



# ***Beeple, B-Pel, Beepul? Understanding BPEL and Its Role in SOA***

presented by  
**John Jay King**  
King Training Resources  
john@kingtraining.com

**Download this paper and code examples from:**

**<http://www.kingtraining.com>**



- Understand the importance of BPEL to SOA
- Learn how Oracle's BPEL fits into Service Oriented Architecture (SOA) and Oracle Fusion Middleware
- Understand Oracle's BPEL Implementation
- Be able to discuss issues involved in process orchestration



- Business Process Execution Language for Web Services (BPEL or BPEL4WS)
  - Language created to compose, orchestrate, and coordinate web services
  - Processes are “composed” of existing services
  - BPEL is the result of over ten years of collaborative effort in Business Project Management by Microsoft and IBM
  - Today, BPEL products are supported by Oracle (plus BEA and Siebel), IBM, Microsoft, SAP, and many others
  - BPEL is an open industry standard managed by OASIS

<http://docs.oasis-open.org/wsbpel/2.0/wsbpel-specification-draft.html>



- BPEL extends Web Services
  - BPEL provides both synchronous and asynchronous interactions
  - BPEL supports long-running interactions
  - BPEL allows a well-defined mechanism for creating process definitions
- While usually depicted graphically; BPEL is defined using XML



- BPEL uses an XML language to specify and describe business processes in two specific ways:
  - Definition of executable processes that may be orchestrated
  - Definition of message exchanges or abstract business protocols
- BPEL uses web service XML technologies:
  - XML (eXtensible Markup Language)
  - WSDL (Web Service Description Language)
  - XPath (XML Path Language)
  - XML Schema



- Service Oriented Architecture (SOA) represents a new way of looking at the relationship between “the business” and IT
- Today’s organization must be agile enough to innovate to meet rapidly changing needs
- In most organizations, changes that do not fit current IT infrastructure are accomplished slowly:
  - Significant modifications required
  - Infrastructure additions necessary
- SOA ties IT Service development to business processes rather than to a specific infrastructure

# What are Services ?



- With SOA all or part of a business process is represented as a Service or set of Services that may be executed securely in a standardized way
- SOA Services may be stand-alone or combined with other Services to address new business issues
- Services are loosely-coupled communicating via coarse-grained messages
- The ability to orchestrate existing Services to meet new needs provides the agility modern organizations require to meet new and future needs



- Generally, services use one or more software components to satisfy some business process
- Service messages are generally coarse-grained (e.g. Purchase Order)
- Component and component tasks that make up a service are often focused in nature and usually require fine-grained messaging (e.g. Purchase Order Line Item)
- Each Service is generally represented by one or more software components; frequently Web Services today
- Other Services might represent existing legacy components or non-SOA implementations





- A key strength of SOA is simplicity
- Basic principles guiding SOA:
  - Standard set of enterprise service definitions *described in a registry*
  - Central management of service definitions *(enabled in-part by a registry)*
  - Loose coupling



- Central management of service definitions ensures that
  - Duplicate services are not created
  - Developers follow organization standards
  - Developers can find (and use) services



- In order to interact successfully with a service, you must know at least two things:
  - What you expect to get from the service
  - What information you have to provide the service
- A well-defined “contract” from the service provider spells out business and technology requirements for using a service (the “interface”) and how to invoke the service
  - A service contract reflects specific business knowledge and is the basis for sharing and reusing services
  - Maintenance of service “contracts” becomes critical over time
  - Contracts are stored in a service registry



- All the Services in the world are **useless** unless:
  - We know what they are named
  - We know where to find them
  - We know the expected inputs and outputs
  - We trust them to work as specified in their contract



