

Handling Faults in Composite Applications

Objectives

After completing this lesson, you should be able to:

- Describe basic fault handling and propagation
- Explain fault management for synchronous and asynchronous services
- Modify a WSDL operation to have a fault message
- Manage faults with Mediator components
- Throw and catch faults in a BPEL process
- Describe the Fault Management Framework



Agenda

- **Faults: Overview**
- Managing Faults in Mediator
- Fault Handling in BPEL
- Compensation in BPEL
- The Fault Management Framework
- Faults in Enterprise Manager



Faults: Overview

Faults are:

- Errors encountered during the execution of an application
- Similar to exceptions in Java

There are different types of faults. We focus on two:

- Business faults, which are:
 - Available in synchronous operations
 - Defined by a user and are application-specific
 - Generated when a problem is detected with data
 - Thrown by the process or received from an invoked operation
- Runtime faults, which are:
 - Defined by the system
 - Thrown by the runtime system for incorrect logic or values

Fault-Handling Challenges

The handling and propagation (passing on) of faults is a multi-dimensional problem. Strategies for fault handling must consider the following:

- Fault type
 - Business
 - Runtime
- Component type
 - Mediator
 - BPEL component
- Interaction type
 - Synchronous
 - Asynchronous
- Transactionality of the services involved

Fault-Handling Options

Oracle SOA Suite provides multiple tools for responding to faults, including:

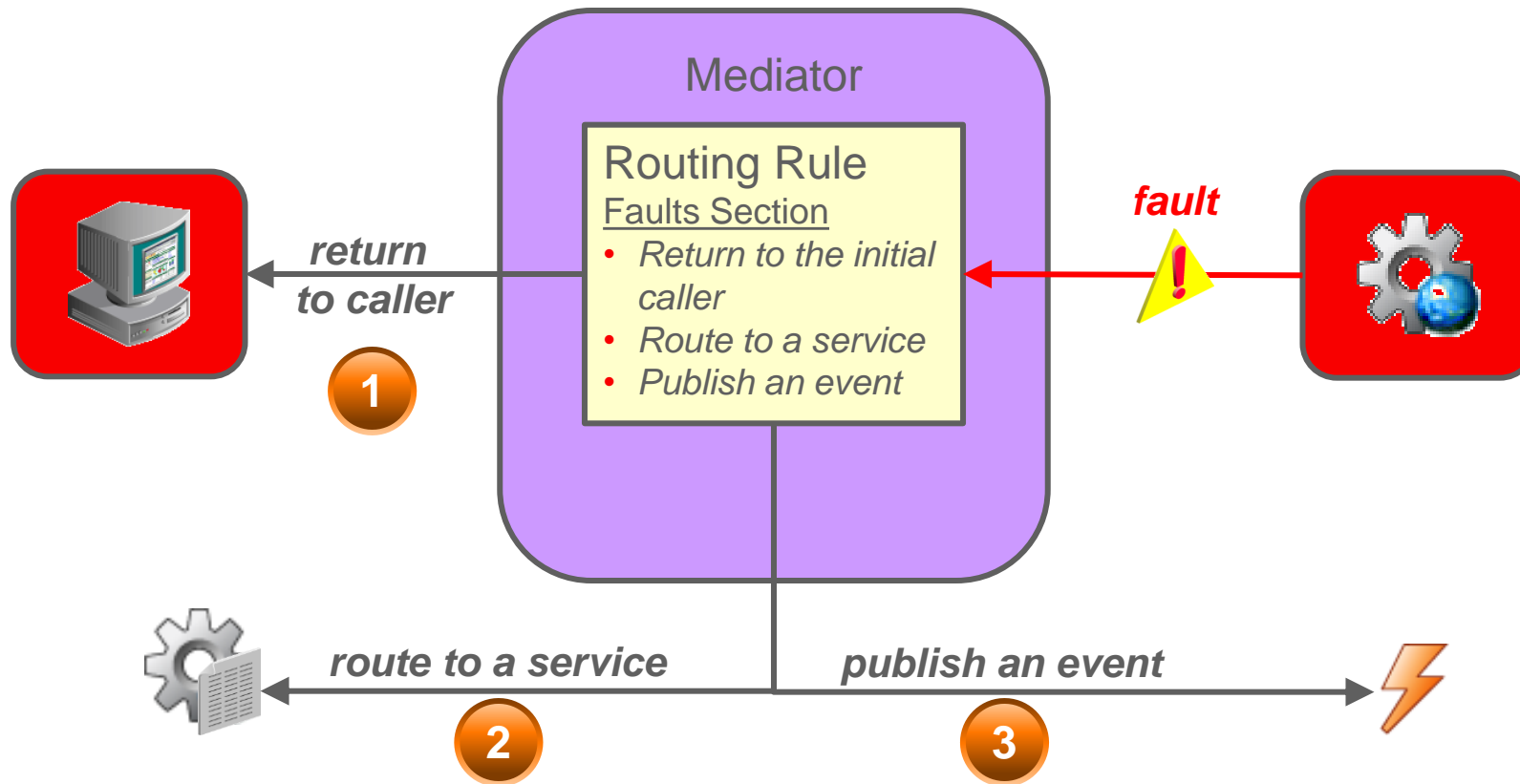
- Mediator configuration options
- BPEL language constructs
- The Fault Management Framework
- Enterprise Manager

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- Faults: Overview
- **Managing Faults in Mediator**
- Fault Handling in BPEL
- Compensation in BPEL
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Managing Faults in a Mediator



Quiz



A Mediator can return a fault to the original caller, if the fault is defined in its WSDL.

- a. True
- b. False



Agenda

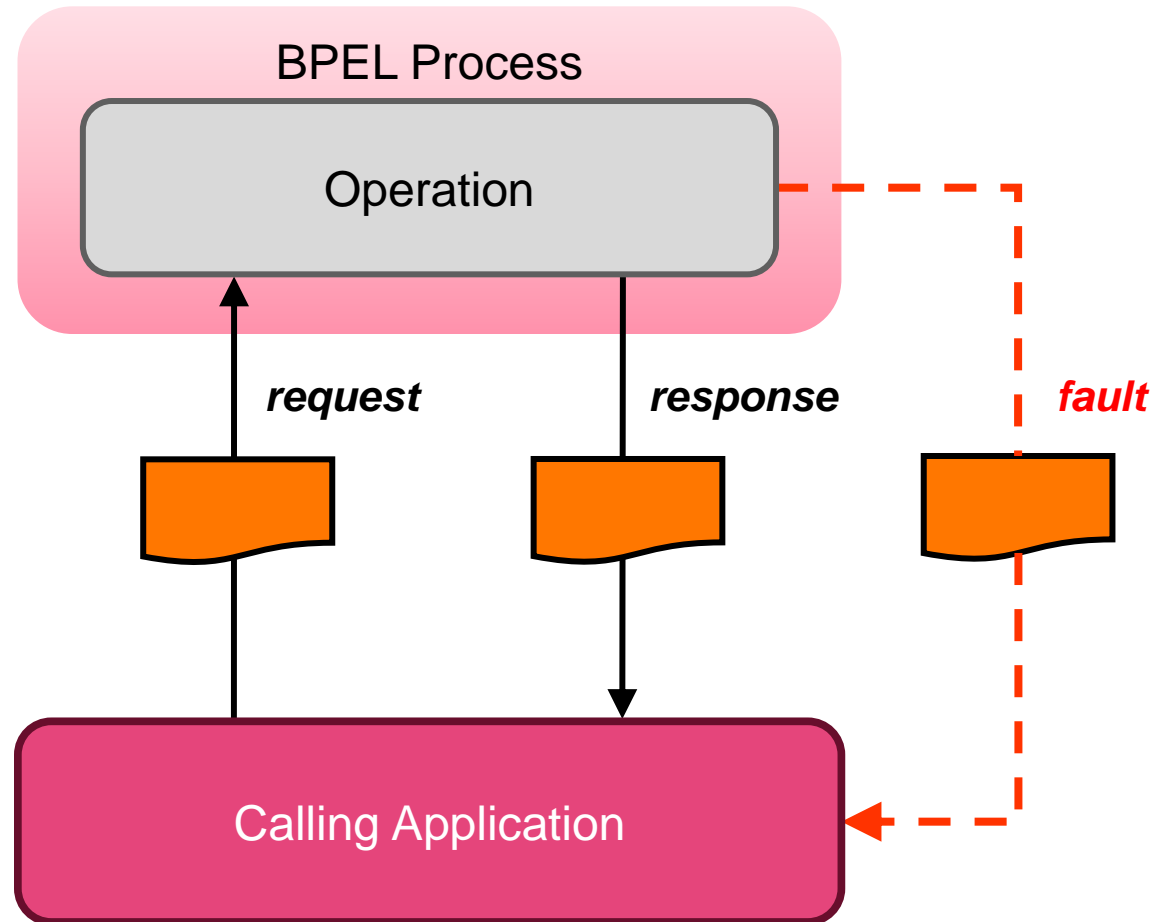
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- Faults in Enterprise Manager



Faults in BPEL Processes

- During execution, a BPEL process can encounter:
 - Both business and runtime faults
 - A third type of fault known as a *standard* fault
- Standard faults are:
 - Defined by the WS-BPEL specification
 - Not associated with a message type or WSDL message
 - Thrown by the systems

