HERZLICH WILLKOMMEN

Effektives Fault Handling mit Oracle SOA Suite 11g

Guido Schmutz
Technology Manager

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BASEL BERN LAUSANNE ZÜRICH DÜSSELDORF FRANKFURT A.M. FREIBURG I.BR. HAMBURG MÜNCHEN STUTTGART WIEN

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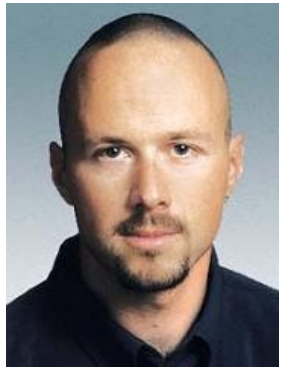
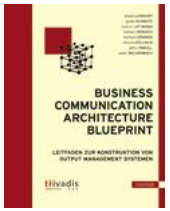
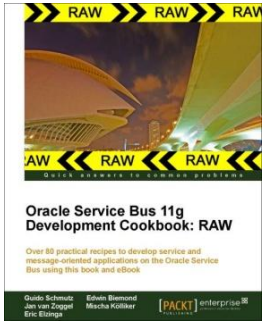
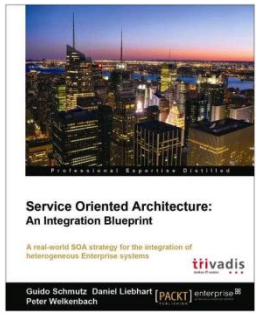


- Working for Trivadis for more than 14 years
- Oracle ACE Director for Fusion Middleware and SOA
- Co-Author of different books
- Consultant, Trainer Software Architect for Java, Oracle, SOA and EDA
- Member of Trivadis Architecture Board
- Technology Manager @ Trivadis

- More than 20 years of software development experience







- Contact: guido.schmutz@trivadis.com
- Blog: http://guidoschmutz.wordpress.com
- Twitter: gschmutz

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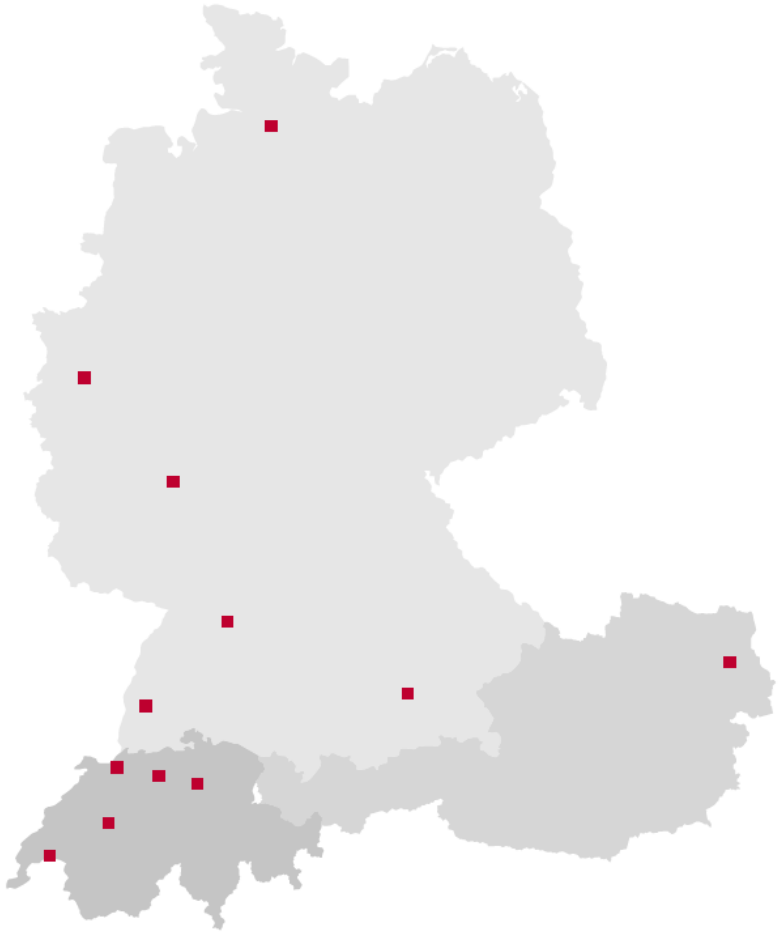
Trivadis Facts & Figures

- 11 Trivadis locations with more than 550 employees
- Financially independent and sustainably profitable
- Key figures 2010
  - Revenue CHF 101 / EUR 73 mio.
  - Services for more than 700 clients in over 1'800 projects
  - Over 170 Service Level Agreements
  - More than 5'000 training participants
  - Research and development budget: CHF 5.0 / EUR 3.6 mio



Agenda

1. **What is Fault Handling**
2. Fault Handling in SOA vs. traditional systems
3. Scenario and Patterns
4. Implementation of Scenario
5. Summary and Best Practices

Error/Fault Handling

- The goal of every programmer should be to write unbreakable software
- depends on how good expected and unexpected exception conditions are handled and managed
- Object-oriented languages (C++, Java, C#) provide efficient way for handling exceptions
  - constructs such as `try`, `catch`, and `finally`.
- With SOA
  - most of what is available at language level is still valid and usable
  - different challenges will appear, once starting orchestrating services and creating composite applications
- Prevention vs. handling

What is a Fault ?

- Something outside normal operational activity or “happy flow” happened
  - Technical error
  - Programming error
  - Faulty operation by user
  - Exceptional business behavior

Two Types of Faults

Business faults

- Faults that service clients can expect and recover from
- Failure to meet a particular business requirement
- Often: expected, business value, contractual and recoverable

Technical faults

- Faults that service clients do not expect and cannot (easily) recover from
- Results of unexpected errors during runtime, e.g. null pointer errors, resources not available, and so on
- Often: unexpected, technical, implementation and non-recoverable

Business Fault

```
<wsdl:operation name="orderProduct">
  <wsdl:input message="order:OrderProductRequestMessage"/>
  <wsdl:output message="order:OrderProductResponseMessage"/>
  <wsdl:fault message="order:ProductNotInStockFaultMessage"
              name="ProductNotInStockFault"/>
  <wsdl:fault message="order:CustomerNotFoundFaultMessage"
              name="CustomerNotFoundFault"/>
</wsdl:operation>
```

1. Service contract including fault

```
<xsd:element name="CustomerNotFoundFaultMessage">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="CustName" type="xsd:string"/>
      <xsd:element name="City" type="xsd:string"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

2. Fault message payload

Business Fault (II)

```
<soap:Envelope>
  <soap:Header/>
  <soap:Body>
    <soap:Fault>
      <faultcode>CST-1234</faultcode>
      <faultstring>Customer not found</faultstring>
      <detail>
        <CustomerNotFoundFault>
          <CustName>John Doe</CustName>
          <City>Long Beach</City>
        </CustomerNotFoundFault>
      </detail>
    </soap:Fault>
  </soap:Body>
</soap:Envelope>
```

3. Actual service response

Technical Fault

```
<wsdl:operation name="orderProduct">
  <wsdl:input message="order:OrderProductMessage"/>
  <wsdl:output message="order:OrderProductResponseMessage"/>
  <wsdl:fault message="order:ProductNotInStockFaultMessage"
              name="ProductNotInStockFault"/>
  <wsdl:fault message="order:CustomerNotFoundFaultMessage"
              name="CustomerNotFoundFault"/>
</wsdl:operation>
```

1. Service contract including fault

2. Actual service response