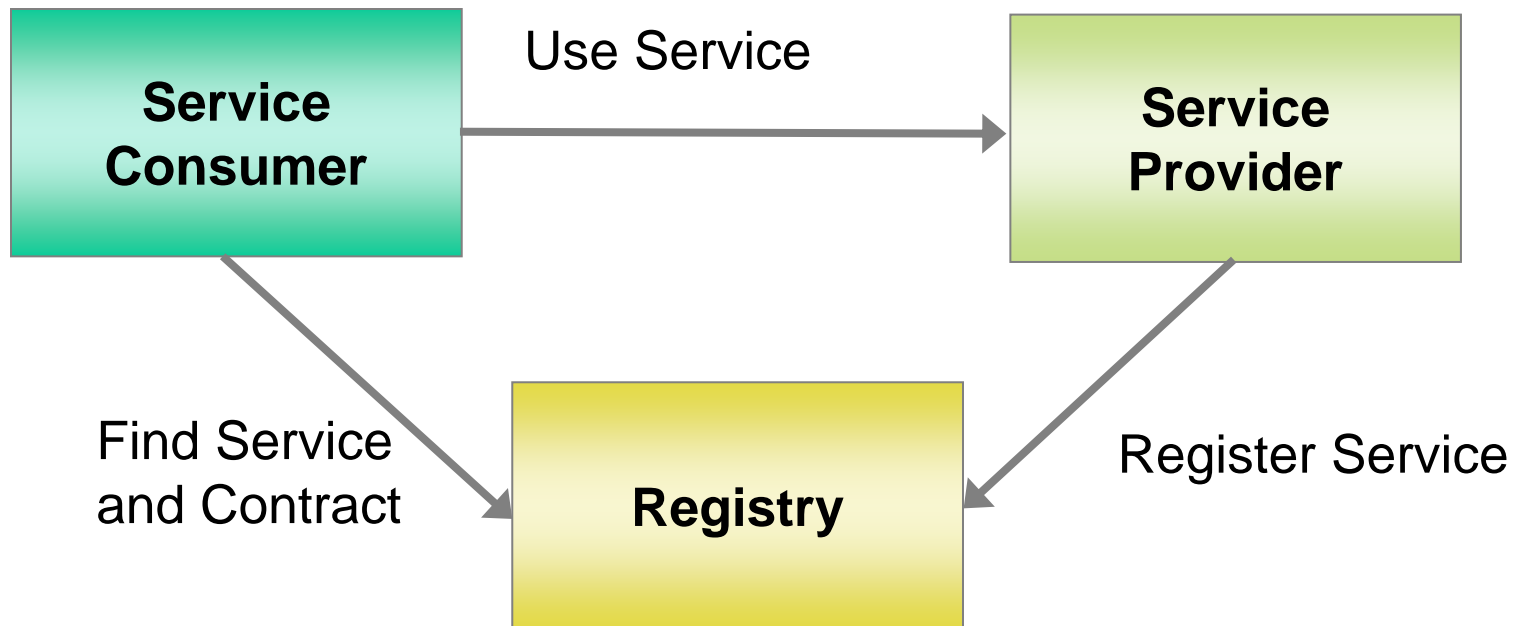
- Governance is needed to:
  - Make sure multiple services don't provide the same functionality
  - Understand who is responsible for a given service
  - Prioritize and control change requests
  - Determine that services conform to standards
  - Ensure that contracts are accurate
  - Provide a level of comfort that advertised services work and can be accessed as described by their contract
  - Be sure that services are cataloged and can be located



- What enables SOA?
  - Services  
Software components or sets of components
  - Service Providers  
Location (server) where Services are available
  - Service Consumers  
Software actually using Services (often user-facing)
  - Service Registries  
Contains “contracts” describing available services
  - Messaging  
Communications between Service and Service Consumer



- The **Contract** describing the **service**, its inputs and outputs, location, and method of invocation is placed in the **Registry** by the **Service Provider**
- The **Service Consumer** locates a **Service** using the specifications found in the service's **contract** from a **Registry**
- **Service Consumers** use **Services** provided by a **Service Provider** to perform all or part of some business function





- Service Component Architecture (SCA) describes a model for building SOA applications and systems via component-based applications that either provide or consume functional components via Service-Oriented interfaces
- SCA separates SOA application development into two parts:
  - Implementation of service components that provide/consume services
  - Orchestration of sets of service components to create new applications
  - SCA was originally created by a collaboration of industry organizations including: BEA Systems, Inc., Cape Clear Software, IBM Corporation, IONA Technologies PLC, **Oracle**, Red Hat Inc., Rogue Wave Software, SAP AG, Siemens AG, Software AG, Sun Microsystems, Sybase, TIBCO Software Inc., and Zend Technologies

<http://www.osoa.org/display/Main/Service+Component+Architecture+Home>  
<http://www.oasis-opencsa.org/sca>



- So how does Oracle's Fusion fit in?
- Oracle uses the title "Fusion" to unify its SOA-directed offerings and highlight the integration features incorporated in their products
- Two major legs of Oracle Fusion Architecture identified so far are:
  - Oracle Fusion Middleware
  - Oracle Fusion Applications



- Oracle outlines five core principles to Fusion Architecture:
  - Model Driven                      Following business processes
  - Service and Event-Enabled              Loosely-coupled, modular, and flexible
  - Information-Centric              Providing complete, actionable information
  - Grid-ready                      Scalable via low-cost hardware
  - Standards-based              Based upon open standards allowing easy interaction with other products



- Oracle Fusion Middleware builds on the solid Java EE and open-source architecture of Oracle App. Server
- SOA emphasis on business processes in Oracle Fusion Middleware leads to better coordination between Oracle's IT groups and business units
- Oracle Fusion Middleware comes complete with over 250 adapters to existing application systems including (but not limited to): Oracle E-Business Suite, PeopleSoft, JD Edwards, and Siebel
- **No, I have no idea how the purchase of BEA will impact Fusion middleware; we'll know soon! *BEA's BPEL and BPELJ tools are pertinent to this discussion***



