

Course Guide

# Process Implementing with IBM Business Process Manager Standard V8.5.7 - II

Course code WB824 / ZB824 ERC 1.0



## August 2016 edition

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# Course description

## Process Implementing with IBM Business Process Manager Standard V8.5.7 - II

**Duration: 3 days**

### Purpose

This course teaches methods for designing and building complex process application solutions with IBM Business Process Manager.

IBM Business Process Manager is a comprehensive BPM product that provides the visibility and insight that is necessary to effectively manage organizational business processes. This course focuses on the Standard and Express editions of IBM Business Process Manager, but the lessons apply to process implementation on every version of IBM Business Process Manager, including the Advanced edition.

The course begins by exploring the various configurations and the typical topology considerations for IBM Business Process Manager. It then covers the advantages and disadvantages of the coach designer and a headless implementation. The course describes system integration with IBM Business Process Manager through the REST API, and how to integrate disparate systems and data sources through inbound and outbound integrations.

The course also covers Enterprise Content Management (ECM) integration and document events that affect process flow, and challenges you to implement numerous complex real-world implementation scenarios. The scenarios include advanced routing, a cancellation pattern, a multi-instance loop, and the “four eyes” policy. Good practices and proper project governance principles are enforced throughout the course.

Hands-on exercises throughout the course give you the opportunity to develop a process application that enhances the function, usability, performance, and maintainability of a business process.

The lab environment for this course uses the Windows operating system.

### Audience

This course is designed for process application developers with experience in implementing IBM Business Process Manager, or other project team members who design, architect, and build complex process applications.

### Prerequisites

Before taking this course, you should:

- Successfully complete course WB823 or ZB823, *Process Implementing with IBM Business Process Manager Standard V8.5.7 - I*

- Build and deploy at least one IBM Business Process Manager process application release into production

## Objectives

- Describe IBM Business Process Manager topology considerations and typical system configurations
- Use the REST API tester to integrate with external systems
- Integrate with a Content Management Interoperability Services (CMIS) system and use content events in a process
- Translate a coach into numerous languages through localization
- Design an IBM Business Process Manager data architecture for a process application with complex business data
- Model all decision authority for a process and employ complex logic for task routing and assignments
- Construct complex task and process task-to-task interaction controls
- Identify and solve common integration issues

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# Agenda

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**Note**

The following unit and exercise durations are estimates, and might not reflect every class experience.

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## Day 1

- (00:15) Course introduction
- (01:30) Unit 1. Advanced architecture and topology
- (01:30) Unit 2. External activities and use of the REST API
- (01:00) Exercise 1. Exploring the REST API
- (01:30) Unit 3. CMIS integration
- (01:00) Exercise 2. Handling content events in a process

## Day 2

- (01:30) Unit 4. Adding localization
- (01:00) Exercise 3. Localizing a coach
- (01:30) Unit 5. Designing complex process applications
- (01:30) Unit 6. Advanced routing
- (01:00) Exercise 4. Implementing the "four eyes" policy
- (01:30) Unit 7. Managing complex tasks and process interactions
- (01:00) Exercise 5. Building a cancellation pattern

## Day 3

- (01:30) Unit 8. Implementing a multi-instance loop
- (01:00) Exercise 6. Implementing a multi-instance loop
- (01:30) Unit 9. Integrating with external systems
- (01:00) Exercise 7. Building web service connections
- (00:30) Unit 10. Course summary

---

# Unit 1. Advanced architecture and topology

## Estimated time

01:30

## Overview

This unit provides an overview of the available IBM Business Process Manager configurations. It describes the topology considerations and how they affect the process implementation effort. It also covers the Process Federation Server and its use inside the topology. Finally, the unit describes deployment governance.