```
<soap:Envelope>
  <soap:Header/>
  <soap:Body>
    <soap:Fault>
      <faultcode>S:Server</faultcode>
      <faultstring>Could not connect to URL 127.0.0.1 on port 8001</faultstring>
    </soap:Fault>
  </soap:Body>
</soap:Envelope>
```

Agenda

1. What is Fault Handling
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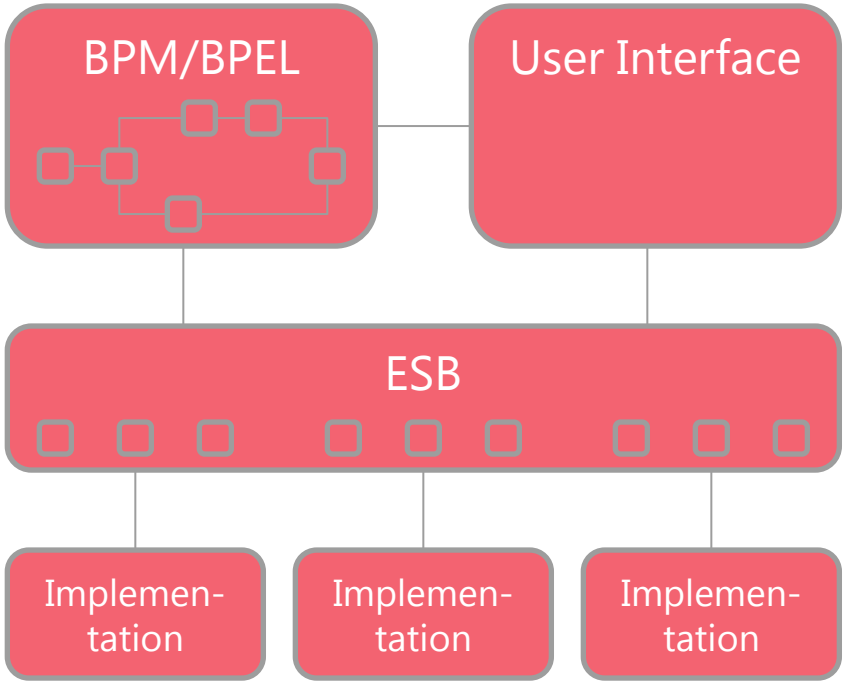
Fault Handling SOA vs. traditional



- Higher degree of complexity
- Multiple service consumers
- Services part of larger unit
- Heterogeneous & external components
- Long running processes
- Asynchronous
- Timed events
- Often enterprise-wide
- Transactions

Agenda

1. What is Fault Handling
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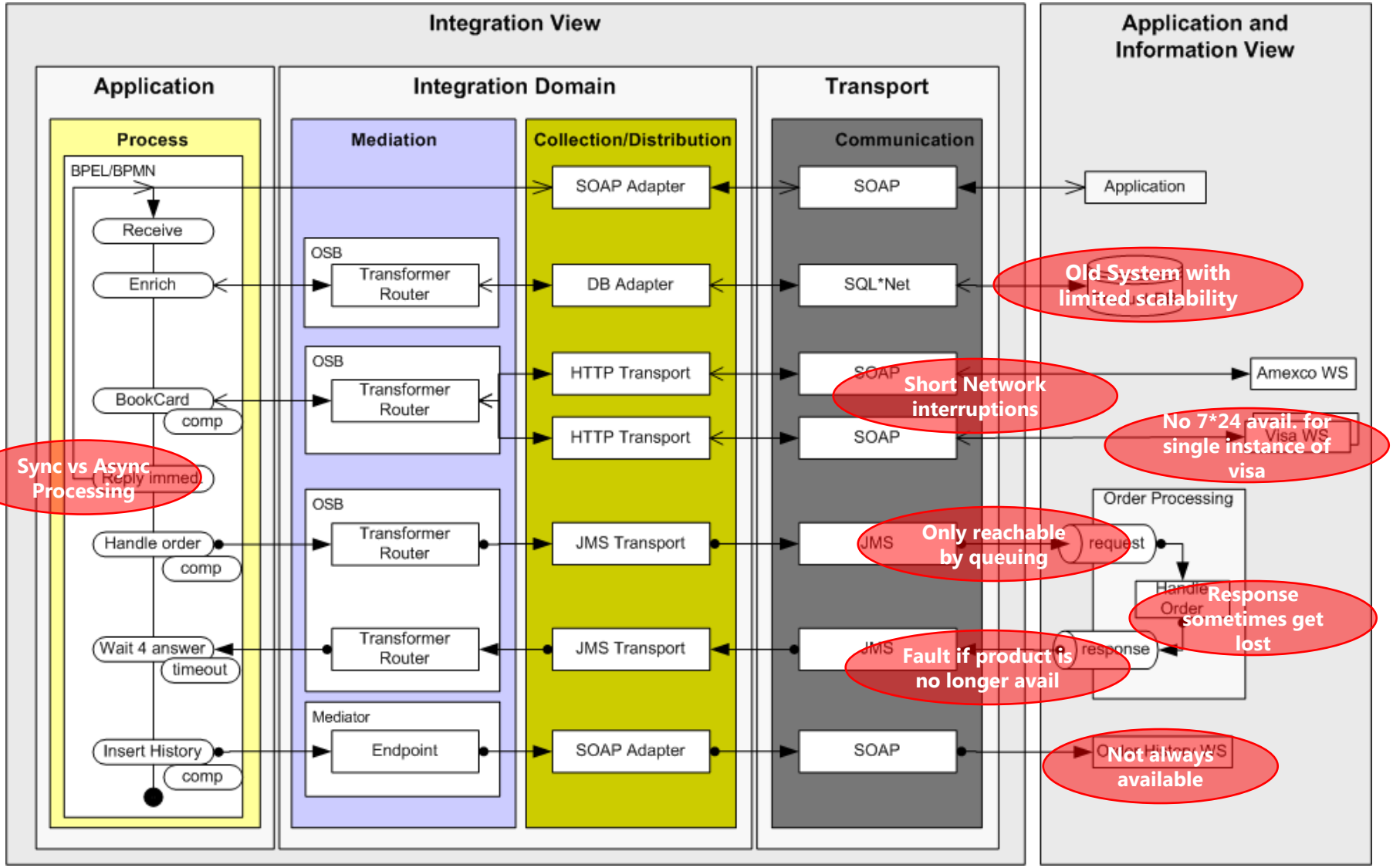
Scenario (Areas of Problems/Faults)



Patterns for Fault Tolerant Software

Compensation

Exception shielding

(Limit) Retry

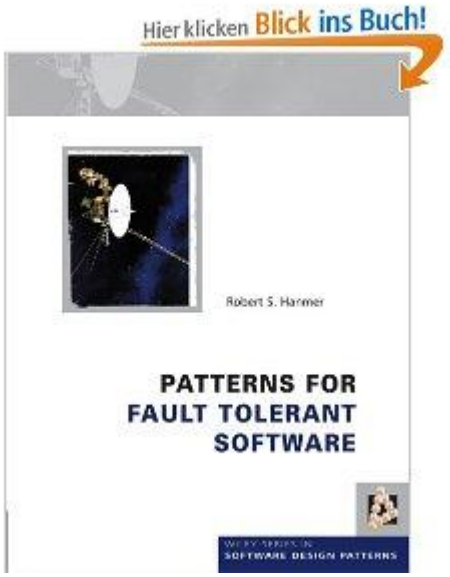
Share the load

Alternative

Exception handler

Heartbeat

Throttling



Agenda

1. What is Fault Handling
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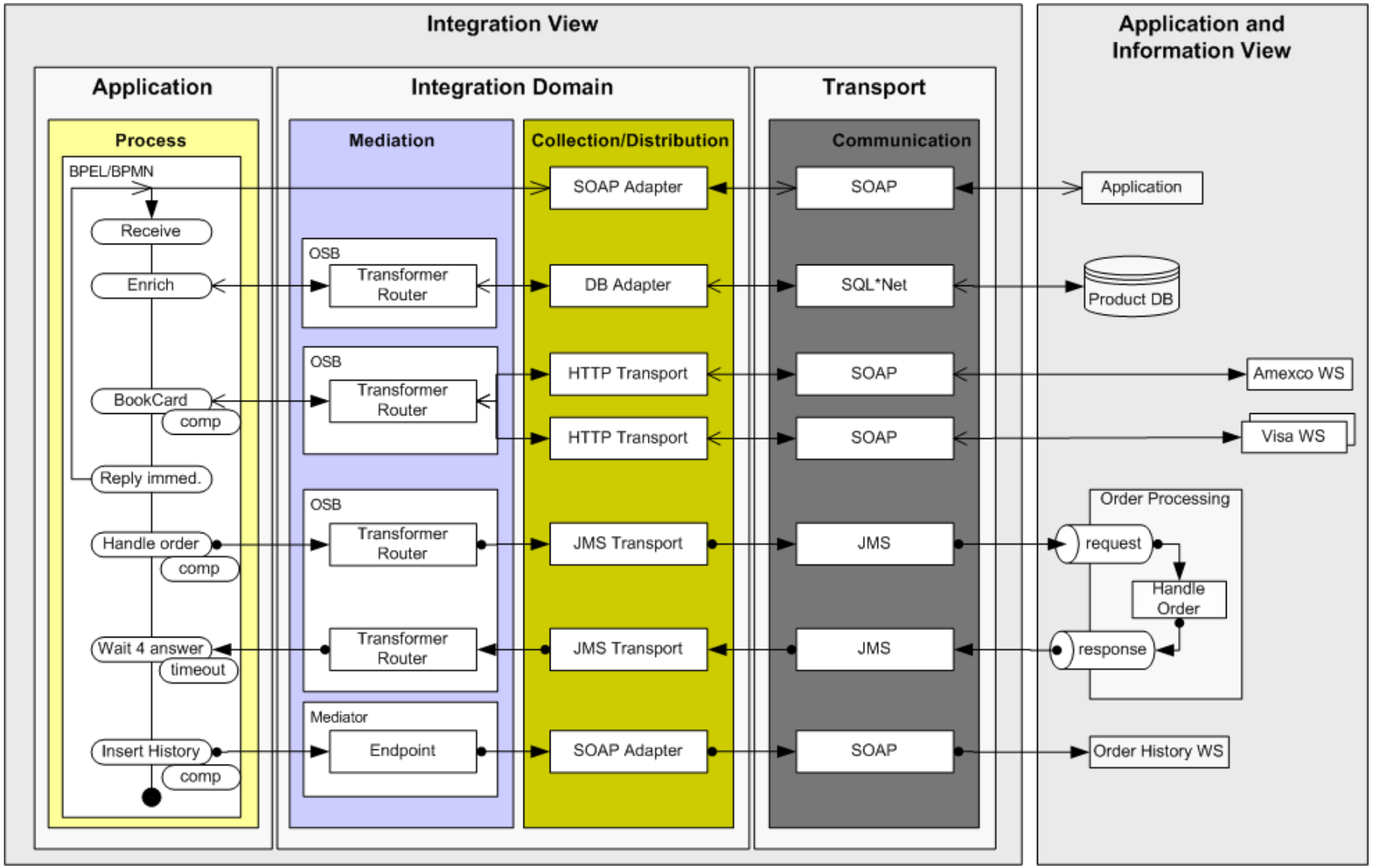
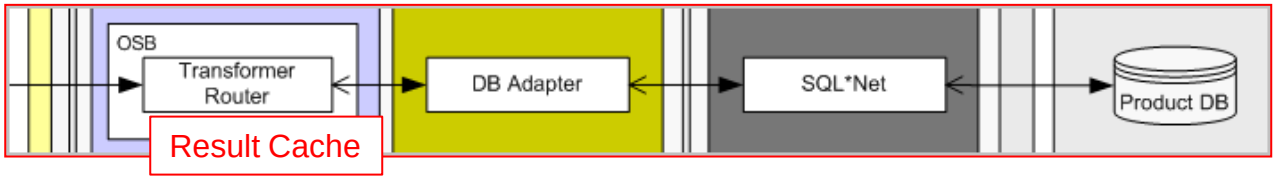
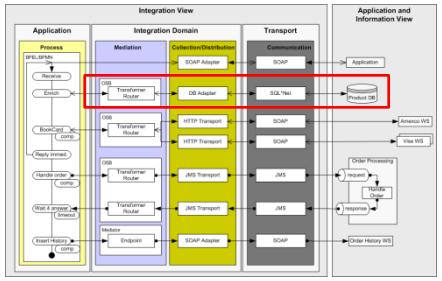
Implementation of Scenario



Product Management
