish the relative strengths of communication method
Gekko Metalayer

- Intercept by proxy
- Reify RSR method call to Channel object
  - Compute on the size, source and destination
- Heuristic object encodes select algorithm
Preliminary Results

• Tested on an emulated grid environment
  – NISTNet to tune network attributes

• Difficult to interpret!
  – Quality of test environment
  – Quality of selected network attributes

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<th>S1(ms)</th>
<th>S2(ms)</th>
<th>S3(ms)</th>
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A Carefully Constructed Example…

S1: 800bps, 1500ms
S2: 80bps, 300ms
S3: S1+S2
Experimental Architecture
Related Work

• Proactive
  INRIA Sophia Antipolis
  • MOP for distributed, asynchronous processing

• Welch and Stroud
  Newcastle on Tyne
  • MOP for security policies

• Channel Reification
  DSI, Uni Genova
  • Reflective model for distributed environments

• NWS and NwsAlarm
  Uni Tennessee, Kentucky
  • Sensing, forecasting and alarms for resource degradation
Summary

• Architecture for adaptable communication using metalevel techniques
  – Metalevel provides an interface that “opens up” the Nexus baselevel to customization
  – All customization separated from Nexus

• Apply similar techniques to other adaptation