- Oracle Fusion Middleware includes the SOA Suite:
  - BAM (Business Activity Monitoring) providing real-time access to business performance information
  - BPEL (Business Process Execution Language) Process Manager for defining and executing business processes
  - Business Rules Engine to manage business rules
  - Web Services Manager for security (Oracle Directory, Active Directory, LDAP) and management
  - ESB (Enterprise Service Bus) to provide routing/messaging
- JDeveloper provides a unified SOA Suite toolset
- The Oracle Service Registry, Oracle Portal, and other products are also available



- Fusion Applications are the next generation of Oracle's Applications products
  - Oracle E-Business Suite
  - PeopleSoft
  - JD Edwards Enterprise
  - JD Edwards World
  - Siebel
  - Retek
  - more...
- Rather than “stitching together” disparate technologies, Fusion uses a service-oriented architecture to make the functionality of the various tools available



- Oracle Fusion Applications rely heavily on Oracle Fusion Middleware; the opposite is not true
- An organization may use Oracle Fusion Middleware and its wide array of tools even if Oracle Fusion Applications are not installed
- Oracle Fusion Middleware's reliance on industry standards (like SOAP, WSDL, and UDDI) and SOA makes it an excellent choice no matter how applications are supported in an organization

*Fusion Middleware is already good, but will get better and better since it is the lynchpin that thousands of Oracle's developers are building Fusion Applications with. **We all win!***



- BPEL consists of specific steps:
  - Invoking web services <invoke>
  - Waiting for client to invoke a web service via a message <receive>
  - Generating responses for synchronous operations <reply>
  - Manipulating variables <assign>
  - Signaling faults and exceptions <throw>
  - Pausing for selected time <wait>
  - Ending the process <terminate>





- BPEL provides common programming constructs:
  - Sequence <sequence>
  - Flow <flow>
  - Path selection <pick>
  - Case construct <switch>
  - Looping <while>



- BPEL XML syntax is “clunky” and error prone
- BPEL tools are:
  - Graphical (pretty):
  - Paint-by-the-numbers
  - Abstractions of BPEL resulting in BPEL
- Some BPEL tools provide ESB-like features enabling them to fulfill integration roles
- Some tools extend the basic BPEL functionality
- BPEL tools allow the creation of Composite Processes; a collection of coordinated service invocations and related activities that provide useful business process functionality



- Oracle BPEL Process Manager
- BEA (Oracle) Aqualogic
- Microsoft BizTalk
- IBM WebSphere Process Server
- IBM AlphaWorks BPWS4J



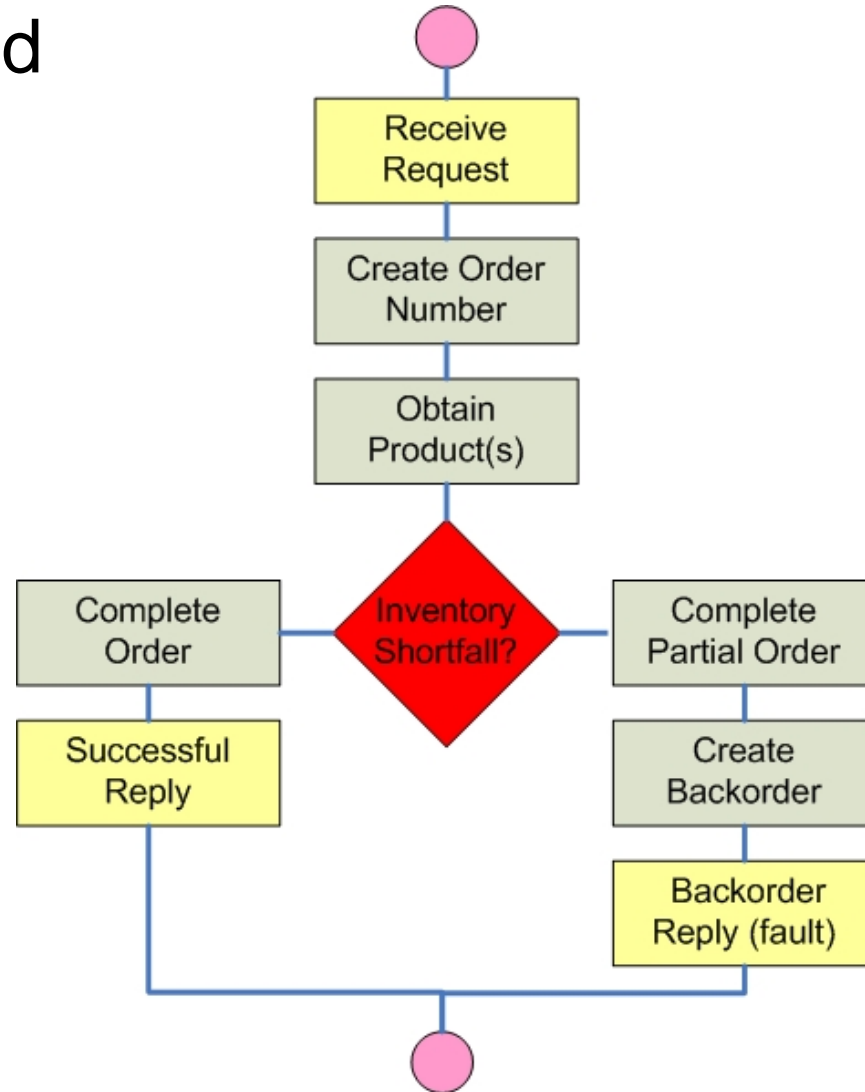
- Oracle provides two types of BPEL support:
  - Oracle BPEL Process Manager
    - Execution environment for BPEL processes
    - Supports BPEL version 1.1
    - Used to monitor, manage, and deploy BPEL processes
    - Designed for Oracle Application Server and OC4J
    - Versions available for JBoss and BEA (Oracle) WebLogic Server
  - Oracle BPEL Designer
    - Development environment for BPEL processes using GUI
    - Develops standard BPEL interoperable with other BPEL tools
    - Works with Oracle JDeveloper
    - Available as plug-in for Eclipse platform