Result Caching





Problem

- Not to overload the old, non-scalable product system with the new demand

Solution

- Use **Result Caching** to cache the product information (read-only operation)
- Use **Service Throttling** to limit the number of concurrent requests

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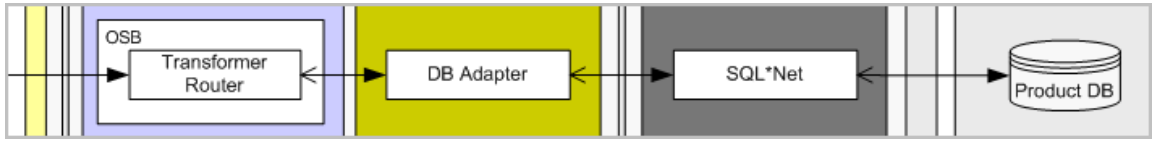
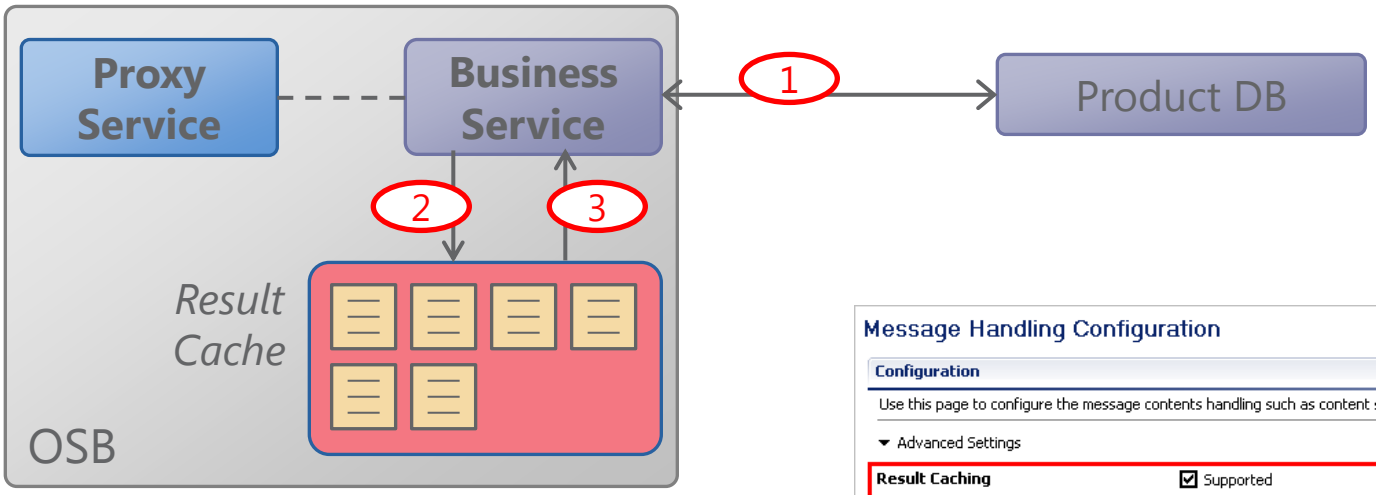
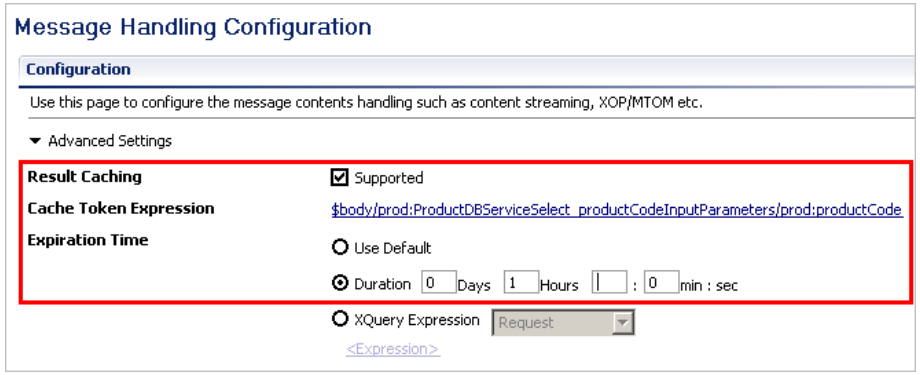
Product Management Result Caching



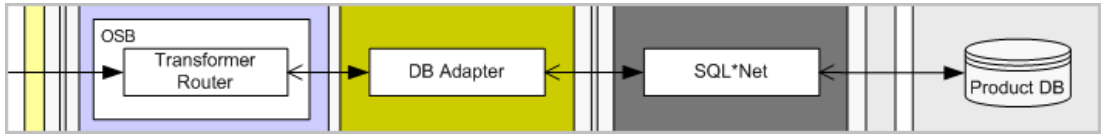
Results are returned from cache rather than invoking always the external service

- Product data is rather static, so ideal candidate for caching

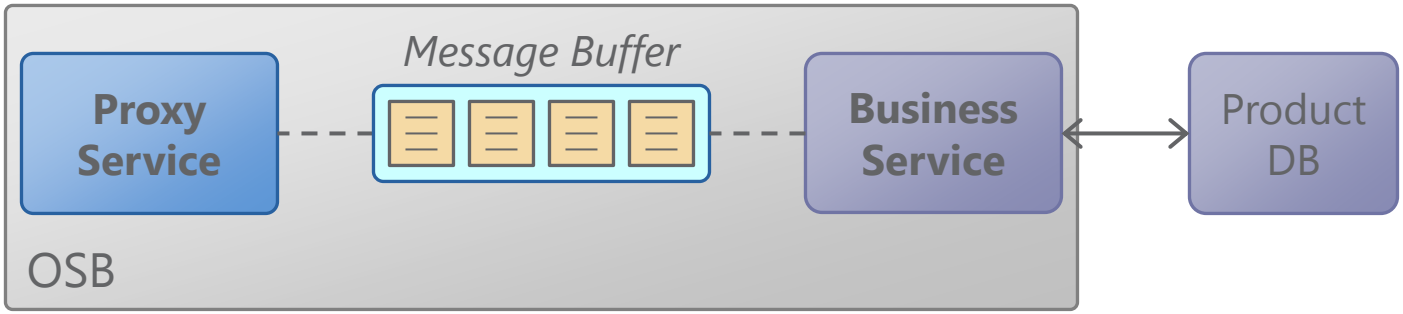




Product Management Service Throttling



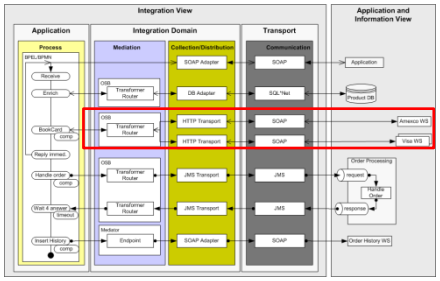
restricts the number of messages on the message flow to a business service

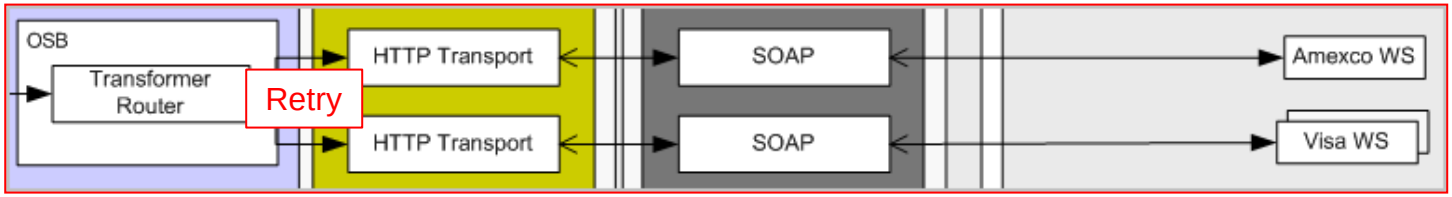


- Set from **Operational Settings** on the OSB console

Throttling	
Throttling State	☑ Enabled
Maximum Concurrency*	5
Throttling Queue*	100 messages
Message Expiration	0 msecs

Credit Card Booking
Retry Configuration





Problem

- Unstable network between us and the external services

Solution

- Use **Retry** mechanism of OSB to try many times