Faults in Synchronous BPEL

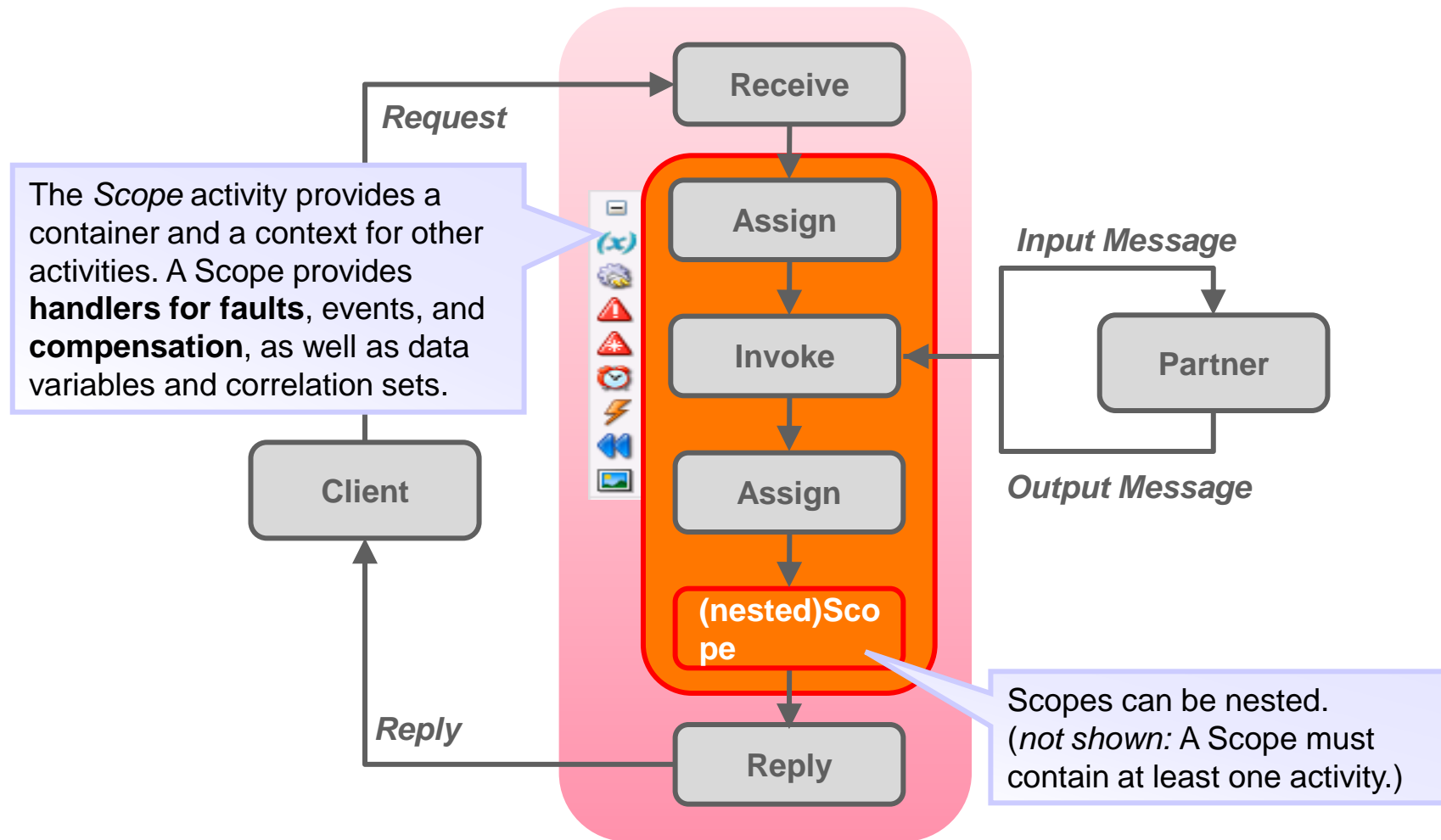


Synchronous Service Faults

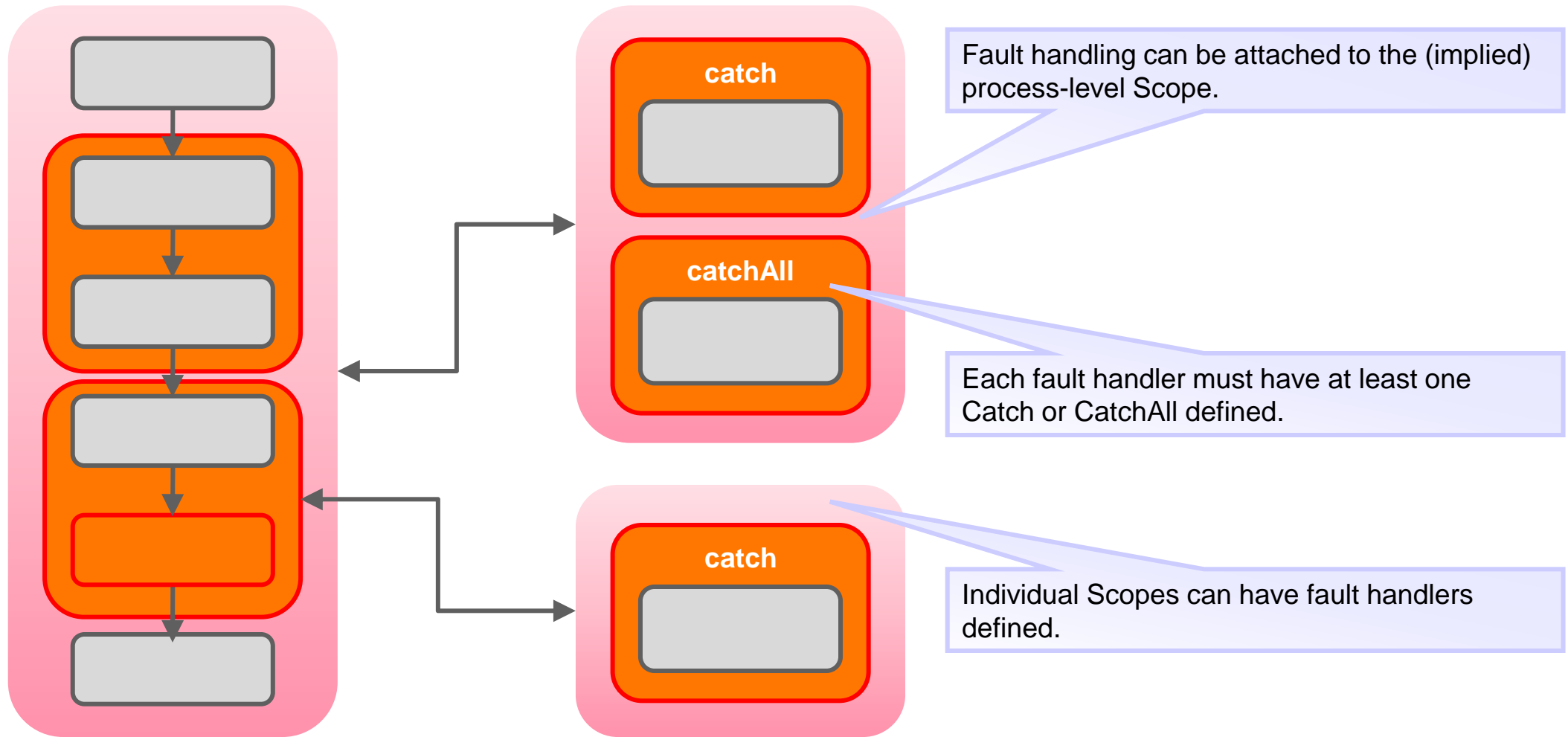
```
<!--      MESSAGE TYPE DEFINITION  -->
<wsdl:message name="BookingRequestMsg">
    <wsdl:part name="payload" element="ns1:enrollmentRequest" />
</wsdl:message>
<wsdl:message name="BookingResponseMsg">
    <wsdl:part name="payload" element="ns1:enrollmentResponse" />
</wsdl:message>
<wsdl:message name="BookingFaultMsg">
    <wsdl:part name="payload" element="ns1:enrollmentFault" />
</wsdl:message>

<!-- portType implemented by the Booking BPEL process -->
<wsdl:portType name="Booking">
    <wsdl:operation name="process">
        <wsdl:input  message="client:BookingRequestMsg" />
        <wsdl:output message="client:BookingResponseMsg"/>
    <wsdl:fault message="client:BookingFaultMsg" name="pymtFault"/>
    </wsdl:operation>
</wsdl:portType>
```