- Oracle's BPEL tool began as the “Collaxa BPEL Designer & Web Service Orchestration Server” tool acquired by Oracle in 2004
  - Fully-compliant BPEL implementation
  - Oracle has added Human Workflow and Database Interface services
  - Easy-to-use modeler
  - Scalable
  - Flexible
  - Monitoring available



- Services are composed to support a complete Business Process





- Create Application using JDeveloper
- Create a SOA Composite project:  
File->New->Project->SOA Tier->SOA Composite
- Define the BPEL process with input and output processes
- Use the GUI to complete the composition; assign values to input/output variables
- Save and deploy the application
- Use the SOA Console to review and test composite services



- Partner Links
- Variables
- Activities
  - Service Activities
  - Structure Activities
  - Fault Activities
- Expression Language
- Correlation Set
- Scope
- Fault Handler
- Compensation Handler
- Event Handler





- BPEL processes are called by clients and also use services themselves
- Services and clients that interact with BPEL processes are referred to as “Partners”
  - partnerLinks define BPEL process partners
    - Reference partners are services invoked by a process
    - Interface partners allow a process to be invoked by a client
  - BPEL processes have at least one partnerLink



- Variables are used:
  - Create request messages used for service invocation
  - Hold state information between BPEL activities
  - Receive response messages returned from services invoked



- Steps in a BPEL process are called “Activities”
- Three major groups of activities are used:
  - Service Activities      Communicate with partners
  - Structure Activities      Program logic (sequence, looping, if-then,else...)
  - Fault Activities      Error-handling activities
- Each Activity type is usually represented by an icon in BPEL tools



- XPath is used by BPEL processing and evaluation statements like While and Switch



- Some BPEL processes are long-running and may have multiple instances executing at once
  - A unique key is attached to messages to make sure they go to the correct instance
  - Since some services provide different operations they need additional keys for each type of message
  - Correlation Set is the term used to refer to the key field(s) used by the various messages that are used for a service



- BPEL allows the grouping of activities into “Scopes”
  - Every BPEL process begins with a “Global Scope”
  - Scopes provide a context for a group of activities
  - A scope may be associated with various “handlers” (fault handlers, compensation handlers, event handlers)



- Various handlers might be associated with a BPEL process
  - Fault Handler
  - Compensation Handler
  - Event Handler



- Service invocation or execution errors are called “faults”
- BPEL allows faults that occur within a given scope to be associated with fault handlers specific to the scope’s activities
- When faults occur
  - Scope execution stops
  - If a fault handler is available it is executed
  - If a fault handler is not available the fault is passed to the scope’s parent scope





- Compensation handlers are necessary because
  - Some processes are long-running
  - Sometimes handling of a fault requires that the work of one or more scopes must be reversed
  - Compensation handlers are defined as part of a scope and describe the “undo” activities to be performed if an unhandled fault occurs



- BPEL event handlers are defined as part of a scope to handle messages that are received when a process is “blocking” (waiting) due to the execution of a Receive or Pick (or Receive Choice) activity
  - An event handler describes what type of message it can receive
  - An event handler includes activities to be performed upon receipt of an expected message



Oracle BPEL Console v10.1.3.1.0 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://teqram3.kinghome.private.johnjayking.com/BPELConsole/default/index.jsp

ORACLE Enterprise Manager 10g BPEL Control

Manage BPEL Domain | Logout | Support  
Logged to domain: default

Dashboard BPEL Processes Instances Activities

Deployed BPEL Processes	In-Flight BPEL Process Instances		
Name	Instance	BPEL Process	Last Modified ↑
CreditRatingService			
StockQuoteService			
TaskActionHandler			
TaskManager			