- No Fault Management necessary for service consumer if network interruption is only for a short time

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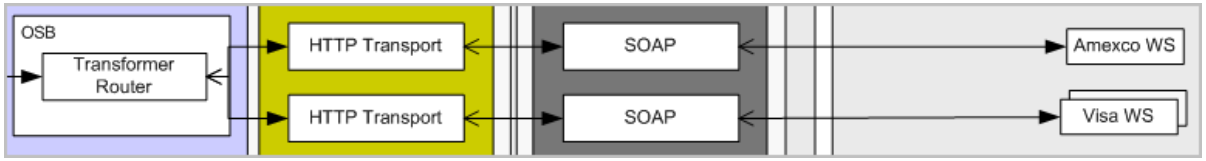
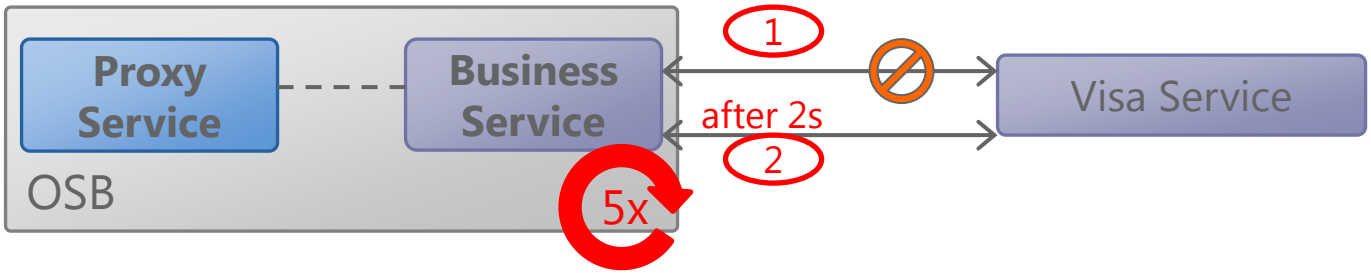
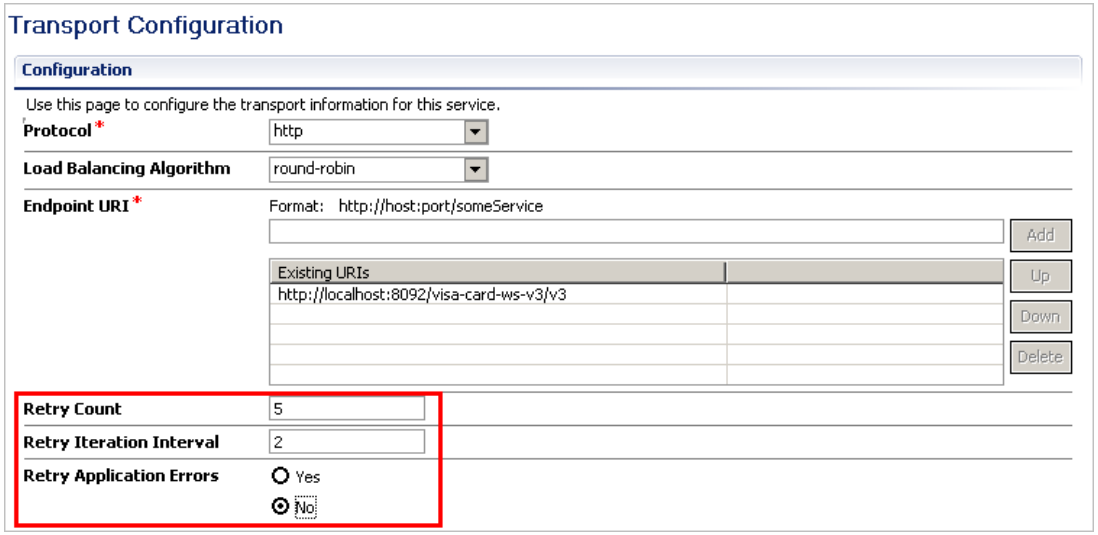
Credit Card Booking Retry Configuration



Configured on the business service in OSB





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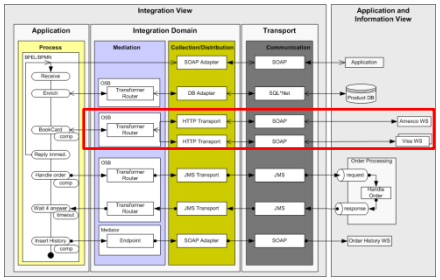
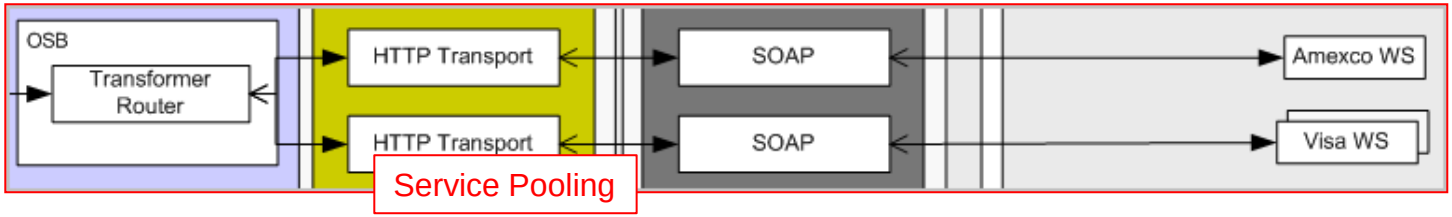
Credit Card Booking
Service Pooling





Problem

- Visa Service does not guarantee 7*24 availability for one single instance

Solution

- Use the multiple instances (endpoints) visa provides and use service pooling feature of OSB
- No Fault Management for the service consumer if at least one endpoint is available

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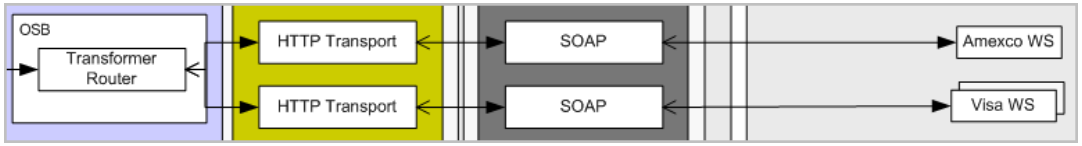
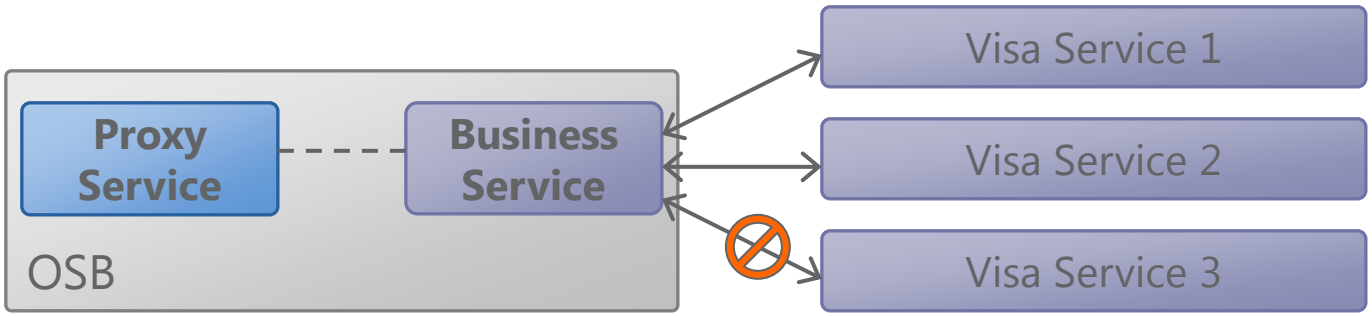
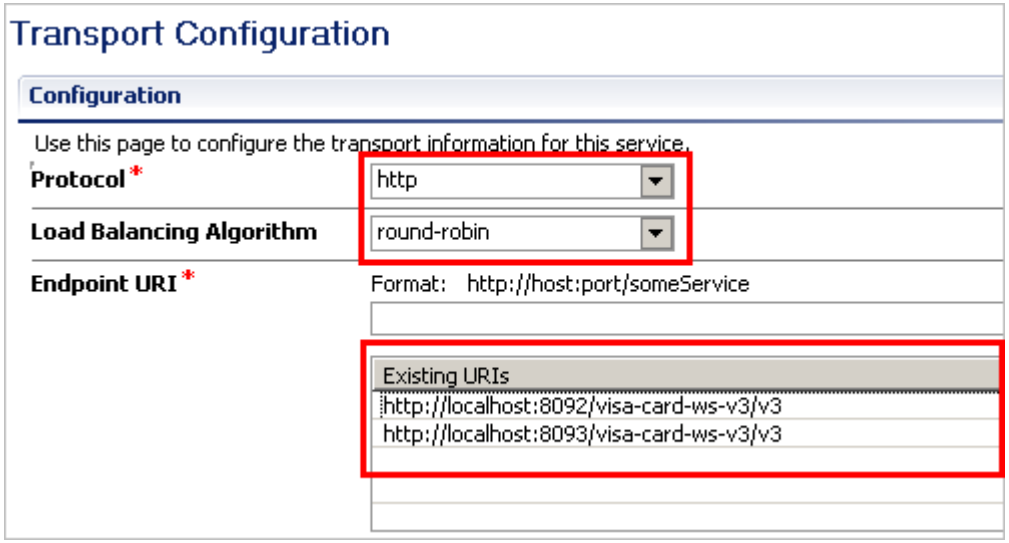
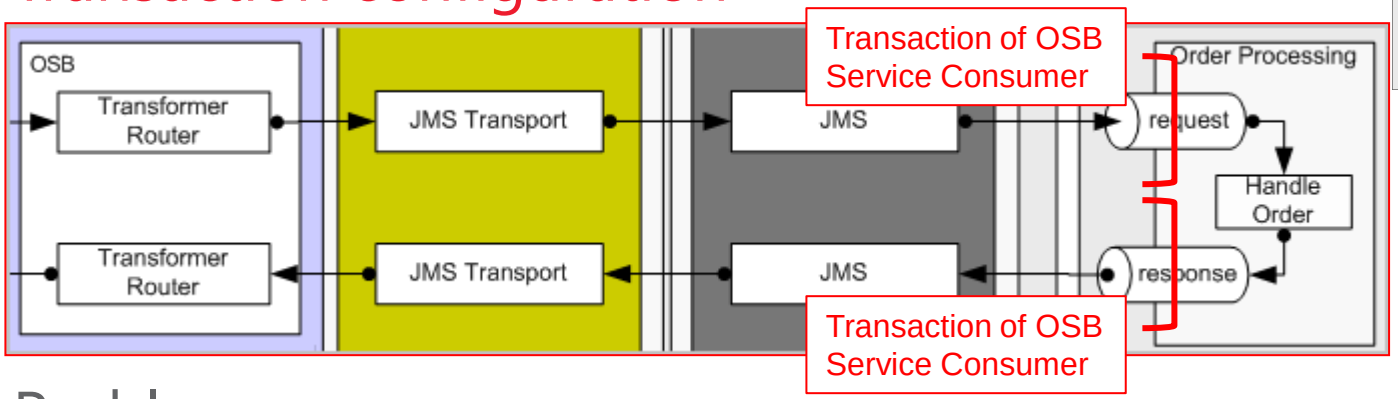
Credit Card Booking Service Pooling

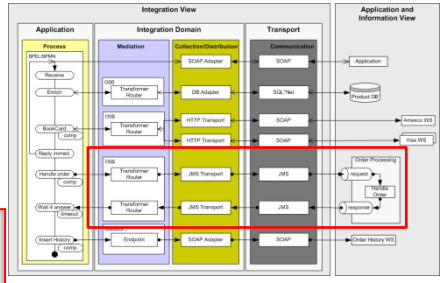






Order Management
Transaction configuration





Problem

- Guarantee that the message will be delivered to the order management system

Solution

