Performance Abstractions of Communication Patterns for Connectors

Study Thesis Final Presentation
Misha Strittmatter | December 8, 2014
Motivation: Illustration

3 sec
Motivation: Illustration
Motivation: Illustration

Completion

Pipe Filter Pipe Filter Pipe Filter

18,53 sec
Motivation: PIBA

- **Problem:** Prediction and analysis considering non-functional properties of connectors
- **Idea:** Connector abstraction can be inserted by transformation
- **Benefit:**
  - Original model kept abstract
  - Simulations on intermediate model enriched with implementation details
  - (Coordination of other communication oriented completions)
- **Action:**
  - Research
  - Assert feasibility
  - Design basic constructs
  - Model arch and FMs
  - Map features to arch
  - Evaluate
Research: Related Work

Connectors

- Connector taxonomy [MMP00]
- Composing connectors of elements [BP03]

Completions

- Completion generation [KHB10], conflict resolution [KG09]
- Replication [Har10]
- Middleware completion [HFBR08]
- Encryption, Compression, Marshalling [Bec08]

Component Systems

- Surveys [Koz10, LW05, KZM+10, Bur06]
- ROBOCOP [BMdW+04, Rob], OLAN [BBB+98], SOFA [PBJ98]
Research: Connector Topology

Procedure Call

n:1

Messaging

full duplex
1:1

half duplex
1:n

Streaming

Blackboard

Motivation Research Contribution Evaluation Restrictions Conclusion References Appendix

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Contribution: Basic Design

Scope of the filter's control focus
pull for data from Pipe 1 (block if Pipe empty)
process
push data to Pipe 2 (block if Pipe full)
Contribution: Basic Design

Scope of the filter’s control focus
forked activity
Pipe1: release capacity
Filter: process
Filter: release worker
Pipe2: acquire capacity
Filter: acquire worker
Pipe2: acquire capacity

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Contribution: Basic Design
Contribution: Architecture Excerpt

1:1 Procedure Call Connector

Client

Client Unit

Server Unit

Server

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Contribution: Architecture Excerpt

Client Unit

Pipe
Interceptor
Pipe
Adapter
Pipe
Compressor
Distributor
Pipe
Cryptor

Client

Server Unit

Server
Contribution: Feature Selection
Contribution: Feature Annotation
Evaluation

We identified following effects:

- Feature configuration
- Limitation of concurrency
- Piling chain effect
- Use of asynchronous calls

Diagram:

- Procedure Call
  - Interception
  - Adaption
  - Local
  - Remote
  - Distribution
- Target Interface
  - WP, Buffer RD
  - Compression
  - Replication
  - Encryption
  - WP, Buffer RD
We identified following effects:

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We identified following effects:

- Feature configuration
- Limitation of concurrency
- Piling chain effect
- Use of asynchronous calls

Worker Threads: 4
every 25 seconds
Worker Threads: 3
Worker Threads: 2

Simulation Time
Time Consumption

0 500 1000 1500 2000 2500 3000 3500 4000
0 100 200 300 400 500 600 700 800 900 1000

Simulation Time
Time Consumption
Evaluation

We identified following effects:

- Feature configuration
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Restrictions

- Connector-use restricted to its communication method.
  Cannot be deployed in arbitrary context.
- Restricted to PCM → obvious and intended
- Remaining restrictions → future work (see next slide)
Conclusion

Feasibility assured:
active pulling, buffering, asynch, connectors

Future Work

- Implementation (done: static prototype [Vog10],
  open: configurable completion)
- Needs data and incorporation of other completions
- Case study (evaluate concept)
- Find and validate connector configurations
- Refinement and expansion (architecture and feature model)
- Identify and implement new connectors
- Integration into a completion library or the PCM IDE
Thanks for your attention!
Any questions?
References


References II

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Modeling parallel, component-based software architectures with design patterns.  

A pattern-based performance completion for message-oriented middleware.  

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Automated feature model-based generation of refinement transformations.  

[KHB10] Lucia Kapova, Jens Happe, and Steffen Becker.  
Systematic pattern-based design of performance models for concurrent software systems.  
Will be published, 2010.

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Performance evaluation of component-based software systems: A survey.  
Special Issue on Software and Performance.

[KZM+10] Lucia Kapova, Barbora Zimmerova, Anne Martens, Jens Happe, and Ralf H. Reussner.  
State dependence in performance evaluation of component-based software systems.  


Appendix: Feature Diagram

An instance of a feature diagram is a subset of nodes, selected after the following restrictions:

- The root is always included.
- Mandatory features have to be included, if their parent is included.
- Optional features can be included, if their parent is included.
- One or more features of an or-feature set have to be included, if their parent is included.
- Exactly one feature of an exclusive-or-feature set has to be included, if its parent is included.
- All requires- and excludes-constraints of a feature are satisfied.
Appendix: Full Procedure Call
Connector Topology

Client Unit

Server Unit

C
C
C
S
S
S
Appendix: Procedure Call Connector
Client Unit Architecture

Client Component → Pipe → Interceptor → Pipe → Adapter → Pipe → Server Unit

Compressor → Pipe → Distributor → Pipe → Cryptor
Appendix: Procedure Call Connector
Server Unit Architecture
Appendix: Worker Management
Appendix: Filter Feature Tree

Filter (x2)

- Buffer Size
- per Method
- WP Size

- Manual
- Lib

- Resource Demand
- Bytesize Modification
Appendix: Interception & Replication

Feature Tree

Interception
- Buffer Size (x2)
- WP Size (x2)
- Target

Replication
- per Replica
  - Resource Container
  - Replication Count
  - Buffer Size (x2)
  - Distributor WP Size (x2)
- Policy

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