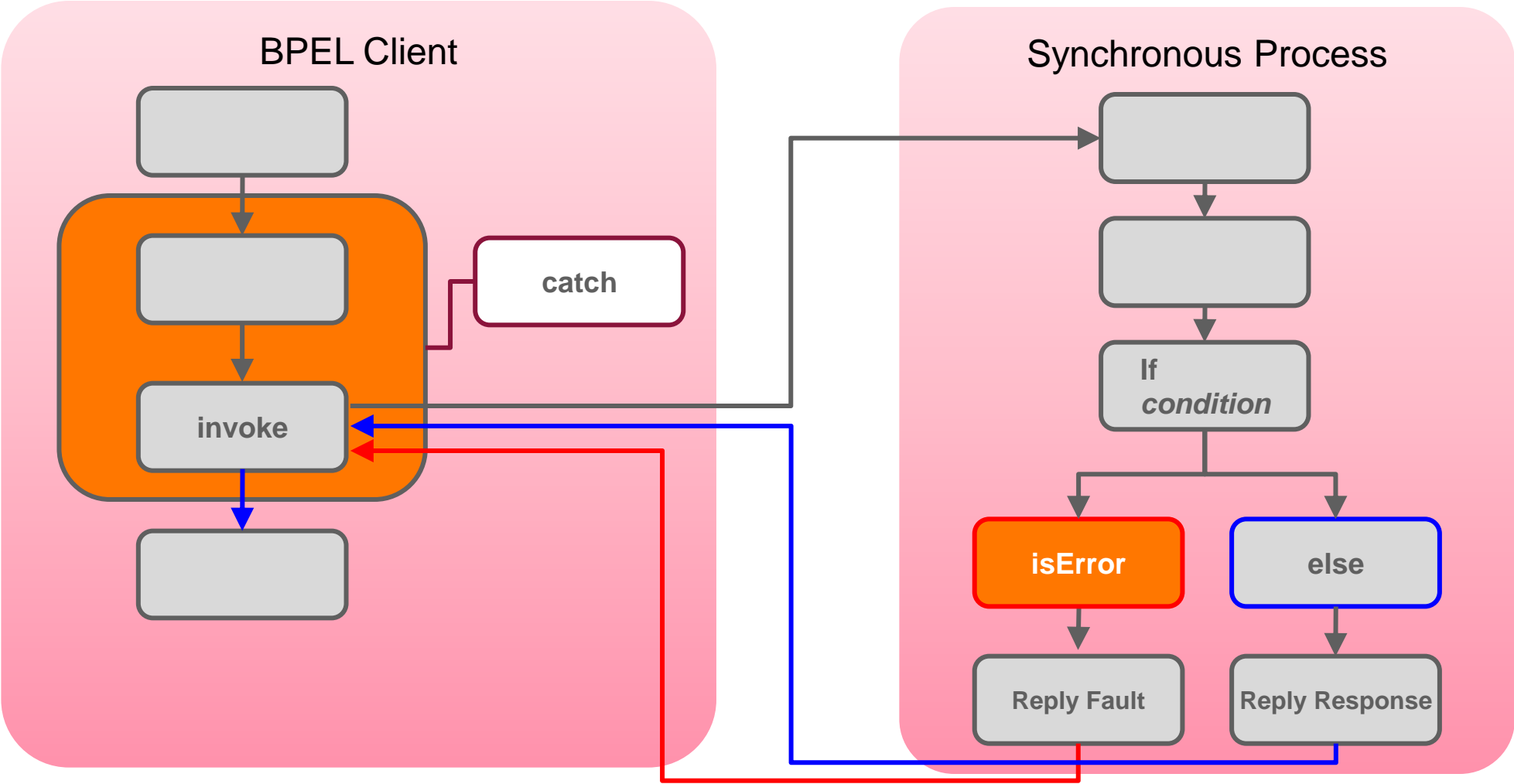
Review: Scope Activity



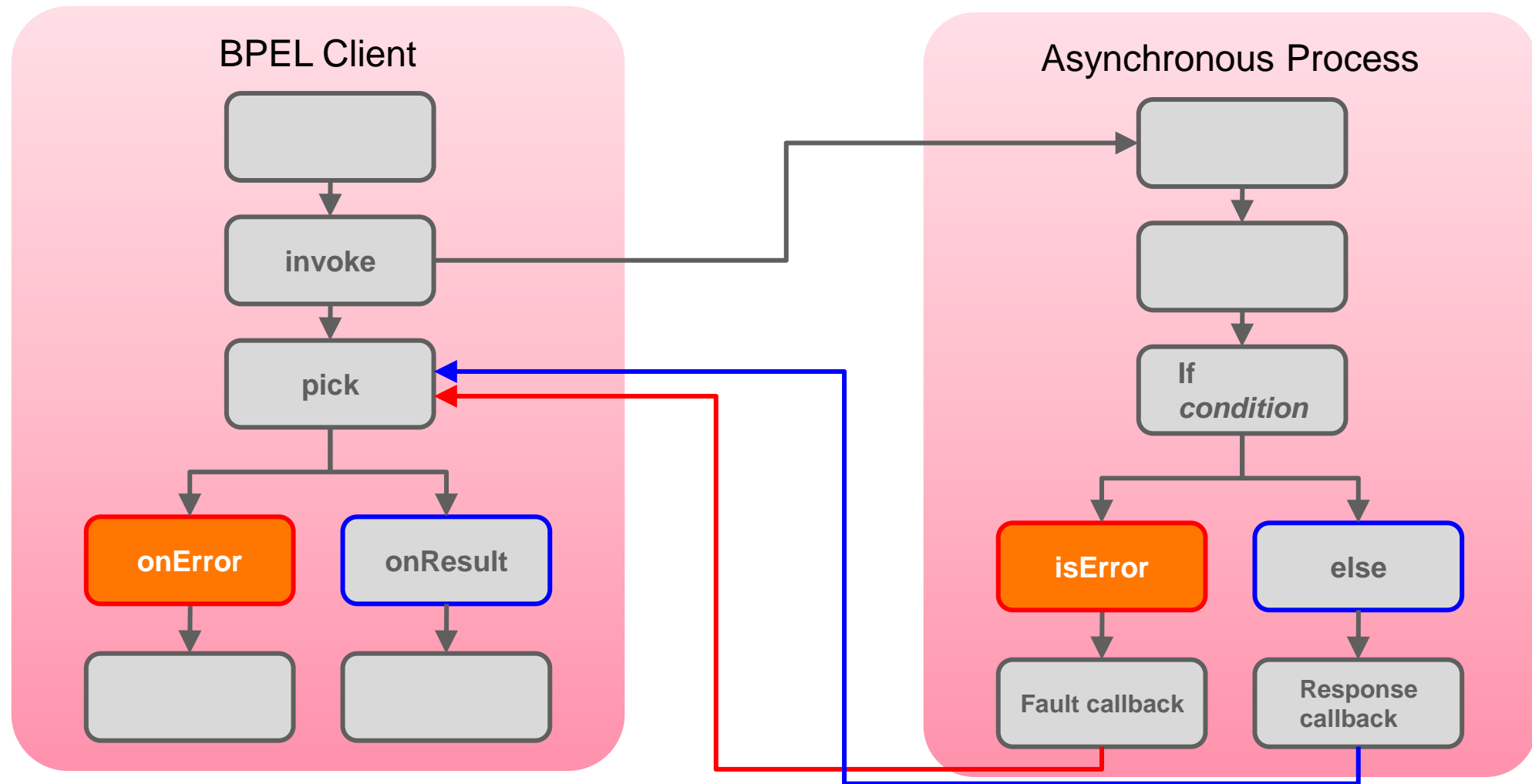
Fault Handlers



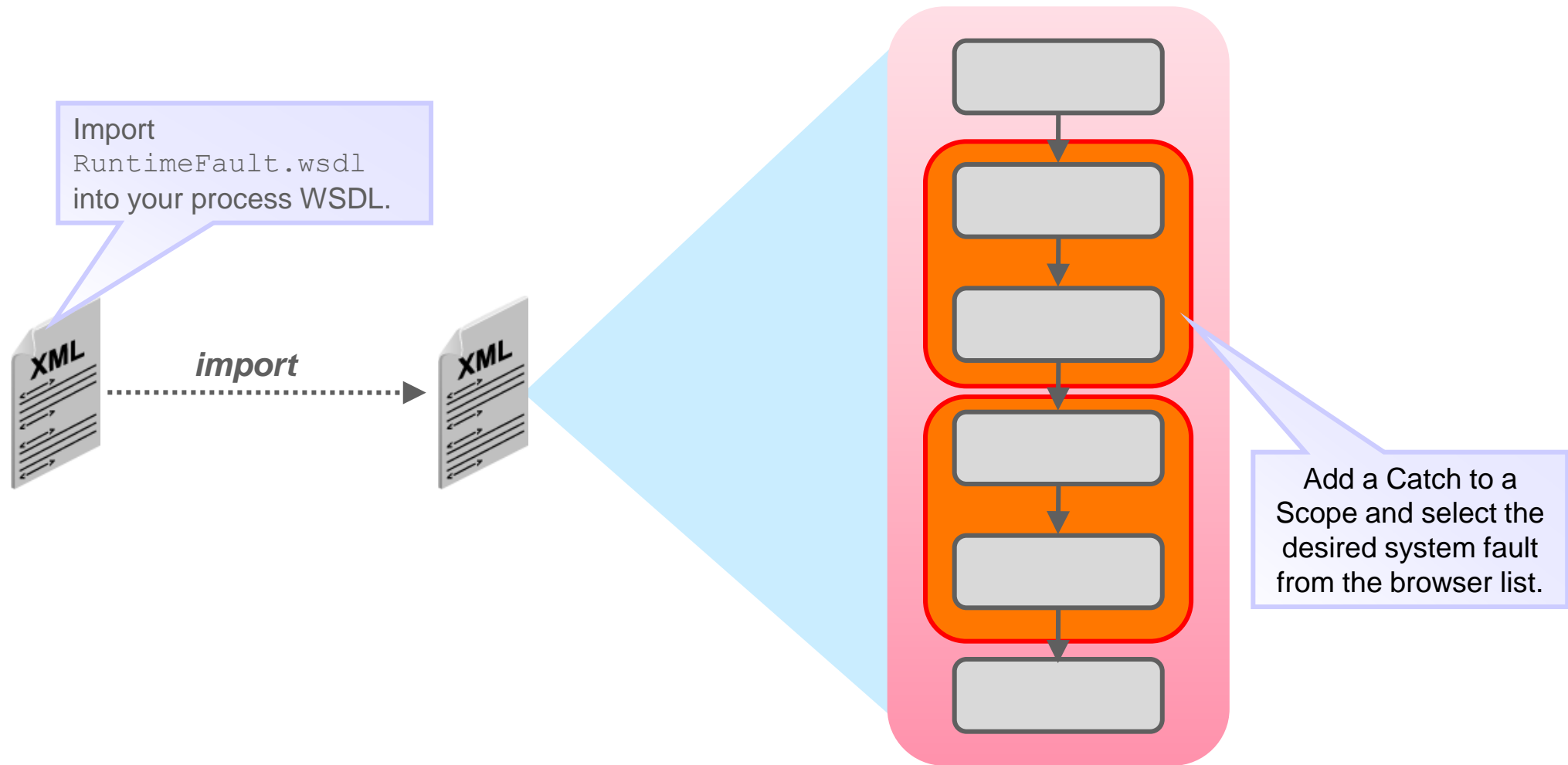
Returning Faults from a Synchronous Process



Returning Faults from an Asynchronous Process



Catching BPEL Runtime Faults



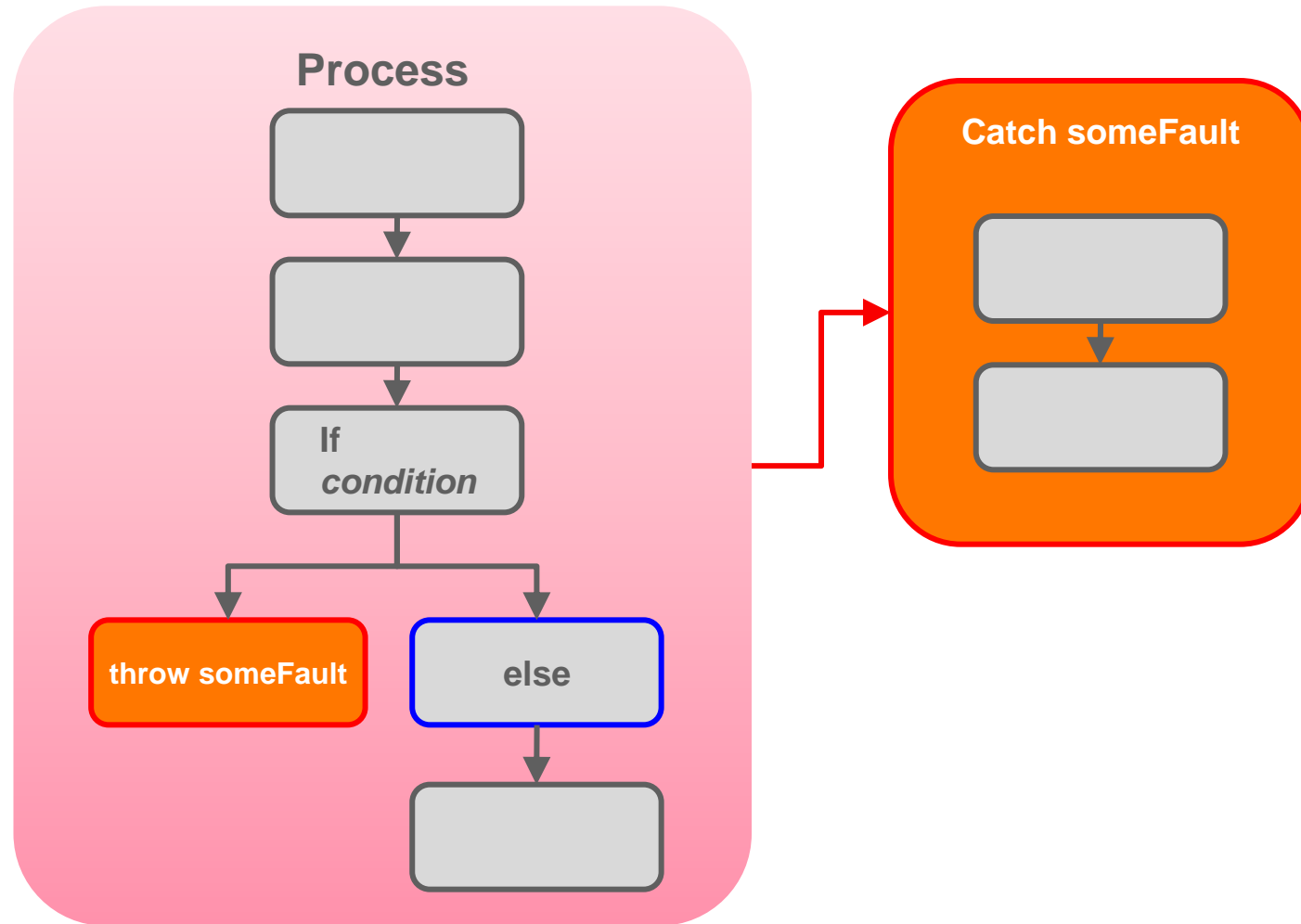
Faults That Cannot Be Handled

Some faults cannot be handled. Examples include:

- Some internal server errors
- Lower-level JVM errors
- Transaction timeout conditions and transactions that are marked for rollback

Note: The BPEL Process Manager (server) manages these error conditions by writing them to log files and terminating the instance.