- Make sure that queues are available, even if the Handle Order system is not available, messages can still be sent
- Make sure that queuing run's within the same transaction as the message producer (BPEL => ESB)

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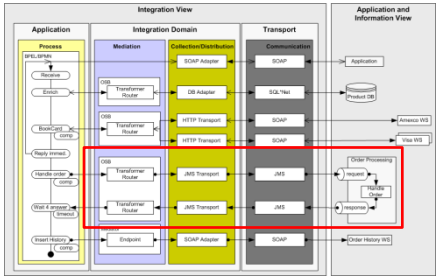
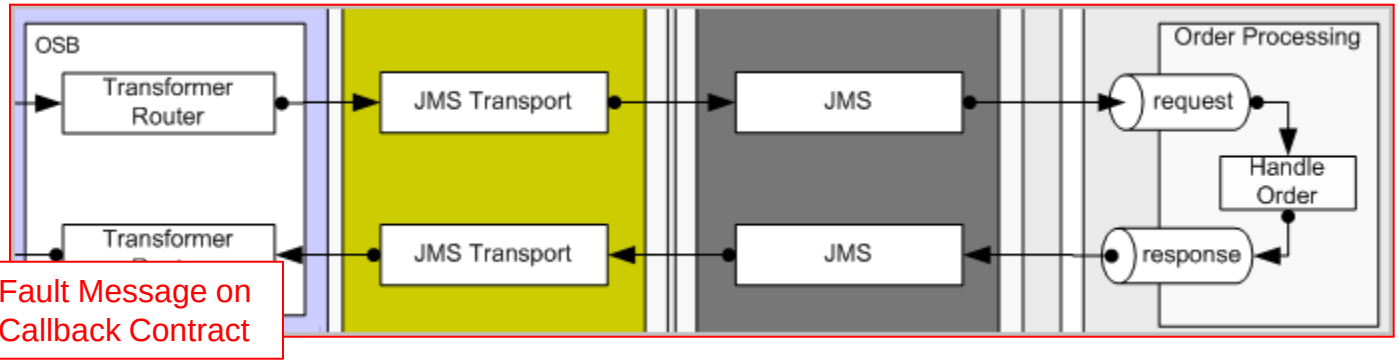
Order Management (II)
Fault Message on Callback Contract





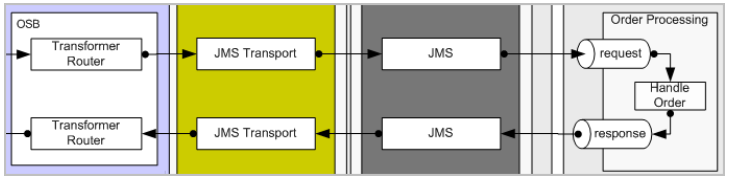
Problem

- Need to return a “Product No Longer Available” Business Fault over an Asynchronous MEP

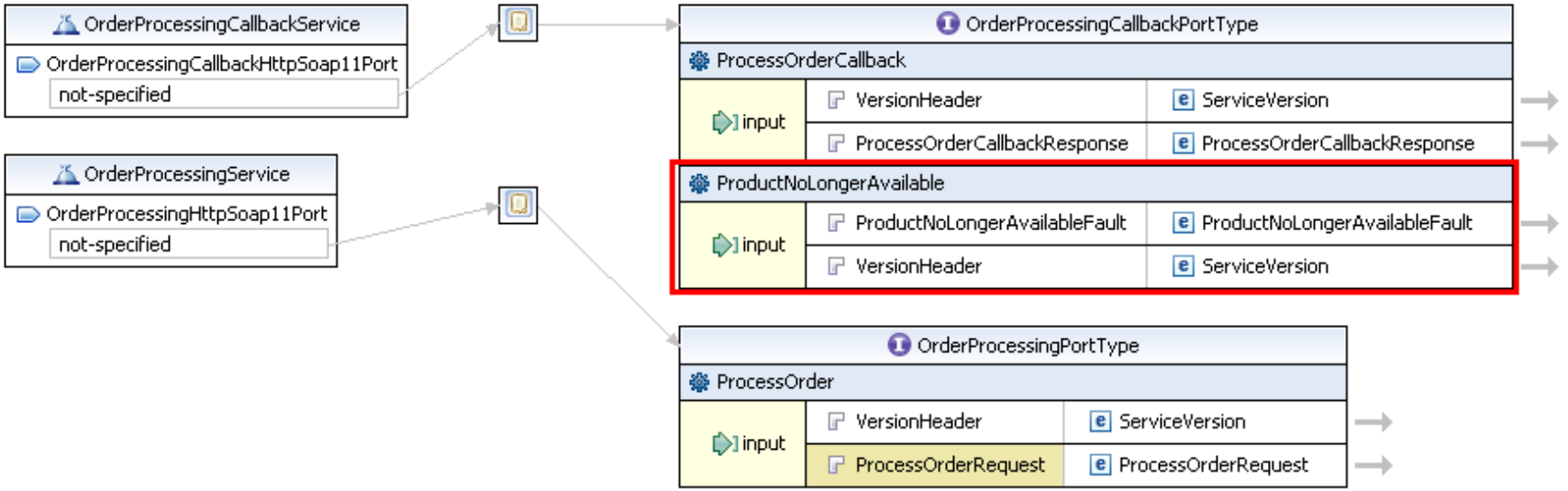
Solution

- Design a separate Fault Message and Operation on the Callback contract (WSDL) and use that

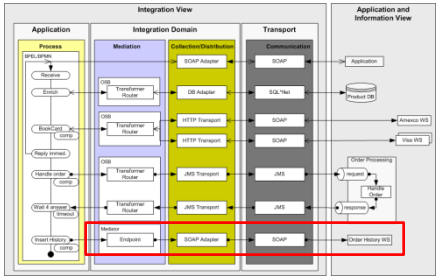
Order Management (II)
Fault Message on Callback Contract

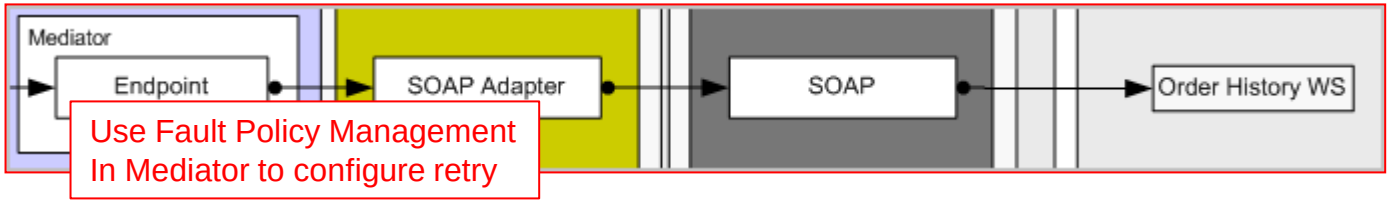


"Business Fault" modeled as another operation on the Callback WSDL



Order History
Fault Management Framework





Problem

- Order History System not available should have no impact on Business Process

Solution

- Use Mediator (ESB) with Fault Management Framework to configure retry

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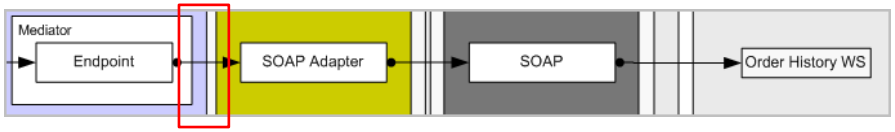
Order History
Fault Management Framework