## How you will check your progress

- Checkpoint

## How to check online for course material updates



**Note:** If your classroom does not have Internet access, ask your instructor for more information.

### Instructions

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<http://ibm.biz/CloudEduCourses>
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3. Find your course in the list and then click the link.
4. The wiki page displays information for the course. If an errata document is available, it is found here.
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About

6. To save the file to your computer, click the document link and follow the dialog box prompts.

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Figure 1-1. How to check online for course material updates

## Unit objectives

- Describe IBM Business Process Manager configurations
- Describe IBM Business Process Manager topology considerations
- Explain the purpose and basic function of the Process Federation Server
- Describe deployment governance

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*Figure 1-2. Unit objectives*

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## Topics

- IBM Business Process Manager configurations
- IBM Business Process Manager topology considerations
- Process Federation Server
- Deployment governance

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*Figure 1-3. Topics*

## **1.1. IBM Business Process Manager configurations**



## IBM Business Process Manager configurations

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*Figure 1-4. IBM Business Process Manager configurations*

## Three editions of IBM Business Process Manager (1 of 2)

- Express Edition
  - Affordable entry point
  - Ideal for medium-sized businesses
  - Two-hundred users and three author limitation
  - Limited to four cores production, two cores development environment
  - No clustering
  - Cannot run Process Federation Server
- Standard Edition
  - Designed for multi-project improvement programs
  - Unlimited users and authors
  - No core limitation
  - Clustering is supported
  - Can run Process Federation Server
  - Only basic system integration support included
  - No Enterprise Service Bus

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*Figure 1-5. Three editions of IBM Business Process Manager (1 of 2)*

This slide and the next slide outlines the differences between three IBM Business Process Manager editions.

## Three editions of IBM Business Process Manager (2 of 2)

- **Advanced Edition**
  - Includes all the features of the Standard and Express edition
  - Extended support for high-volume process automation
  - Built in SOA components for extensive enterprise-wide service integration, orchestration
  - Can run Process Federation Server
  - WebSphere Process Server compatible execution
  - Advanced integration and connectivity capabilities that use the Integration Designer (BPEL/SOA)
  - Built-in Enterprise Service Bus (ESB)
  - Transaction support
  - Integration adapters

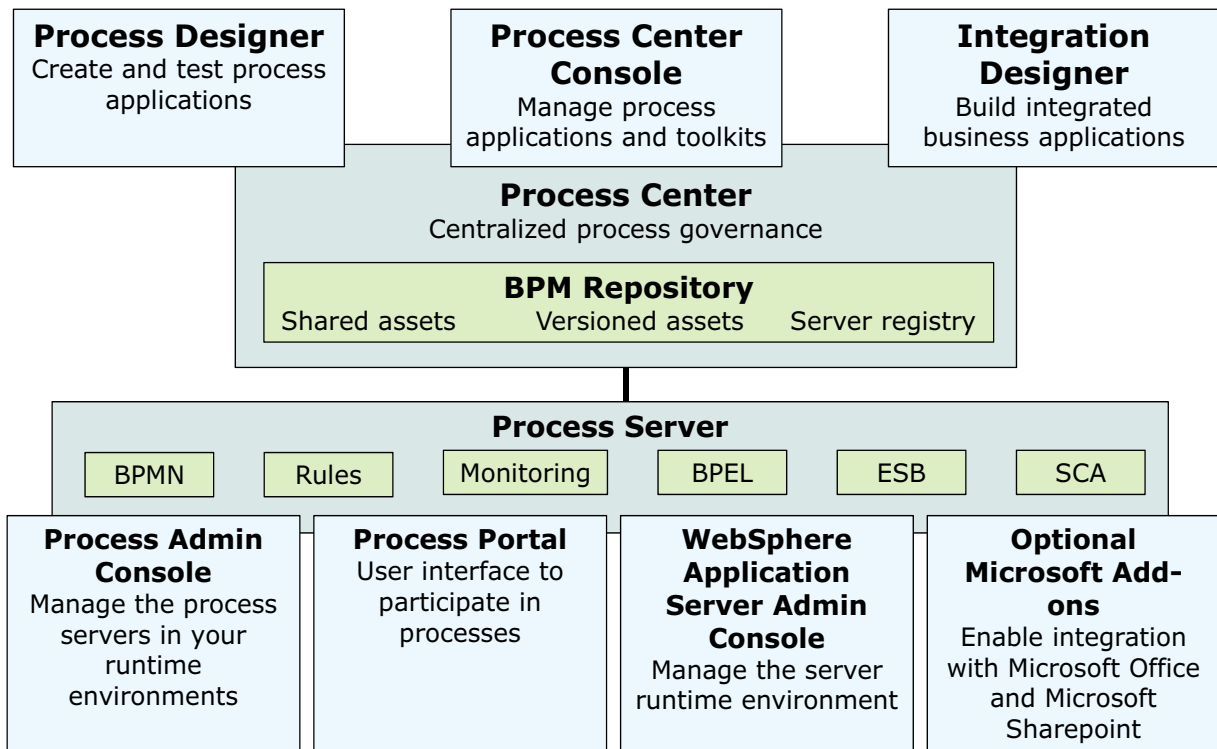
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*Figure 1-6. Three editions of IBM Business Process Manager (2 of 2)*