Throwing Faults



Quiz



Faults are notified and handled differently based on the type of interaction (synchronous or asynchronous invocation).

- a. True
- b. False



Quiz



A BPEL fault handler must include a CatchAll element to handle all exceptions that are not caught by name.

- a. True
- b. False



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- **Compensation in BPEL**
- The Fault Management Framework
- Faults in Enterprise Manager

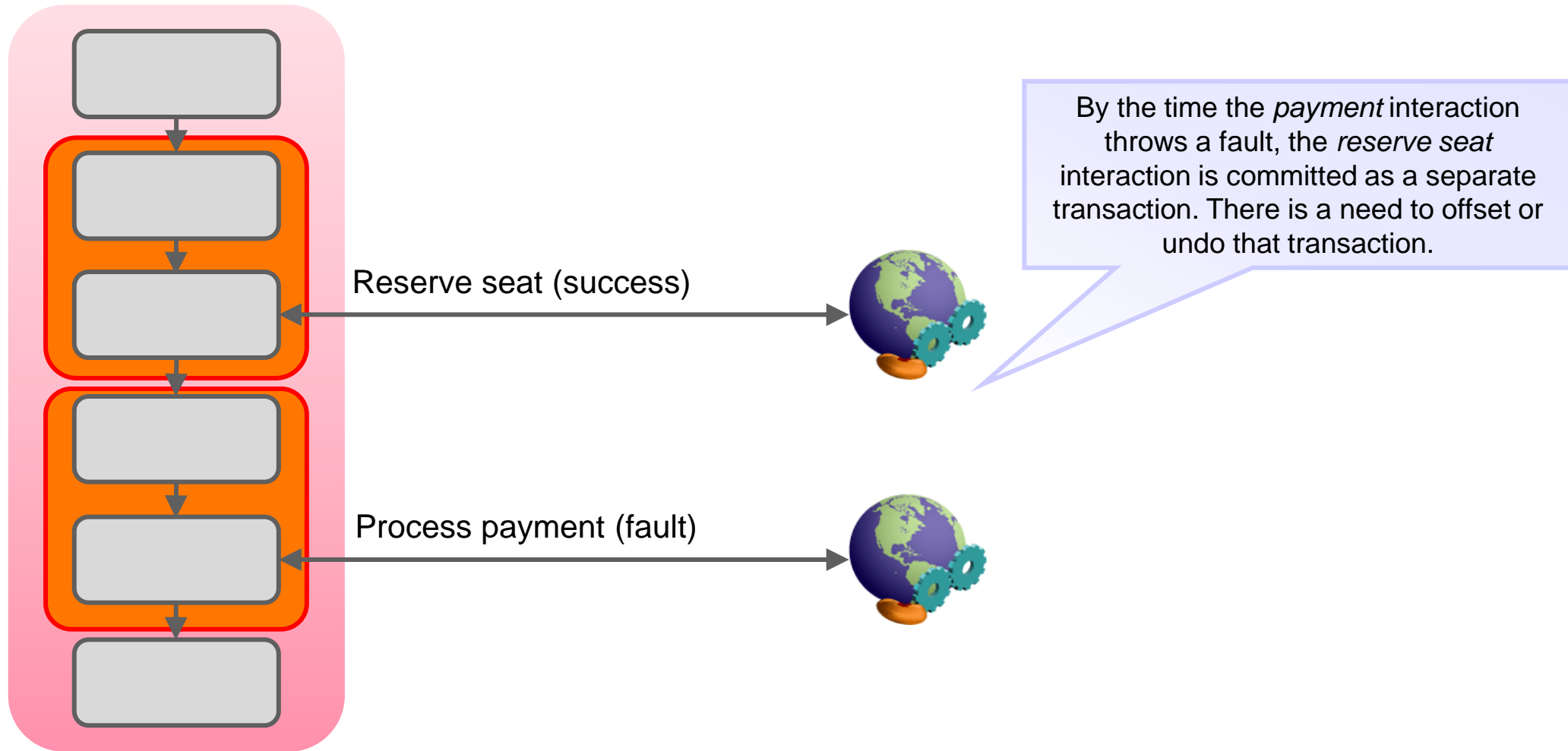


Review: Transactionality

The Database adapter and JMS adapter are both *transactional* (as are the AQ adapter and Java web services).

- In general, a transaction is started by a service when it is invoked by a client, and ends when the service operation completes. If the invoked service completes successfully, the transaction that is started is committed; otherwise errors roll back the transaction.
- Transactional boundaries depend on the context, configuration, and environment of the services that are implemented and invoked.
- Transaction semantics are different for services that are invoked synchronously than for services that are invoked asynchronously.

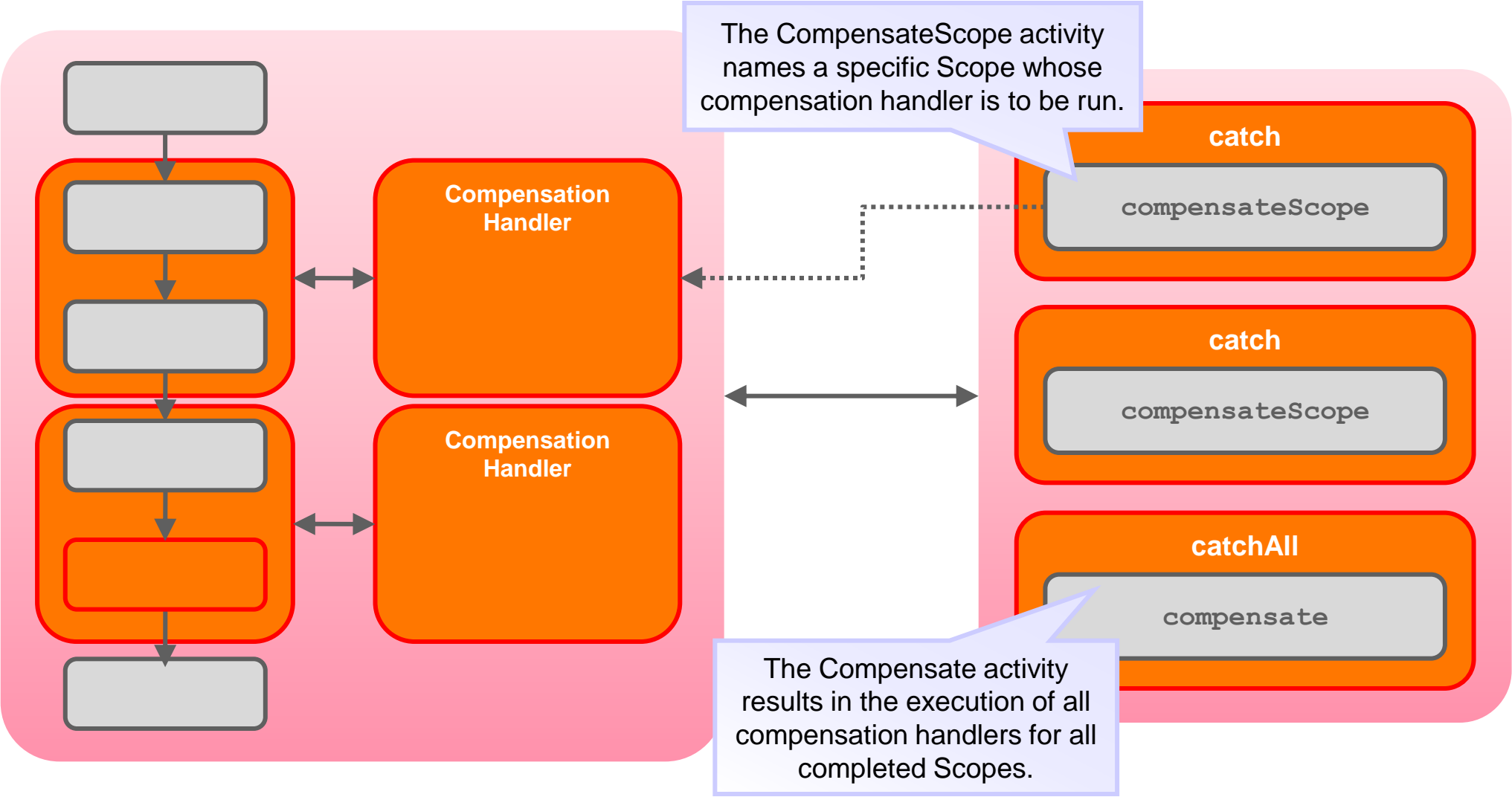
Compensation



Compensation Handlers

```
<scope name="myScope">
  <variables>
    ...local variables declared here
  </variables>
  <compensationHandler>
    <sequence name="compSequence">
      ...compensation activities defined here
    </sequence>
  </compensationHandler>
  <sequence name="mainSequence">
    ...normal activities defined here
  </sequence>
</scope>
```

Invoking Compensation



Quiz



A `compensationHandler` provides a mechanism for undoing or compensating the result of all completed activities in a business process.