Deploy New Process

Oracle BPEL Console v10.1.3.1.0



- The Oracle BPEL Console provides a browser-based management capability supported by JSPs and Servlets on the Application Server hosting BPEL
- BPEL Console includes:
  - Management and administration of BPEL processes
  - Debugging for processes
  - Audit trails and process history
  - GUI representation of process flows

# Oracle BPEL Designer



Oracle JDeveloper - CustomerService.jws : CustomerService.jpj

File Edit View Search Navigate Run Debug Refactor Versioning Tools Window Help

Applications Navig... Connections CreditFlow.bpel CreditRatingService.bpel CreditRatingService.wsdl Component Palette

Applications

- CreditRatingService
  - CreditRatingService
    - Resources
      - bpel.xml
      - CreditRatingService.bpel
      - CreditRatingService.wsdl
- CustomerService
- MyBPELApp

Services

client

receiveInput

Service

Process Activities

- Pointer
- Assign
- Compensate
- Decide
- Email
- Empty
- Flow

Property Inspector

Help Center

- Working with Oracle WebCenter Fram...
- Getting Started with Oracle JDevelop...
- Cue Cards
- Working with Service Oriented Archi...

Contents Index Search

CreditRatingService.bpel - Structure

BPEL Structure

- Variables
- Message Types
- Correlation Sets
- Schemas
- Partner Links
- Activity Structure
- Properties
- Property Aliases
- Sensor Actions
- Sensors
- Test Suites

Diagram Source History

BPEL Messages - Log

null.bpel

XPath	Type	# of Errors
/process/partnerLinks/partnerLink	Partner Link	1
/process/sequence/switch/case/sequence/reply	Reply	1
/process/sequence/switch/otherwise/sequence/reply	Reply	1