All editions allow developers to create all types of processes. The Advanced edition includes the ESB and the Integration Designer, and can run BPEL.

## IBM Business Process Manager Advanced



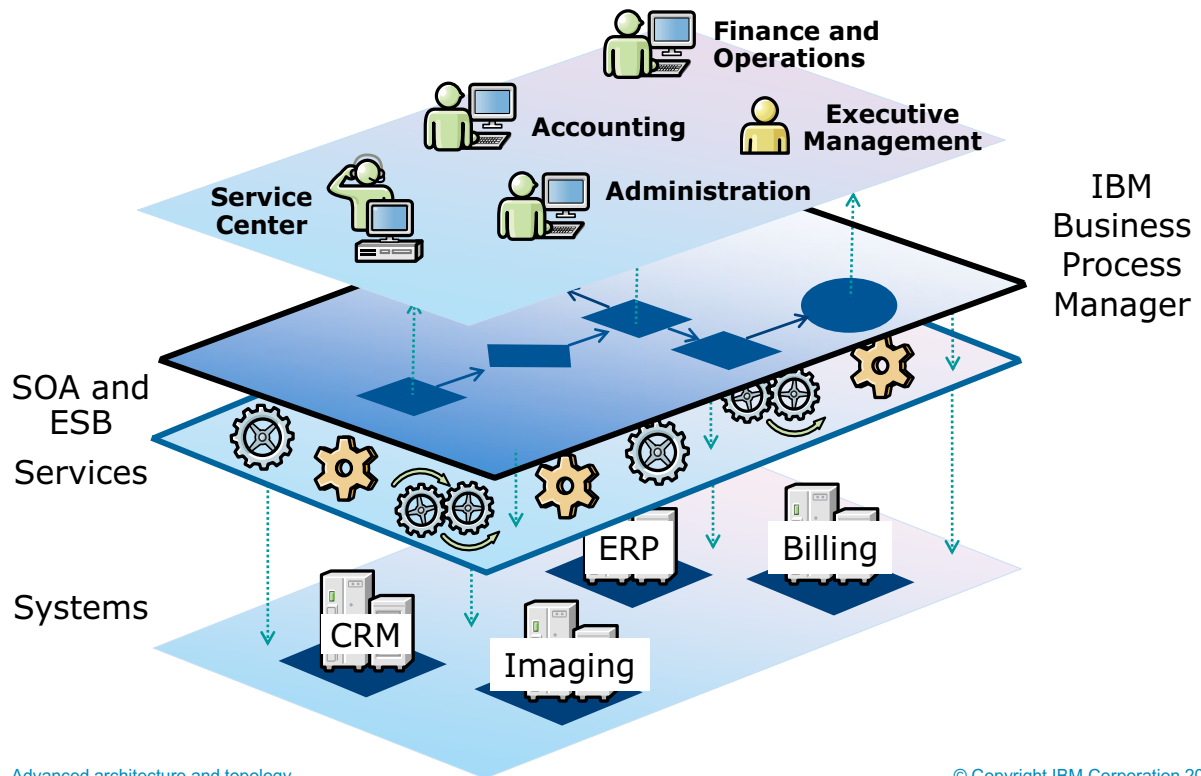
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Figure 1-7. IBM Business Process Manager Advanced

This slide is a review of the capabilities of the Advanced edition. You work with the Standard edition in this course.