- a. True
- b. False

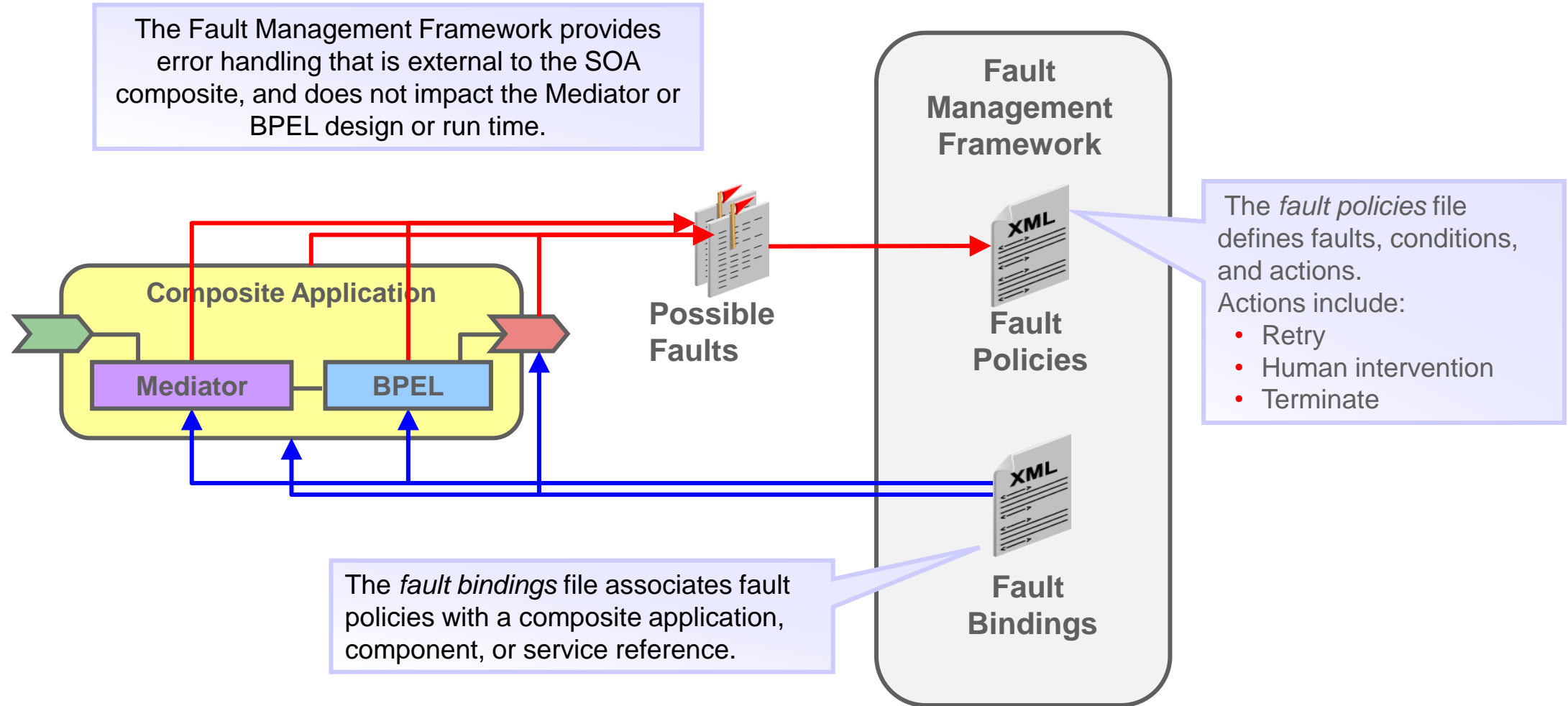


Agenda

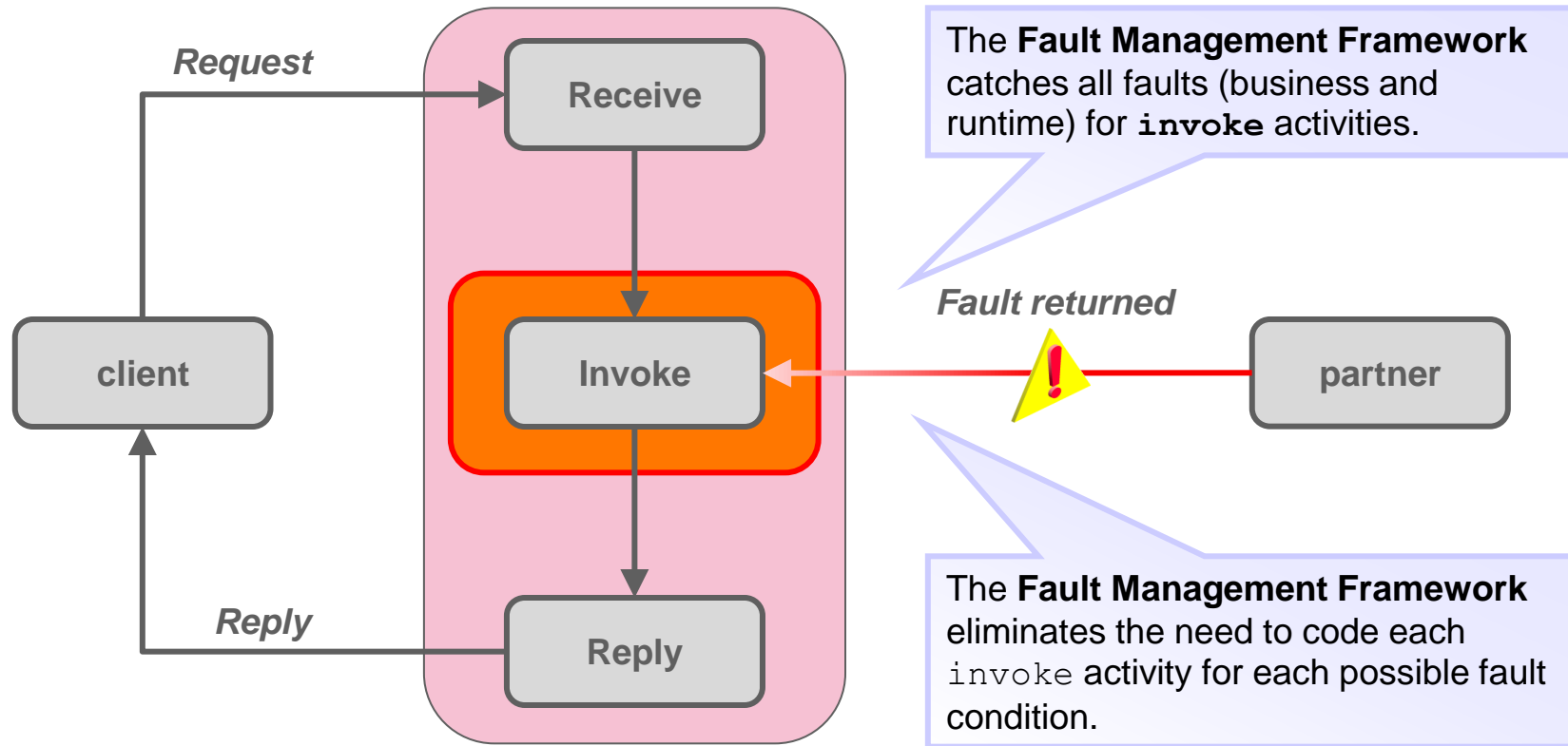
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- Faults in Enterprise Manager



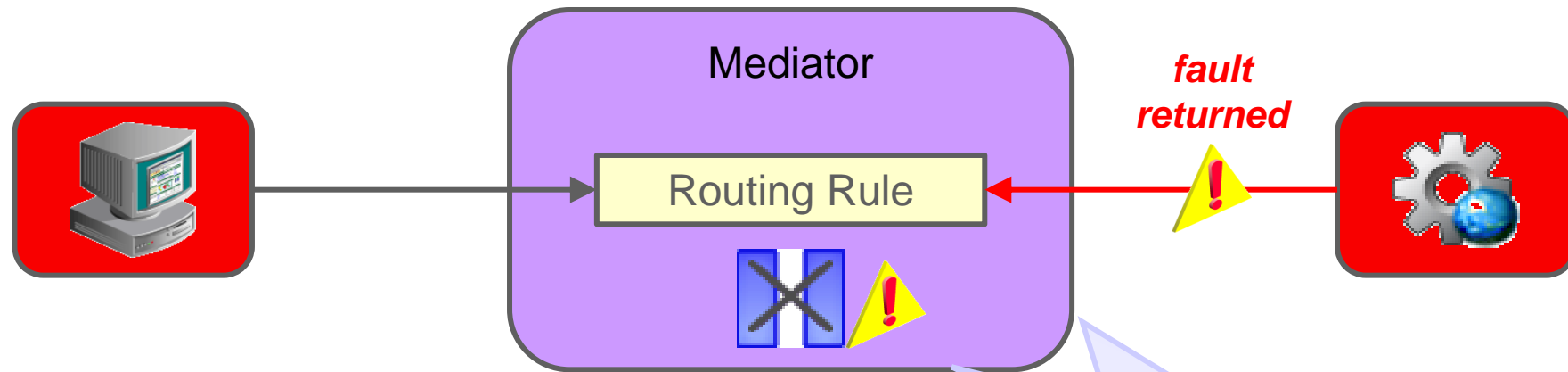
Fault Management Framework: Overview



Fault Management Framework and BPEL



Fault Management Framework and Mediator



The **Fault Management Framework** can catch faults returned by services, and those encountered internally, during message transformation and other mediator activities.

Defining a Fault Policy Document

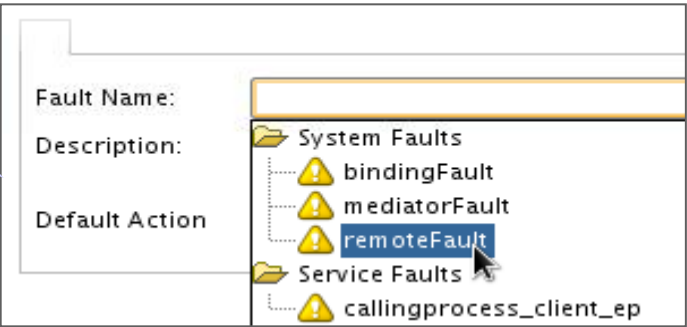


1

Define a Fault Policy Document.

2

Select the name of the fault.



12^c

Specifying a Default Action

Specify the default action to take in response to the raised fault.

1

2

Edit the properties of the chosen action.