Errors: 3 Warnings: 0 Last Validated On: 10 Apr 2008 11:47:54 GMT

Validation Errors Log Messages Search Results

Messages BPEL Messages

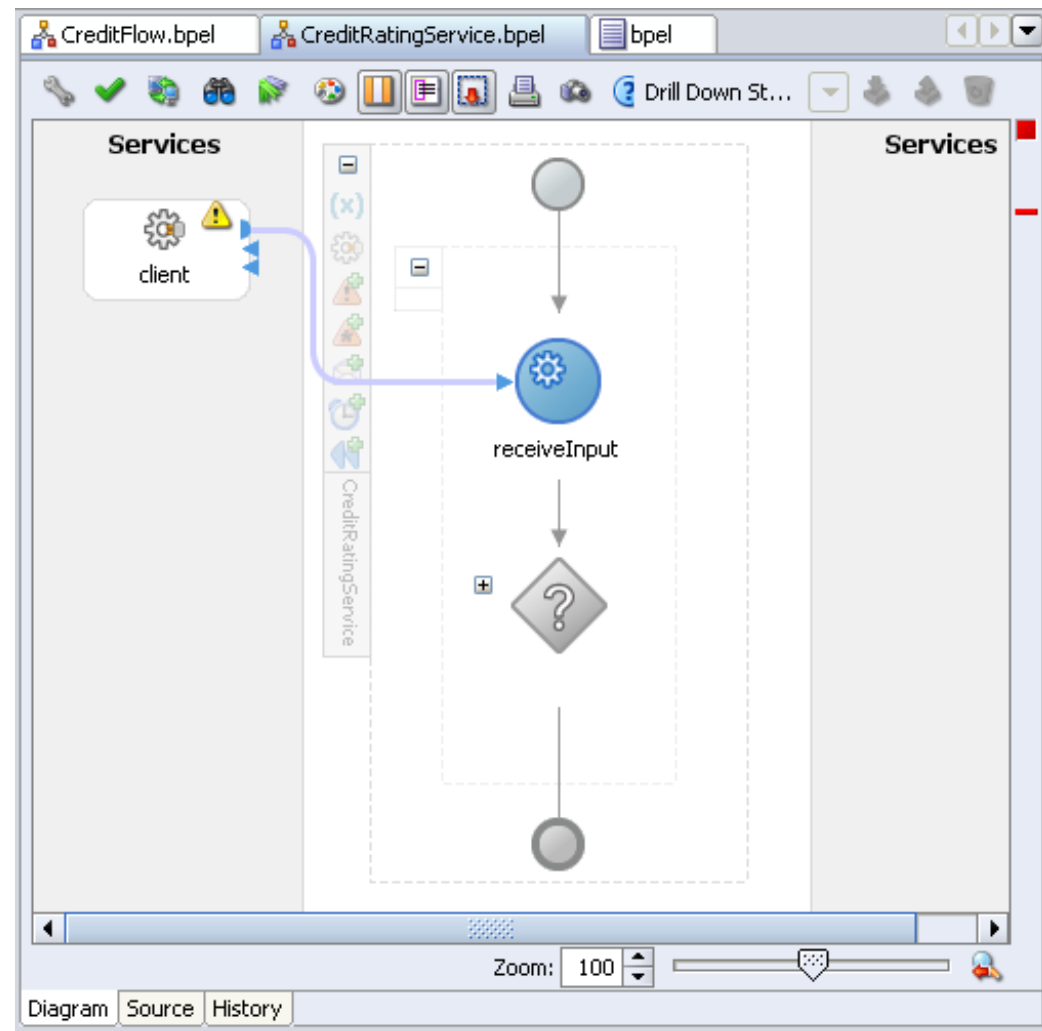
BPEL editor



- BPEL Designer is built-in to Oracle JDeveloper and available as a plug-in to Eclipse
- BPEL Designer allows:
  - Graphical development of BPEL processes (BPEL XML code is generated automatically)
  - Activities, PartnerLinks, Services, and Faults may be added using drag-and-drop

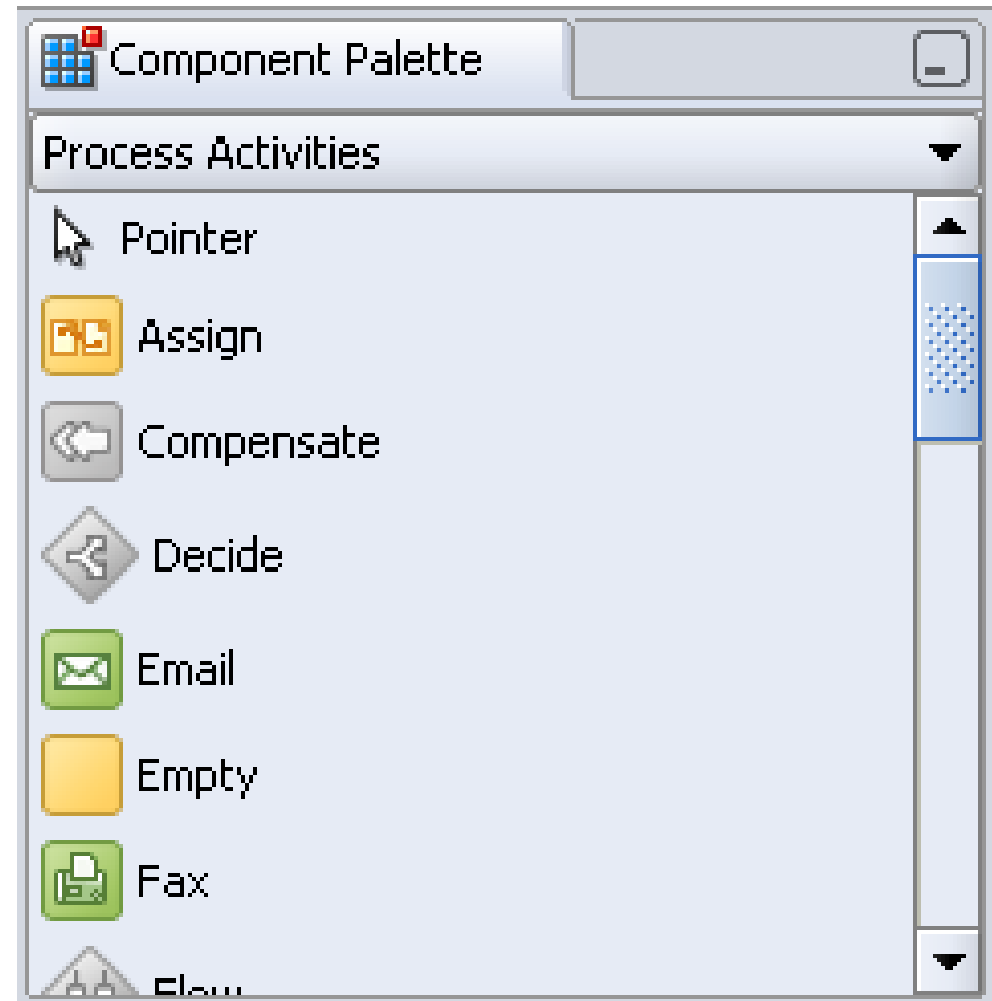


- Processes may be combined in the BPEL Designer to create new processes





- The component palette provides visual representations of Activities, Faults, and other BPEL components