```
<faultPolicyBindings version="2.0.1"
  <composite faultPolicy="OrddderProcessingFaults"/>
</faultPolicyBindings>
```

```
<faultPolicies>
  <faultPolicy version="2.0.1"
      id="OrderProcessingFaults"...>
    <Conditions>
      <action ref="ora-retry"/>
    </Conditions>
    <Actions>
      <Action id="ora-retry">
        <Retry>
          <retryCount>3</retryCount>
          <retryInterval>2</retryInterval>
          <exponentialBackoff/>
          <retryFailureAction ref="ora-java"/>
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      </Action>
    </Actions>
  </faultPolicy>
</faultPolicies>
```

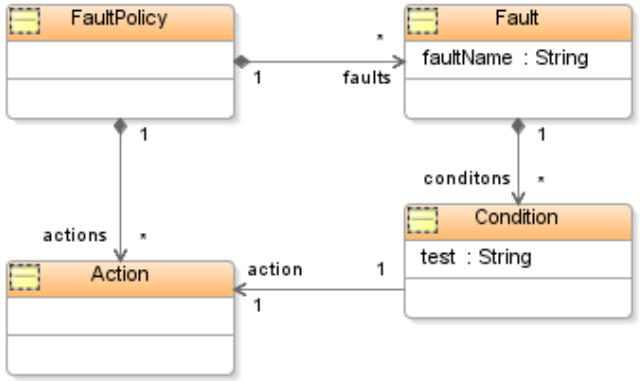

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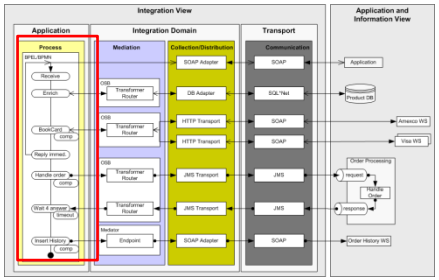
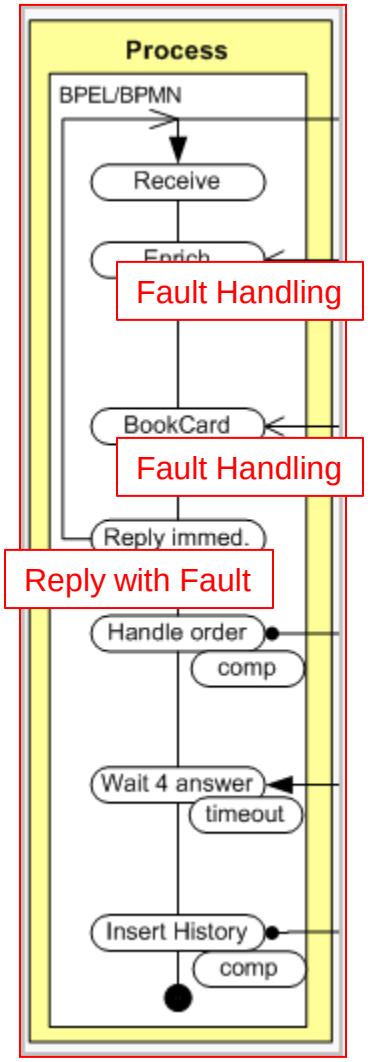
Order Handling Process
Return Errors as synchronous response





Problem

- Both Product Management and Credit Card Booking can return Business Faults

Solution

- Handle errors and map them to errors returned to the service consumer (i.e. the caller of the process)
- After that process changes from synchronous to asynchronous

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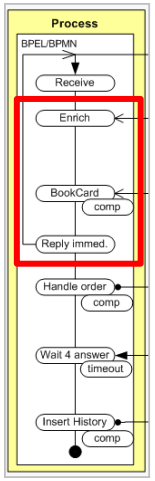
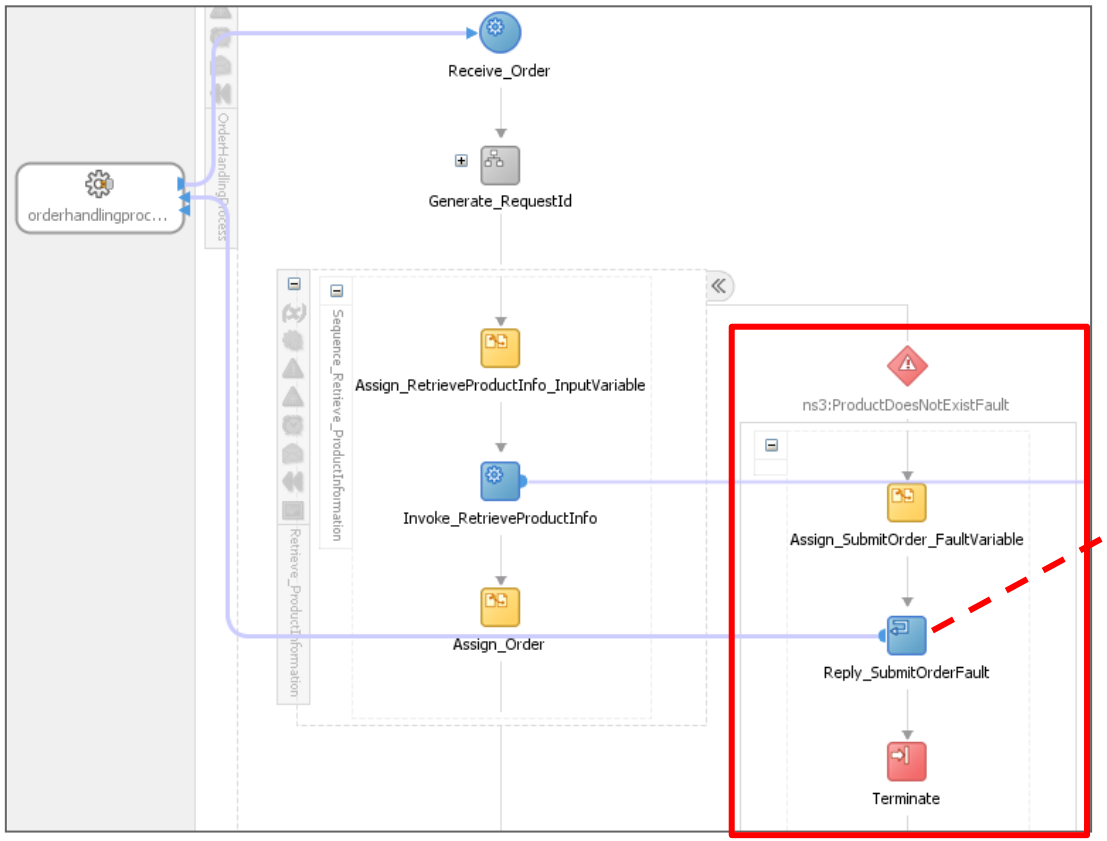
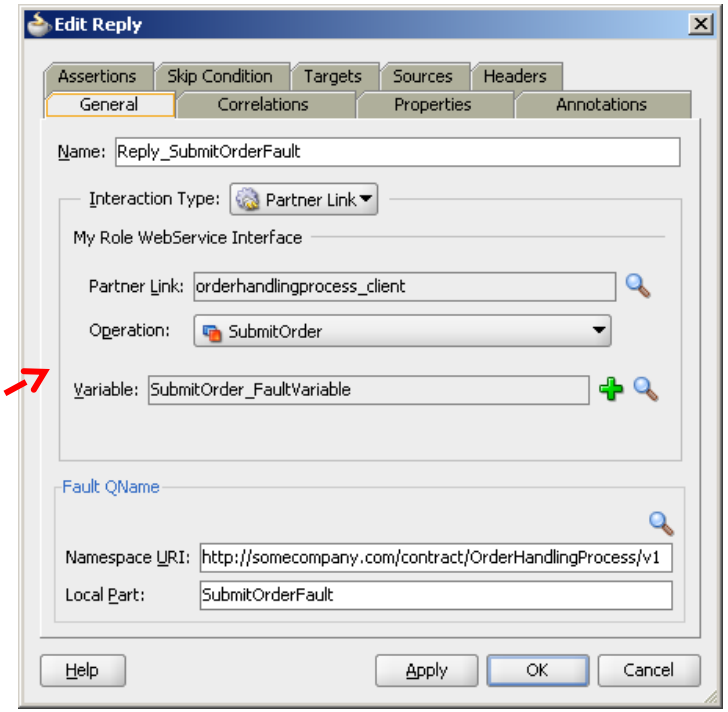
Order Handling Process
Return Errors as synchronous response



Handle Business Faults in BPEL error handler and reply with an error





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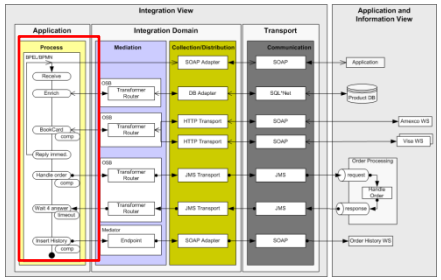
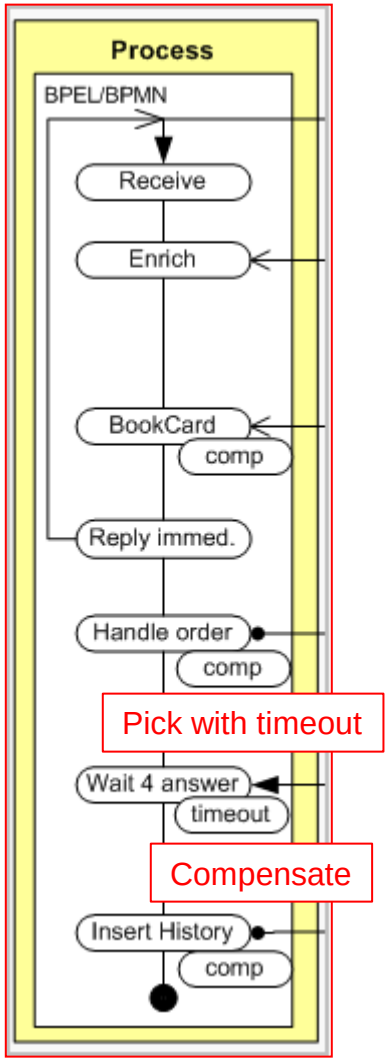
Order Handling Process (II)
Handle missing callback message with timeout





Problem

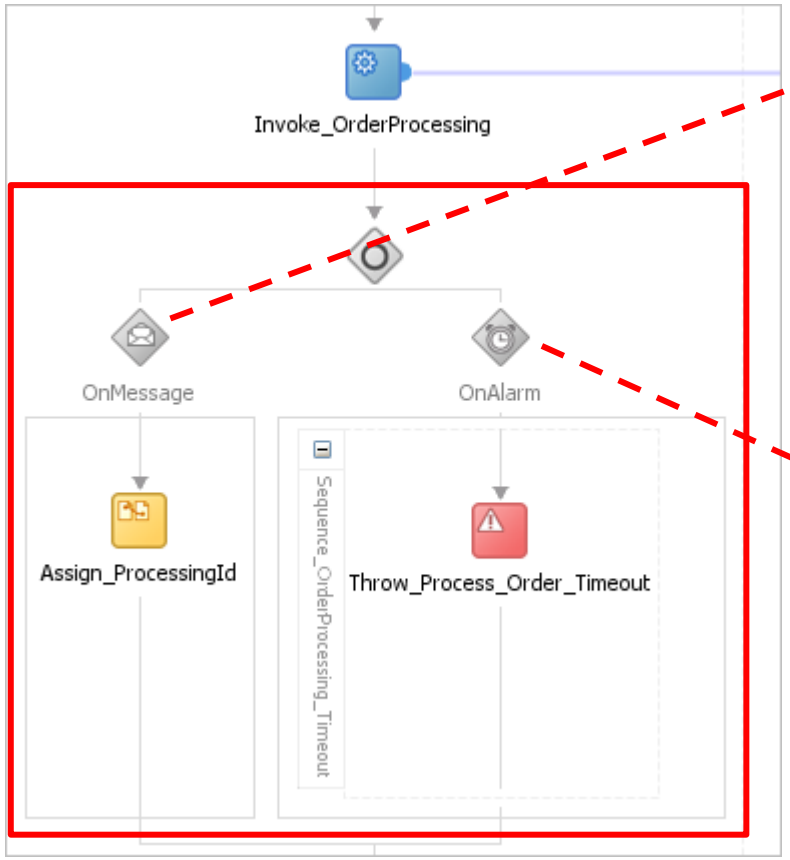
- Order Processing Response Message can get lost in the Order Processing system, i.e. the callback message will never arrive in BPEL

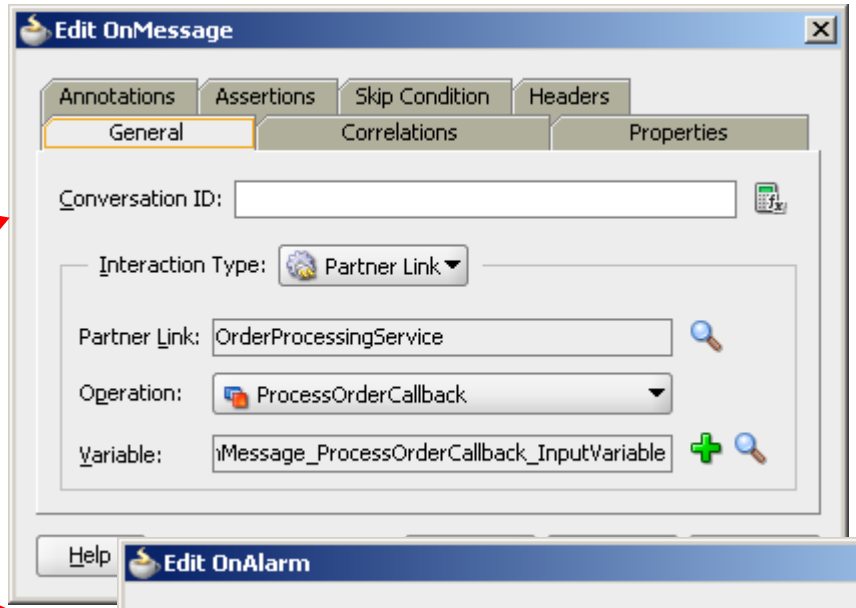
Solution

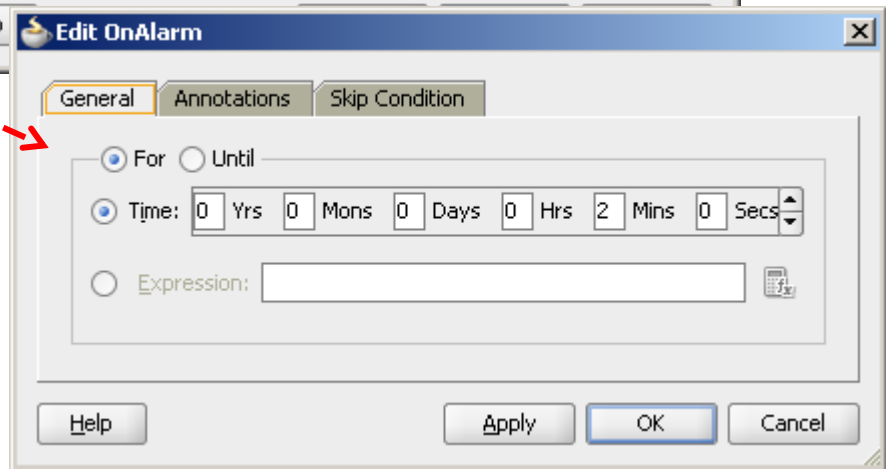
- Timeout on the Wait For Answer with a BPEL pick activity with a timeout
- Undo the process by doing compensation