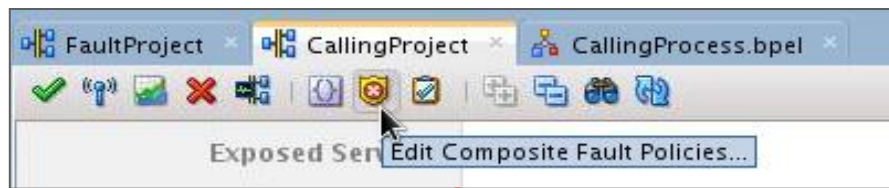
3

Retry Properties

ID *:	default-retry
Retry Count *:	5
Retry Interval *:	1
Exponential Backoff:	<input type="checkbox"/>
Retry Success Action:	Choose...
Retry Failure Action:	[abort] default-termination

Help Ok Cancel

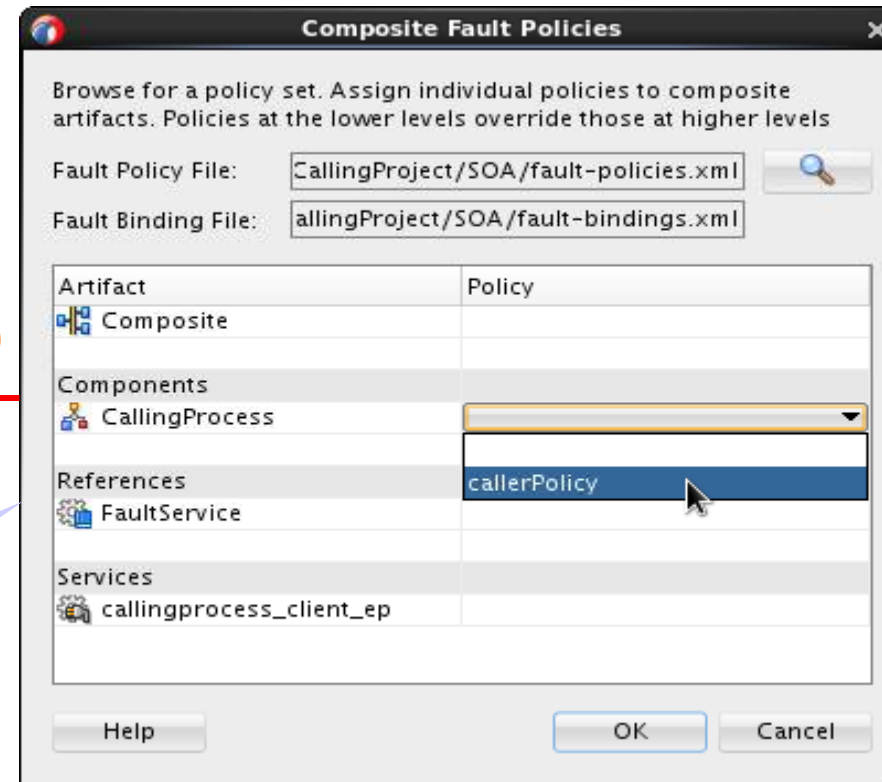
Defining Fault Bindings



1

2

Associate the policy with the desired component, reference, or service.



Quiz



The Fault Management Framework is external to the SOA composite and does not impact the Mediator or BPEL design or run time.

- a. True
- b. False



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- **Faults in Enterprise Manager**

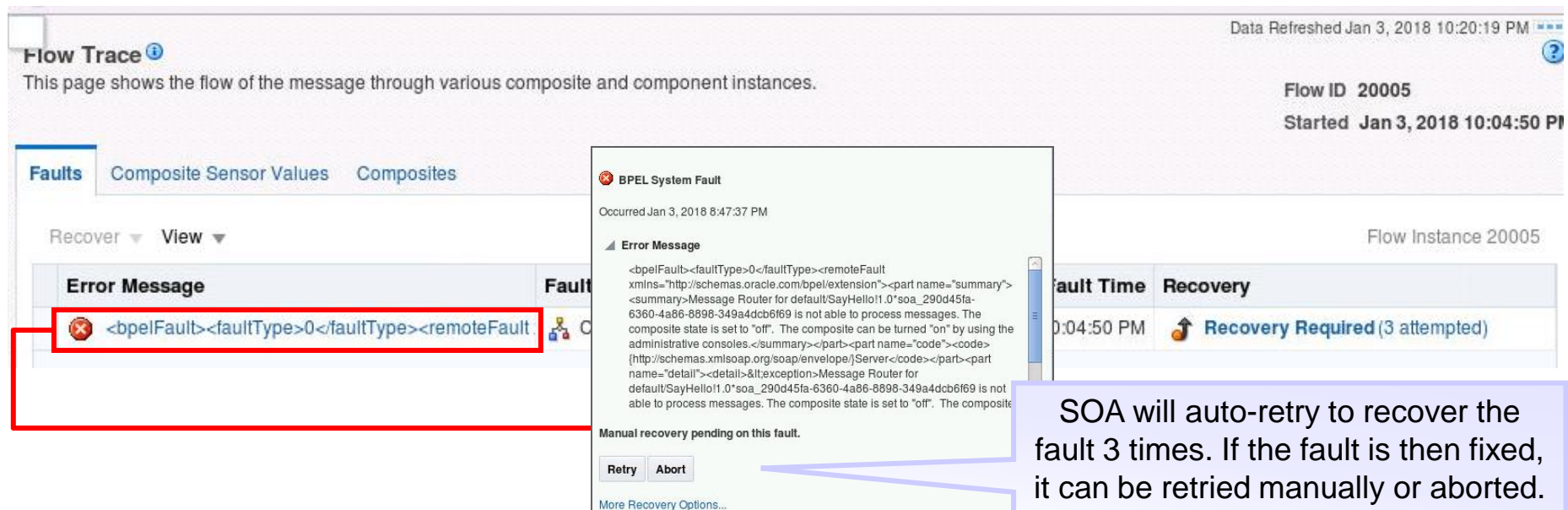


Recovering Faults with Enterprise Manager Fusion Middleware Control

Some faults can be recovered by using Enterprise Manager Fusion Middleware Control from the composite application home page or a Flow Trace page.



Flow ID	Initiating Composite	Flow State	Created	Last Updated
20003	CallGreeting [1.0]	Recovery	Jan 3, 2018 8:47:37 PM	Jan 3, 2018 8:47:41 PM



Flow Trace
This page shows the flow of the message through various composite and component instances.

Flow ID 20005
Started Jan 3, 2018 10:04:50 PM

Faults Composite Sensor Values Composites

Recover View

Error Message	Fault
<code><bpelFault><faultType>0</faultType><remoteFault</code>	

BPEL System Fault
Occurred Jan 3, 2018 8:47:37 PM

Error Message
`<bpelFault><faultType>0</faultType><remoteFault`
xmlns="http://schemas.oracle.com/bpel/extension"><part name="summary"><summary>Message Router for default/SayHello1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite can be turned "on" by using the administrative consoles.</summary></part><part name="code"><code>[http://schemas.xmlsoap.org/soap/envelope/]Server</code></part><part name="detail"><detail><exception>Message Router for default/SayHello1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite

Manual recovery pending on this fault.

Retry Abort

More Recovery Options...

Fault Time	Recovery
10:04:50 PM	Recovery Required (3 attempted)

SOA will auto-retry to recover the fault 3 times. If the fault is then fixed, it can be retried manually or aborted.

Accessing a Recoverable Fault

Scenario: An asynchronous BPEL process invokes a service that is not available.
Solution: Start up the unavailable service and retry on the Enterprise Manager Fusion Middleware Control pages.

Faults Composite Sensor Values Composites

Recover View Flow Instance 20003

Error Message	Fault Owner	Fault Time	Recovery
<bpelFault><faultType>0</faultType><remoteFault xmlns="http://schemas.oracle.com/bpel/extension"><part name="summary"><summary>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite can be turned "on" by using the administrative consoles.</summary></part><part name="code"><code>{http://schemas.xmlsoap.org/soap/envelope/}Server</code></part><part name="detail"><detail><exception>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite	CallingProcess	Jan 3, 2018 8:47:37 PM	Recovery Required(3 attempted)

Trace

View Show Instance IDs Show XML

Instance	Type	Usage	State	Time	Composite
CallingProcess	BPEL		Recovered	Jan 3, 2018 8:47:37 ...	CallGreeting [1.0]
Greeting	Web Service	Reference	Failed	Jan 3, 2018 8:47:37 ...	CallGreeting [1.0]
makegreeting_client_ep	Web Service	Service	Failed	Jan 3, 2018 8:47:37 ...	SayHello [1.0]
Greeting	Web Service	Reference	Failed	Jan 3, 2018 8:47:39 ...	CallGreeting [1.0]
makegreeting_client_ep	Web Service	Service	Failed	Jan 3, 2018 8:47:39 ...	SayHello [1.0]
Greeting	Web Service	Reference	Failed	Jan 3, 2018 8:47:40 ...	CallGreeting [1.0]
makegreeting_client_ep	Web Service	Service	Failed	Jan 3, 2018 8:47:40 ...	SayHello [1.0]
Greeting	Web Service	Reference	Failed	Jan 3, 2018 8:47:41 ...	CallGreeting [1.0]
makegreeting_client_ep	Web Service	Service	Failed	Jan 3, 2018 8:47:41 ...	SayHello [1.0]
Greeting	Web Service	Reference	Completed	Jan 3, 2018 8:54:20 ...	CallGreeting [1.0]
makegreeting_client_ep	Web Service	Service	Completed	Jan 3, 2018 8:54:20 ...	SayHello [1.0]
MakeGreeting	BPEL		Completed	Jan 3, 2018 8:54:20 ...	SayHello [1.0]

BPEL System Fault

Occurred Jan 3, 2018 8:47:37 PM

Error Message

```
<bpelFault><faultType>0</faultType><remoteFault xmlns="http://schemas.oracle.com/bpel/extension"><part name="summary"><summary>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite can be turned "on" by using the administrative consoles.</summary></part><part name="code"><code>{http://schemas.xmlsoap.org/soap/envelope/}Server</code></part><part name="detail"><detail>&lt;exception>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite
```