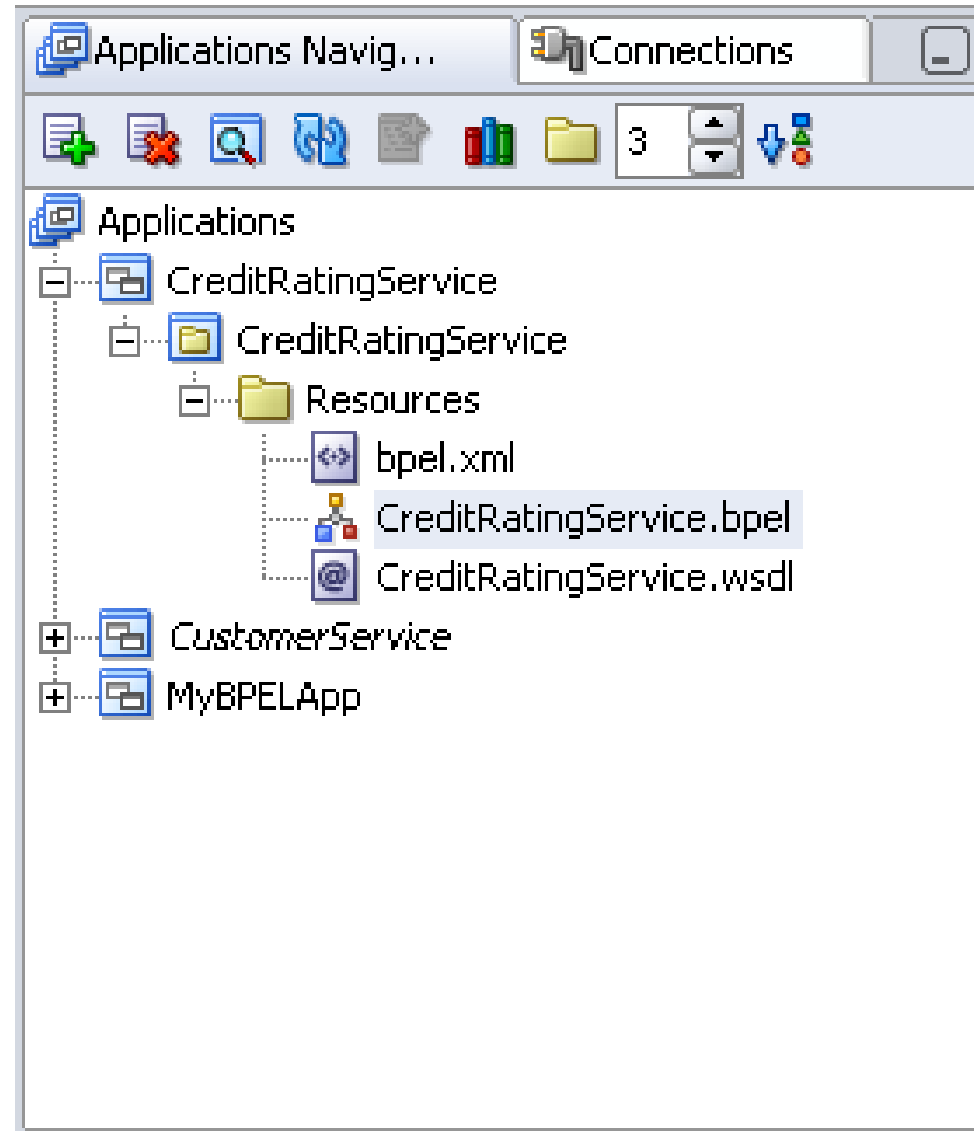
- BPEL XML source may be viewed on the “Source” tab

```
<!-- CreditRatingService BPEL Process -->
<process name="CreditRatingService"
  targetNamespace="http://services.otn.com"
  suppressJoinFailure="yes"
  xmlns:tns="http://services.otn.com"
  xmlns="http://schemas.xmlsoap.org/ws/2003/03/business-pr
  xmlns:bpws="http://schemas.xmlsoap.org/ws/2003/03/busine

<!-- List of services participating in this BPEL process --
<partnerLinks>
  <!-- The 'client' role represents the requester of this s
  <partnerLink name="client"
    partnerLinkType="tns:CreditRatingService"
    myRole="CreditRatingServiceProvider"/>
</partnerLinks>

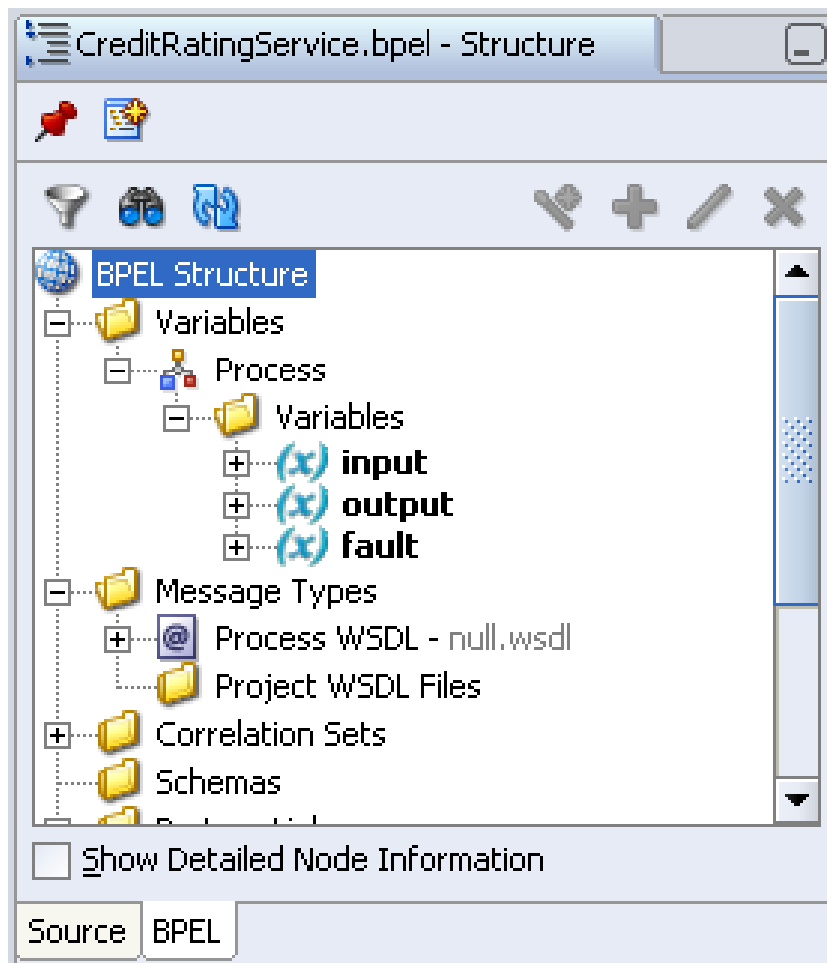
<!-- List of messages and XML documents used as part of thi
<variables>
  <!-- Reference to the message passed as input during init
  <variable name="input"
    messageType="tns:CreditRatingServiceRequestMessage"/

  <!-- Reference to the message that will be sent back to t
```