- Use the BPEL compensate activity together with compensation handler to undo the Booking of the Credit Card

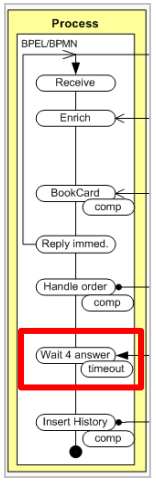
Order Handling Process (II)
Handle missing callback message with timeout

Pick Activity for handling callback message with timeout branch









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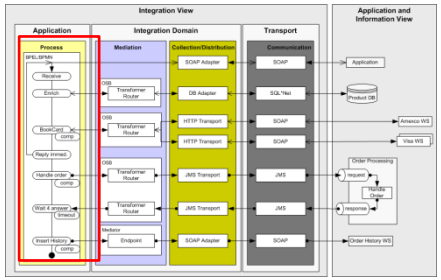
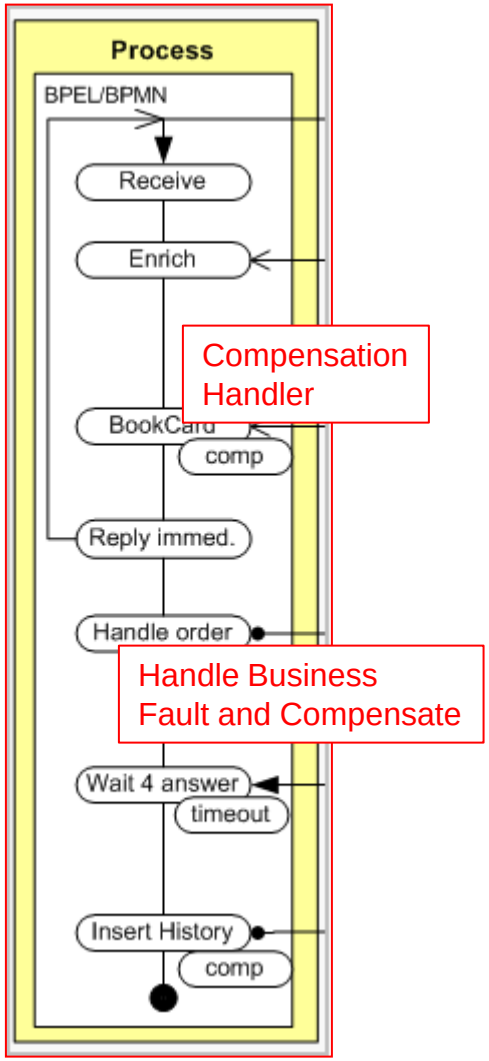
Order Handling Process (III)
Compensation Handling





Problem

- Order Processing Callback Message can be a Product No Longer Available Business Fault

Solution

- Undo the process by doing compensation
- Use the BPEL compensate activity together with compensation handler to undo the Booking of the Credit Card

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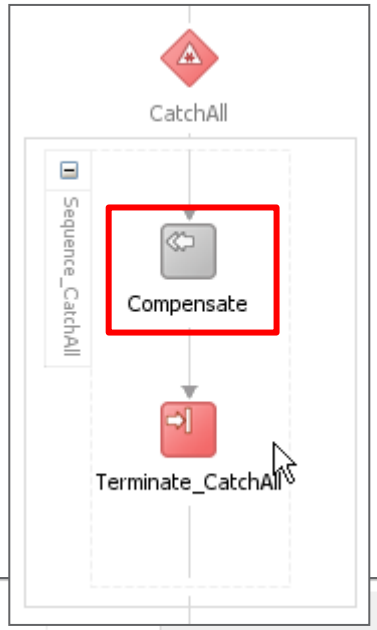
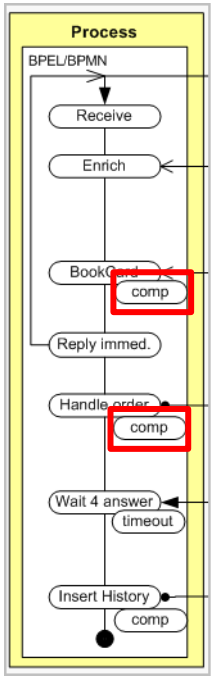
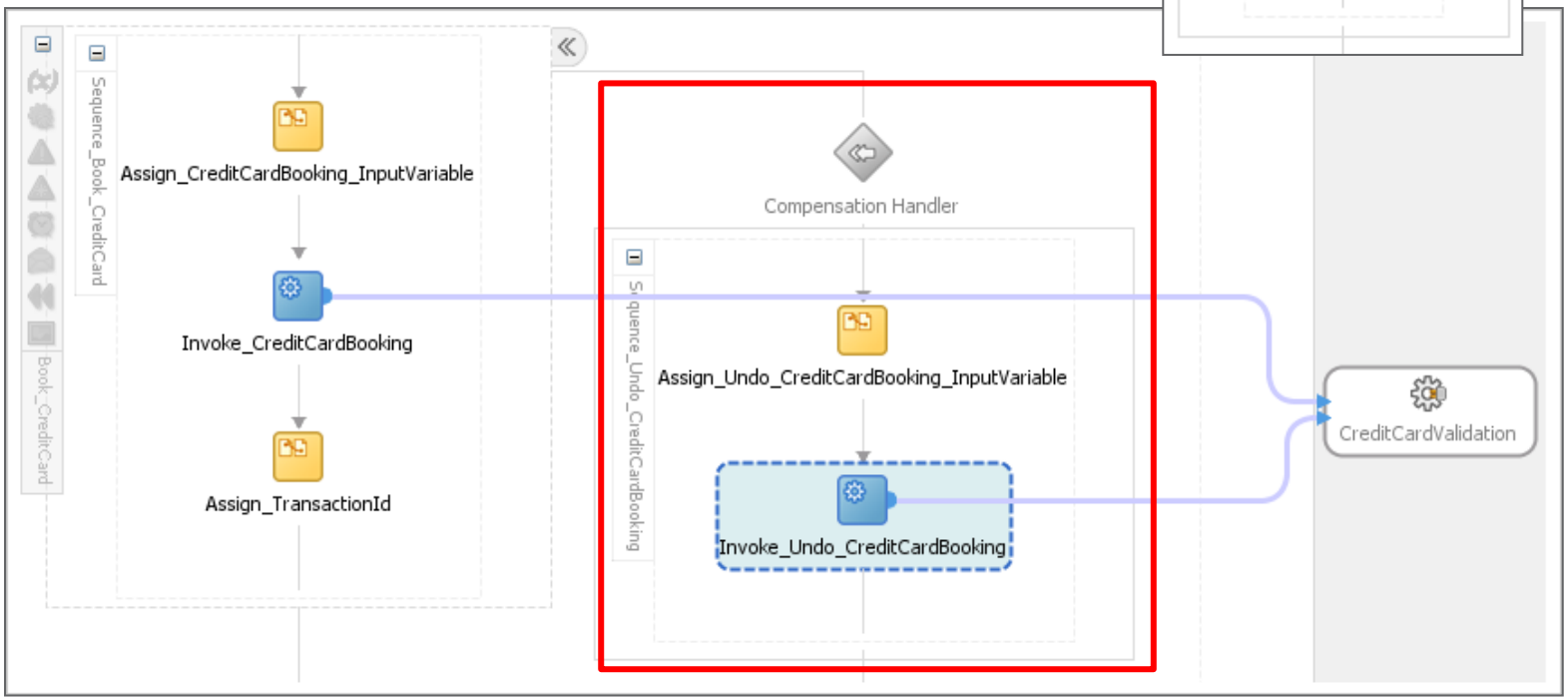
Order Handling Process (III)
Compensation Handling

Compensate activity invokes compensation handling on the inner scope

- Can only be invoked from within a fault handler or another compensation handler







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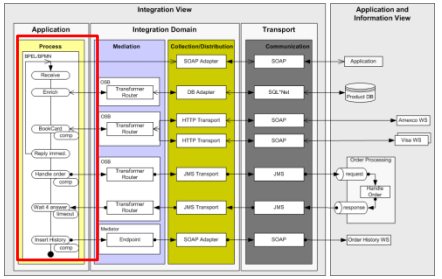
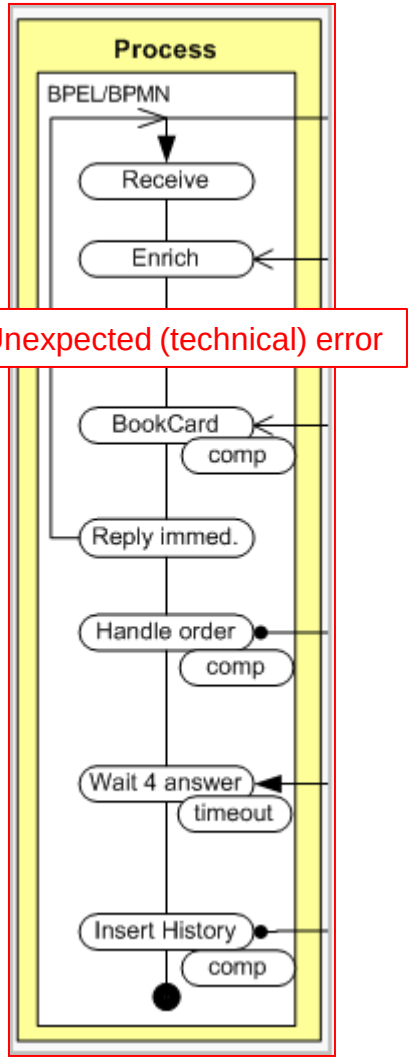
Order Handling Process (V)
Generic Error Handler w. Fault Policy Framework





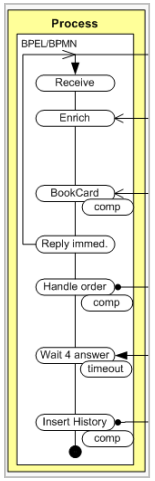
Problem

- Unexpected (technical) fault
- Multiple processes deal with unexpected faults in their own way

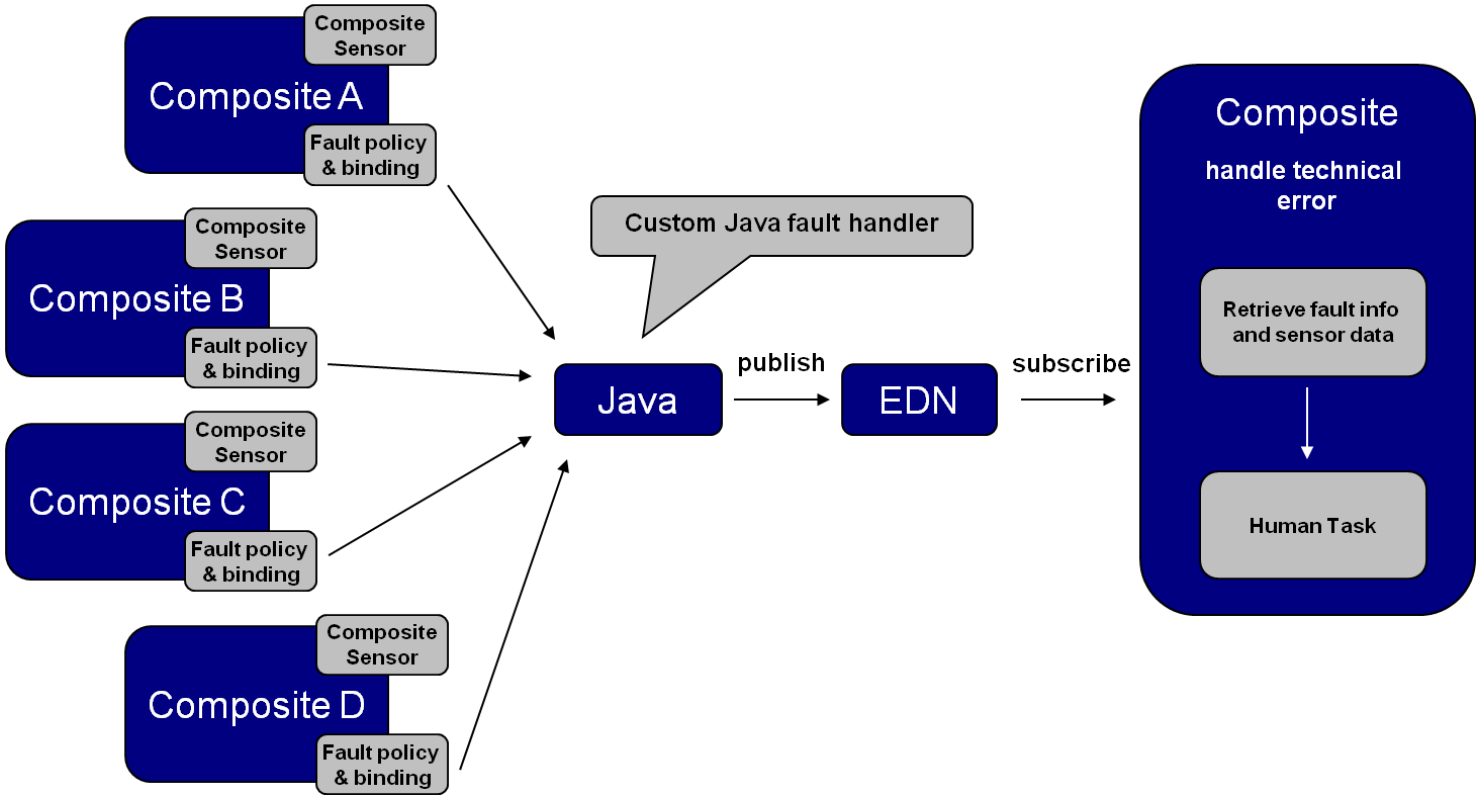
Solution

- Use fault handler mechanism to send error to error queue without adding process logic
- Create one process to listen to error queue and handle faults
- Retrieve process information by using (composite) sensors

Order Handling Process (V)
Generic Error Handler w. Fault Policy Framework



Explanation and demo of generic fault handler



Agenda

1. What is Fault Handling
2. Fault Handling in SOA vs. traditional systems
3. Scenario and Patterns
4. Implementation of Scenario
5. **Summary and Best Practices**