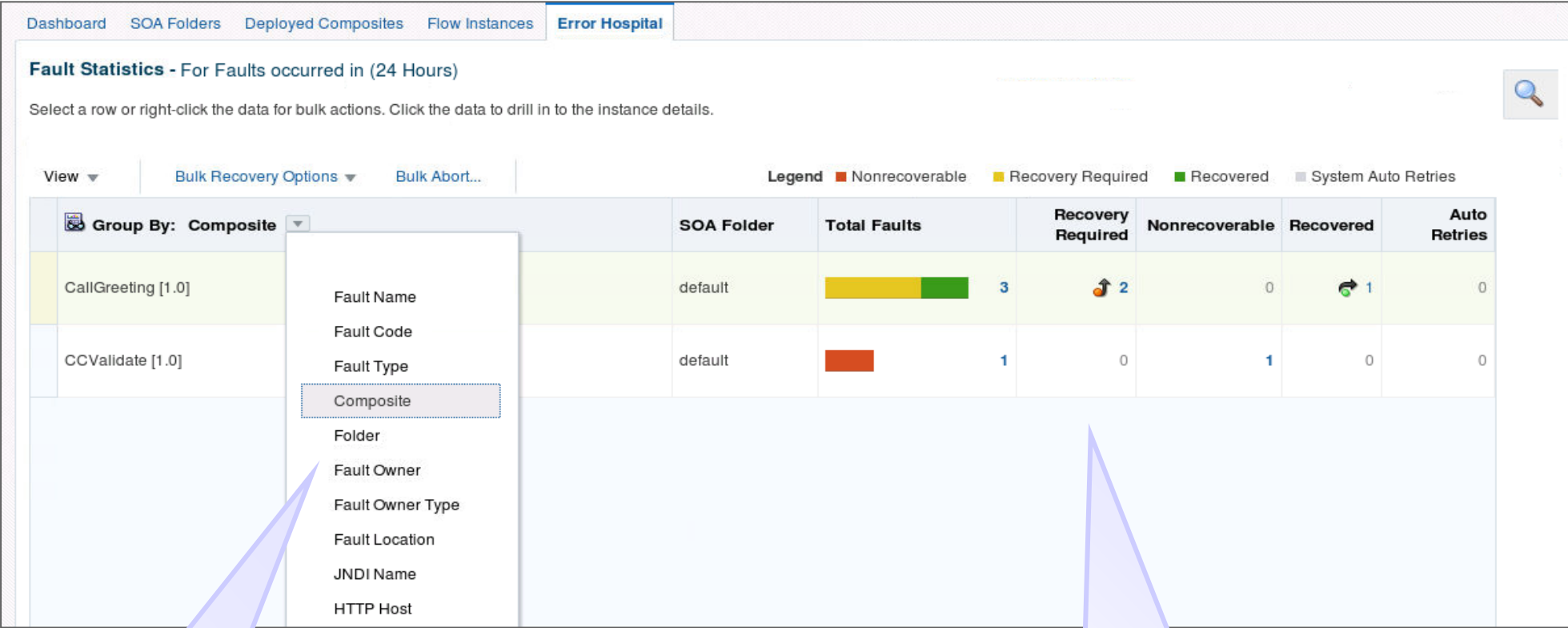
Manual recovery pending on this fault.

Retry **Abort**

[More Recovery Options...](#)

With the problem fixed, the retry succeeds.

Error Hospital



The Error Hospital can display faults by different selected groupings.

You can access the recovery page by clicking on those faults that can be recovered.

Flow Instances Page

The screenshot shows the SOA Infrastructure Flow Instances page. The top navigation bar includes 'Dashboard', 'SOA Folders', 'Deployed Composites', 'Flow Instances' (selected), and 'Error Hospital'. The page title is 'Search Results - Instances Faulted (24 Hours)'. Below the title, there are links for 'Recent Instances', 'Instances With Faults', and 'Recoverable Instances'. A 'Hide Details' button is also present. The main table lists faulted instances with columns: Flow ID, Initiating Composite, Flow State, Created, Last Updated, Folder, Name, and Logs. Two instances are shown, both in a 'Recovery' state. Below the table, there are tabs for 'Faults', 'Composite Sensor Values', and 'Composites'. The 'Faults' tab is selected, showing a detailed view for 'Flow Instance 20005'. This view includes a table with columns: Error Message, Fault Owner, Fault Time, Recovery, and Logs. The error message is a BPEL fault, and the recovery status is 'Recovery Required (3 attempted)'.

Flow ID	Initiating Composite	Flow State	Created	Last Updated	Folder	Name	Logs
20005	CallGreeting [1.0]	Recovery	Jan 3, 2018 10:04:50 PM	Jan 3, 2018 10:04:53 PM	default		
20004	CallGreeting [1.0]	Recovery	Jan 3, 2018 9:57:10 PM	Jan 3, 2018 9:57:14 PM	default		

Error Message	Fault Owner	Fault Time	Recovery	Logs
<bpelFault><faultType>0</faultType><remoteFault>	CallingProcess	Jan 3, 2018 10:04:50 PM	Recovery Required (3 attempted)	

You can view faulted instances and their error details from the same Flow Instances page.
By selecting the Flow ID you can access the Flow Trace.
Or, you can select the error message and choose more recovery options.

Recovering a Fault Condition

BPEL System Fault

Occurred Jan 3, 2018 8:47:37 PM

▲ Error Message

<bpelFault><faultType>0</faultType><remoteFault xmlns="http://schemas.oracle.com/bpel/extension"><part name="summary"><summary>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off". The composite can be restarted from the administrative consoles.</summary></part><part name="detail"><detail><exception>Message Router for default/SayHello!1.0*soa_290d45fa-6360-4a86-8898-349a4dcb6f69 is not able to process messages. The composite state is set to "off".</exception></detail></part></remoteFault></bpelFault>

Manual recovery pending on this fault.

Retry

Abort

More Recovery Options...

When Human Intervention is a selected Fault Handling option for recovering a fault, there are more recovery options available.

Recovery Options

Choose a recovery action, modify the variable information as applicable and click Recover. Or click Abort to terminate the flow instance containing this fault.

Recovery Action

Retry

Variable

Continue

Value

Rethrow

Replay

Abort

Recover

Cancel

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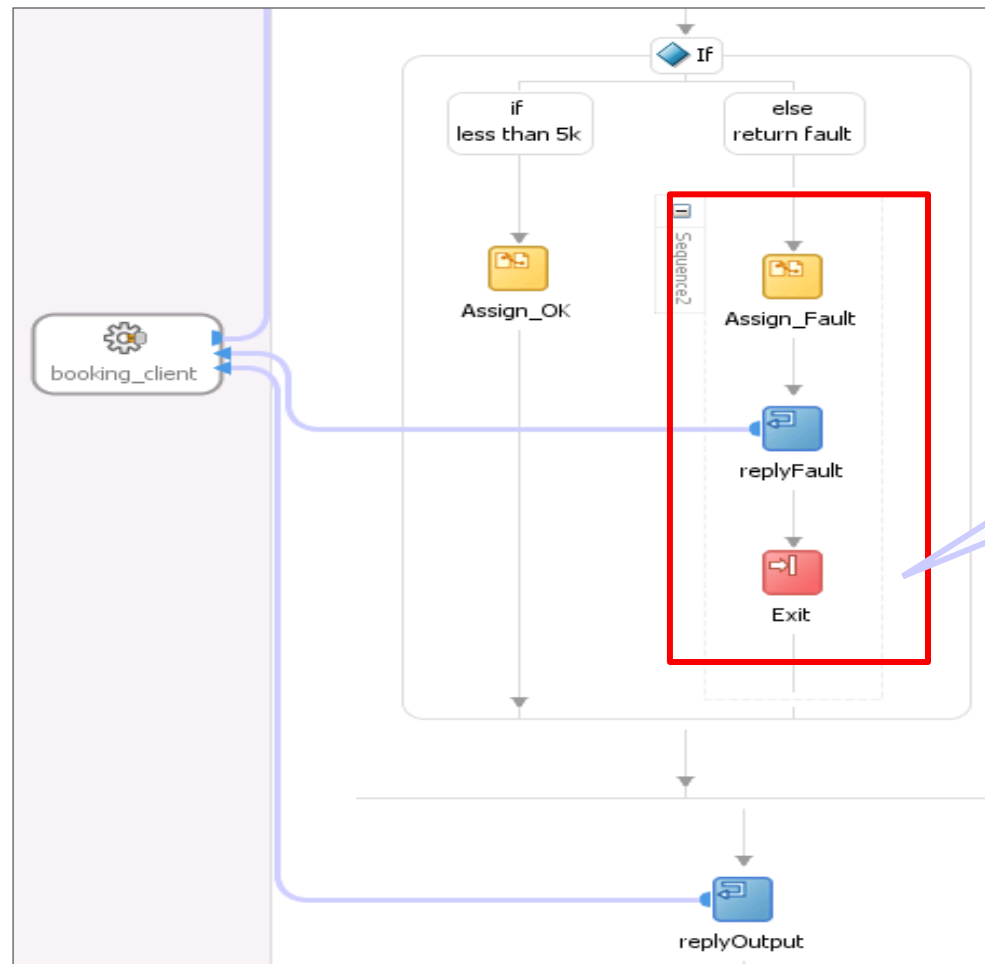
Summary

In this lesson, you should have learned how to:

- Describe basic fault handling and propagation
- Explain fault management for synchronous and asynchronous services
- Modify a WSDL operation to have a fault message
- Manage faults with Mediator components
- Throw and catch faults in a BPEL process
- Describe the Fault Management Framework