- The Structure View shows all of a BPEL processes components





- Oracle uses its skills in the database world to store schemas that support BPEL in the database including
  - “Dehydration” where process state is stored
  - Non-Oracle database products are supported by Oracle BPEL Process Manager including:
    - Oracle Database Lite
    - IBM DB2 UDB
    - Microsoft SQL Server



- Oracle's BPEL Process Manager provides a complete standards-based solution to creating and orchestrating services and composite services
  - Oracle BPEL Console tool is used to manage BPEL services and compositions
  - Oracle BPEL Designer is used to create services and the code that supports them
  - Oracle's Workflow capabilities add a richness and realism that is often missing from BPEL process flows
  - Oracle's database provides robust support for BPEL



**Training Days 2009**

**Save the dates!**

**February 11-12 2009!**



**Save the Date: May 3-7 2009**

**Orange County Convention Center - Orlando, Florida!**



ODTUG Returns to . . .  
**THE BIG EASY!**  
June 15-19, 2008  
Sheraton New Orleans

EVOLUTION OF THE DEVELOPER:  
*Middleware & Beyond*

ODTUG  2008  
KALEIDOSCOPE

ABSTRACTS DUE DECEMBER 10TH

- Fusion Middleware
- Business Intelligence/Hyperion

- Java EE And SOA
- Development DBA

- Oracle Tools
- Methodology

- Third Party Tools
- Professional Development





## *Beeple, B-Pel, Beepul? Understanding BPEL and Its Role in SOA*

To contact the author:

**John King**

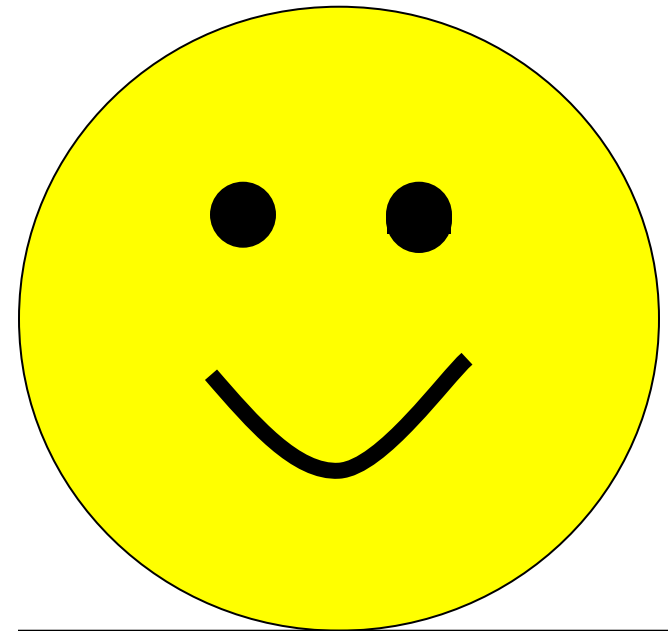
**King Training Resources**

6341 South Williams Street

Littleton, CO 80121-2627 USA

1.800.252.0652 - 1.303.798.5727

Email: [john@kingtraining.com](mailto:john@kingtraining.com)



**Thanks for your attention!**

Today's slides are on the web:

<http://www.kingtraining.com>