Summary

Issue	Solution	Product
Overloading product management system	ThrottlingResult cache	OSB
Visa Service does not guarantee 7*24 uptime due to e.g. network problems	Muliple endpoints Service pooling	OSB
Guarantee message delivery to order management system	Availability of queues Enqueue and dequeue in service consumer transaction	OSB (and SOA Suite for XA propagation to OSB)
Returning business fault over async MEP from order management system	Separate operation and fault message	OSB and SOA Suite (callback contract between the two)
Order history service not available	Retry in Mediator using fault policy framework	SOA Suite
Business fault handling from service to process to consumer	Catch faults in process and reply fault to consumer	OSB and SOA Suite (correct contracts)
Detect missing response message	Timeout in pick activity	SOA Suite
Handle product no longer available	Compensation	SOA Suite
Avoid calling credit card booking twice	Set non-idempotent property	SOA Suite
Processes needing to deal with unexpected technical faults. All processes solving it in their own way using process logic.	Fault policy frameworks, error queue, generic error handler & (composite sensors.	SOA Suite

Summary & Best Practices

Differentiate between business and technical faults

Design service contracts with faults in mind: formally describe business faults in service contracts

Design with criticality, likeliness to fail, and cost in mind

Differentiate fault patterns in OSB and BPM/BPEL:

- OSB: Retry, Throttling, transactions
- BPM/BPEL: Compensation, business fault handling, generic fault handler, timeout

Handle unexpected errors generically

Make services autonomous

Fault-handling on scope of services and in wider perspective

VIELEN DANK.

Trivadis AG

Guido Schmutz

Europa-Strasse 5
CH-8152 Glattbrugg

Tel. +41-44-808 70 20
Fax +41-44-808 70 21

info@trivadis.com
www.trivadis.com

BASEL BERN LAUSANNE ZÜRICH DÜSSELDORF FRANKFURT A.M. FREIBURG I.BR. HAMBURG MÜNCHEN STUTTGART WIEN

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