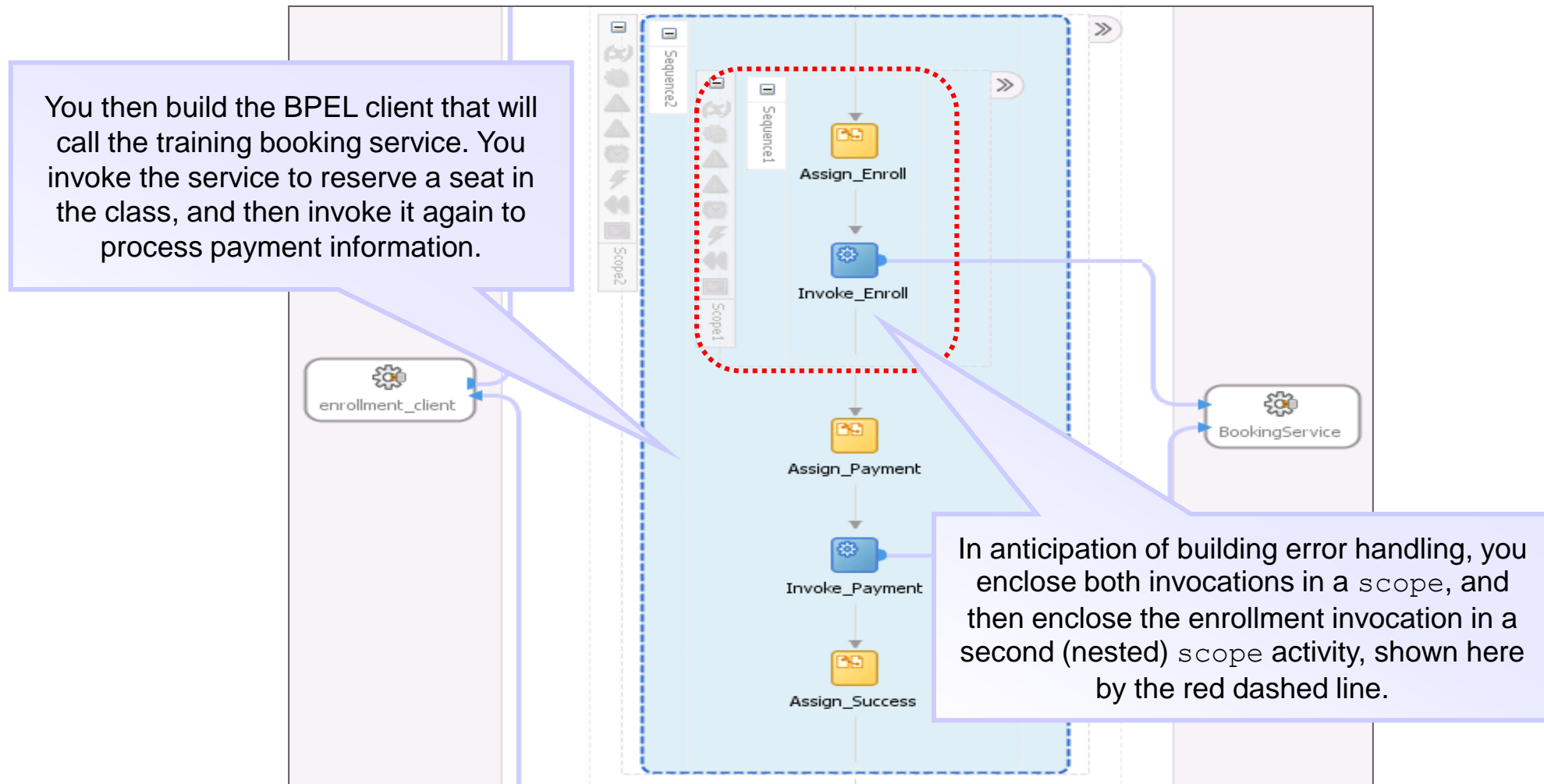


Practice 8-1 to 8-4 Overview

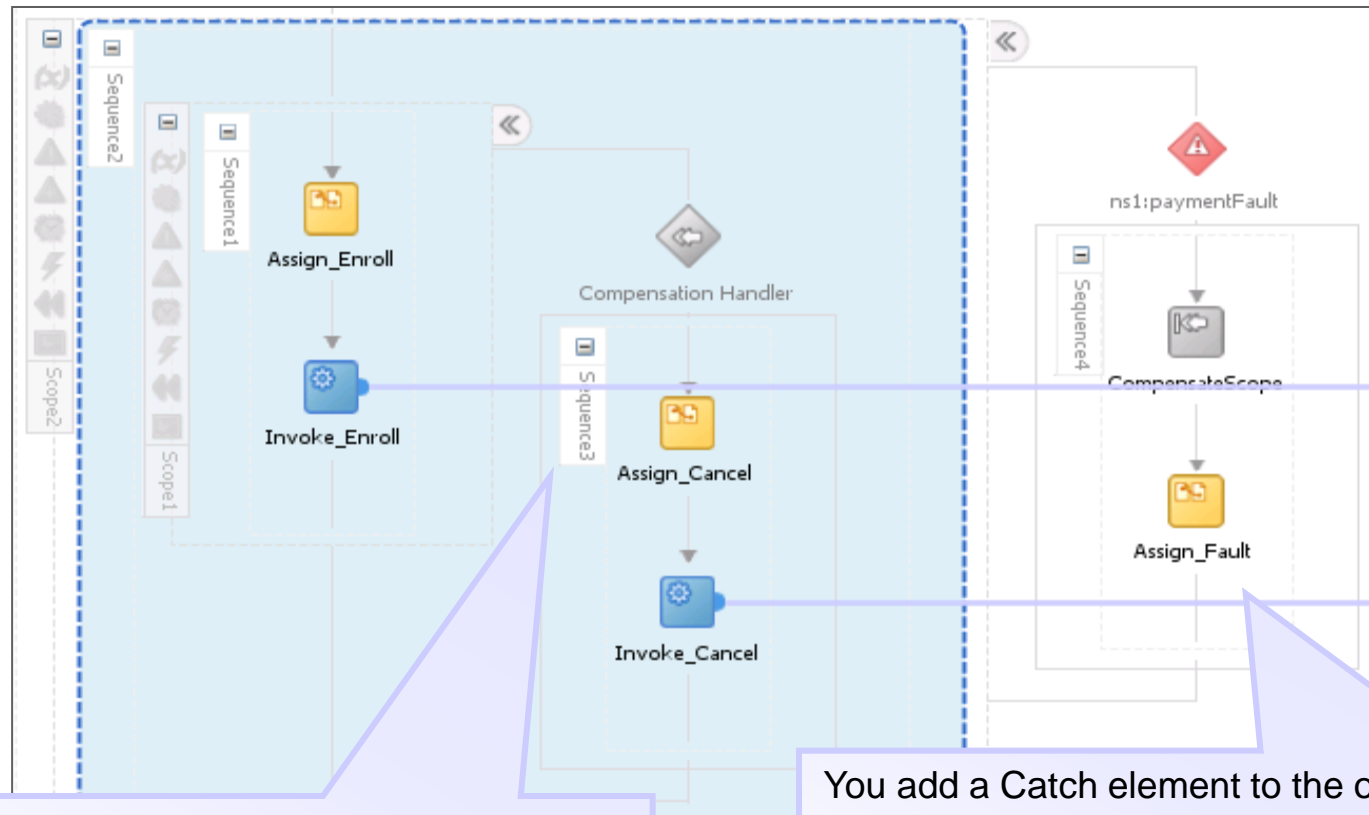


You first deploy a synchronous BPEL process (provided) that mimics processing of training course enrollment requests—both seat reservations and payment information. Under certain circumstances, the process will return a fault.

Practice 8-1 to 8-4 Overview



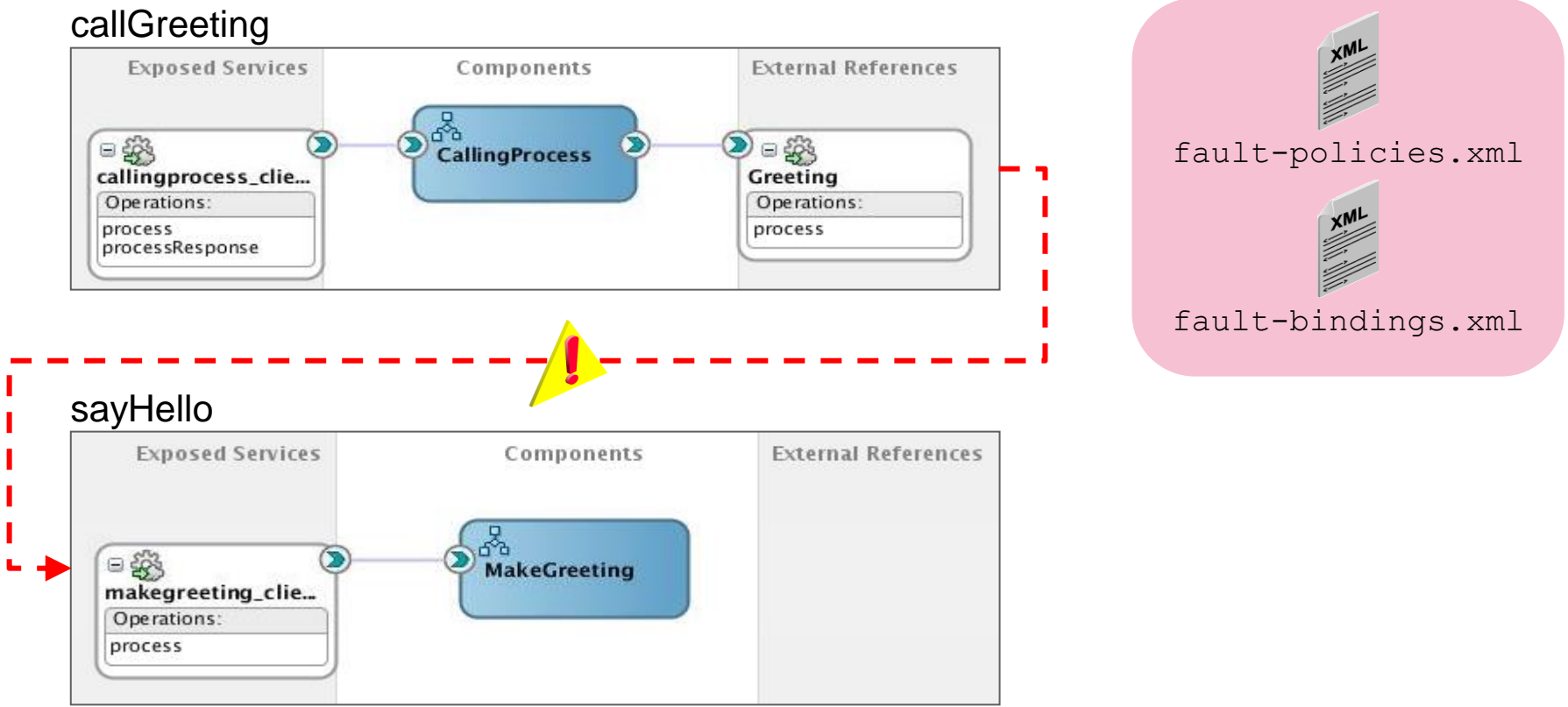
Practice 8-1 to 8-4 Overview



You add a compensation handler to the nested Scope that will reverse the seat assignment when invoked.

You add a Catch element to the outer Scope, which will be invoked if a specific fault is returned by `BookingService`. The Catch element will include a `CompensateScope` to invoke the compensation handler.

Practice 8-5 Overview



Practice 8-5 Overview

Trace

Actions ▾ View ▾ Show Instance IDs ☐

Instance	Type	Usage	State
callingprocess_client_ep	Service	Service	Completed
CallingProcess	BPEL		Recovery Required
Greeting	Reference	Reference	Failed
makegreeting_client_ep	Service	Service	Failed

Manual recovery pending on this fault.

[Retry](#) [Abort](#)

[More Recovery Options...](#)

Trace

Actions ▾ View ▾ Show Instance IDs ☐

Instance	Type	Usage	State
callingprocess_client_ep	Service	Service	Completed
CallingProcess	BPEL		Recovered
Greeting	Reference	Reference	Failed
Greeting	Reference	Reference	Failed
Greeting	Reference	Reference	Failed
Greeting	Reference	Reference	Failed
Greeting	Reference	Reference	Completed
makegreeting_client_ep	Service	Service	Completed
MakeGreeting	BPEL		Completed