Compositional Performance Abstractions of Software Connectors

Work in Progress / Vision Paper
Misha Strittmatter, Lucia Happe | June 19, 2013
Motivation

Correspondence

(Software)  (Model)

Introduction  Approach  Implementation  Evaluation  Conclusion  Appendix

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Motivation

Correspondence

Measurement

Prediction

Correspondence
Motivation

One Possible Cause: Missing Detail

Correspondence

Correspondence

Measurement

Prediction

(Software)
Refinement Based Approach

(Model)

Refine

Prediction
Refinement Based Approach

Refine

(Model)

Prediction
Refinement Based Approach

(Model)

Refine

Prediction

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Refinement Based Approach

Drawback: Increased Effort, Model too Complex
Idea: Purpose Specific Models

Purpose?

Verification
Performance
Prediction
Reliability
Prediction
Documentation
Code Generation

Different Levels of Abstraction Required
Idea: Purpose Specific Models

**Purpose**

- Verification
- Performance Prediction
- Reliability Prediction
- Documentation
- Code Generation

Different Levels of Abstraction Required

SDQ

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Activities of Calls Passing Through the Connector:
- Waiting
- Processing
Performance Specific Abstraction

Activities of Calls Passing Through the Connector:
- Waiting
- Processing

Performance Abstraction:
- Pipe
- Filter (active/passive)
Performance Specific Abstraction

High Abstraction vs. High Detail

13,42 sec
Architecture Excerpt

Client Unit

Pipe

Interceptor

Pipe

Adapter

Pipe

Compressor

Distributor

Pipe

Cryptor

Client

Server

Scope of the filter’s control focus
forked activity

Pipe1: release capacity
Filter: acquire worker
Filter: process
Filter: release worker
Pipe2: acquire capacity

Pipe1

Pipe2

Filter
Feature Arch Mapping

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Feature Selection

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Can the Connectors be Abstracted by Pipe & Filter Chains?

Periodically Send Data

Compression, Socket Transfer, Decompression

Sensor
Sensor
Sensor
Server

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Evaluation

- Procedure Call
- Server Worker Management
- Distribution
- Remote
- Local
- Interception
- Adaption
- Asynch
- Replication
- Compression
- Socket Transfer
- Decompression
- Encryption

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Evaluation
Evaluation
Evaluation

Procedure Call

Server Worker Management

Asynch

Distribution

Remote

Compression

Socket Transfer

Decompression

Sensor

Pipe

Compr

Pipe

Socket

Pipe Decomp

(PCM)

Sensor

Pipe

Compr

Pipe

Socket

Sensor

Pipe

Compr

Pipe

Socket

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Summary

Measurements

1 Thread

Data Size (kB)

Response Time (ms)

Compression Decompression Socket Transfer

Pipe Filter Pipe Filter Pipe Filter

13, 42 sec

Procedure Call

Adaption

Distribution

Interception

Encryption

WP, Buffer RD

WP, Buffer RD

WP, Buffer RD

Server Unit

Configure

Automatic

Client Component

Adaption

Compressor

Pipe Interceptor

Pipe

Pipe

Pipe

Pipe
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)
Basic Design

Filter: acquire worker
Pipe2: acquire capacity
Filter: process
Filter: release worker
Pipe1: release capacity

Scope of the filter’s control focus
forked activity

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Connector Topology

(Originally Designed by Tomas Bures [BP03])
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.

[Bus07]
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]
Procedure Call Connector Client Unit Architecture

Client Component

Pipe

Interceptor

Adapter

Compressor

Distributor

Cryptor

Server Unit

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Procedure Call Connector Server
Unit Architecture

Client Units

Pipe
Cryptor
Pipe
Syncher
Compressor
Pipe
Transaction Manager
Pipe
Adaptor
Interceptor
Pipe
Sink
Pipe

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Worker Management

Diagram:

- Filter
- Pipe
- Filter

Connections:
- Filter to Pipe
- Pipe to Filter

Diagram arrows indicate the flow of data or control signals between components.
Procedure Call Connector Feature Tree

- Buffer Size (x2)
- Transactions
- Target Connections
- Synch Asynch
- Encryption (Coupled)
- Replication (Replication)
- Compression (Coupled)
- Remote
- Local
- Distribution
- Procedure Call
- Critical Section
- Capacity
- Server Worker Management
- Enabled
- Buffer Size (x2)
- WP Size

Legend:
- or
- exclusive or
- mandatory
- optional

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Appendix
Filter Feature Tree

Filter (x2)

- Buffer Size
- per Method
- WP Size

Manual

- Resource Demand
- ByteSize Modification

Lib
Interception & Replication Feature Tree

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

Replication

Policy
References I


References II


References III


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