Towards Dynamic Adaptation within an ESB-based Service Infrastructure Layer

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Agenda

- Motivation
- ESB Background
- Solution Approach
  - Addressing SOA Adaptation
  - Dynamic Adaptation in ESB
- Conclusions
- Future Work
Motivation

- Self-adaptation in SOA is increasingly required
- ESB recognized middleware for supporting the SOA infrastructure layer
- Our main goal:
  - To enable dynamic adaptation in ESB-based service infrastructures to support self-adaptation in SOA
ESB Essentials

- An ESB is a standards-based integration platform which combines messaging, web services, data transformation, and intelligent routing… (Chappell 2004)
- Applications (or services) communicate through the ESB by sending messages

ESB

Mediation flows

transformation, routing, monitoring, etc
ESB Mediation Patterns

- Intermediate Routing Patterns determine message path based on different factors
  - router
  - static router
  - routing slip

- Transformation Patterns deal with runtime transformation of messages

- Others
  - Cache:
    - transformation
    - content filter
Solution Approach

- ESBs provide various built-in mediation features, however:
  - Their main purpose is to address integration / communication issues
  - They generally require static configuration
  - They are usually configured in a per service basis

- S-Cube Project
  - Adaptation as a cross-layer issue in SOA
  - Definition of an Adaptation and Monitoring Framework
Our approach consists in:

- Analyzing and specifying how SOA adaptation requirements can be addressed with ESB capabilities
- Enabling the dynamic execution of the identified adaptations
- Providing adaptations which can be re-used by different services
- Considering S-Cube definitions regarding SOA adaptation
To analyze how adaptation requirements can be addressed in an ESB, we use concepts defined within the S-Cube A&M Framework.

- There is a difference with the expected state, functionality or environment. (e.g. Response time degradation)
- There is a need of changing the actual situation (e.g. Optimize response time)
- Possible ways to address the requirements. (e.g. change provider)
- Monitoring Mechanisms to check if the actual situation is the expected one. (e.g. Monitoring response times)
- Facilities provided by the underlying application or platform. (e.g. discovery/rebinding)

- Detect
- Trigger
- Achieve
- Realize

Monitored Events

Adaptation Requirements

Adaptation Strategies

Monitoring Mechanisms

Adaptation Mechanisms
Handling Web Service Interface Changes

**Adaptation Requirements**
- Handle interface change

**Monitored Events**
- Interface change

**Monitoring Mechanisms**
- WSDL Monitoring
- UDDI v3 subscription

**Adaptation Strategies**
- Modify service requests
- Invoke equivalent service

**Adaptation Mechanisms**
- Transform service requests
- Route service requests

An unmodified operation is invoked

- ESB
- Service Specific Mediations
- Adaptation Mediations

The modified operation is invoked

Remove a parameter

Integration expert
Addressing SOA Adaptation

- Reducing Response Time

**Adaptation Requirements**

- Reduce response time

**Monitored Events**

- Response time greater than X

**Monitoring Mechanisms**

- ESB built-in tools
- Alerts

**Adaptation Strategies**

- Use processed information
- Invoke an equivalent service

**Adaptation Mechanisms**

- Use a cache service
- Route service requests

**Application**

not between 9:00 and 11:00

between 9:00 and 11:00

Web Service

Response time problems from 9:00 to 11:00
Addressing SOA Adaptation

- Other Adaptation Requirements
  - Handling service contract changes
    - Operations, policies, data model
  - Optimizing quality of service values
    - Availability, performance, service saturation
  - Handling Faults
  - Handling invalid input / output
The general idea is to intercept all messages and attach them an “adaptation path” when an adaptation is required.
Dynamic Adaptation in ESB
Conclusions

- We presented how an ESB can be leveraged to address common SOA adaptation requirements
- We also proposed an approach to execute these adaptations dynamically
- The solution approach is based on:
  - commonly supported ESB patterns (likely to be applied in different ESB products)
  - S-Cube definitions on SOA adaptation
Future Work

- Analyze how other SOA adaptation requirements can be addressed by ESBs
- Incorporate other ESB mechanisms to perform adaptations
- Decision mechanisms
- Consider other SOA layers
- Implementation and evaluation of the proposed approach
  - Currently being implemented with JBossESB
Questions?
Contact Information

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