## The BPM layer: What makes IBM Business Process Manager special



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Figure 1-8. The BPM layer: What makes IBM Business Process Manager special

A good way to think about BPM is that it is a layer that gives you the control and visibility over the processes. IBM Business Process Manager:

- Sits between people and systems, and manages the process across those participants
- Prioritizes your work, but also gives you visibility and control
- When the process evolves and changes, you can quickly and immediately implement that change

The business users create and refine the process model. Developers start with the model and implement the solution to its final executable state. The one process that is created is the one that you run in your production environment. The entire conversation revolves around the one version of the process.

## **1.2. IBM Business Process Manager topology considerations**

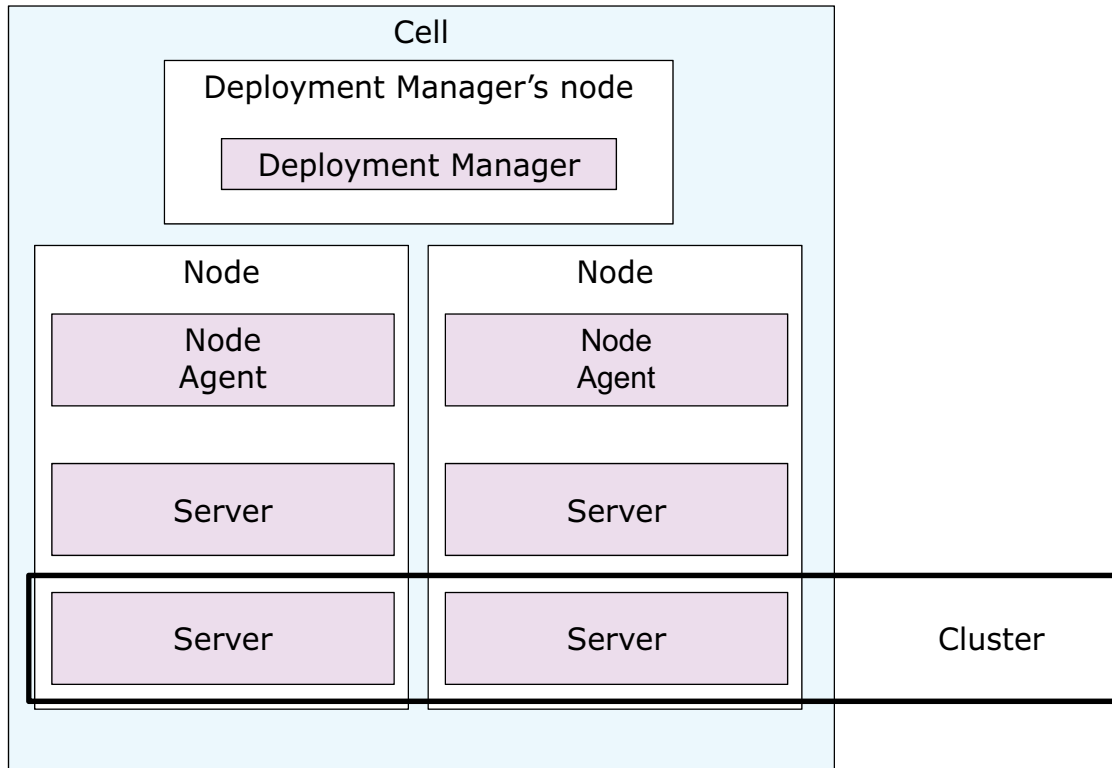
## IBM Business Process Manager topology considerations

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*Figure 1-9. IBM Business Process Manager topology considerations*

## WebSphere Application Server Network Deployment cell structure



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Figure 1-10. WebSphere Application Server Network Deployment cell structure

An IBM WebSphere Application Server environment uses a cell structure. The IBM Business Process Manager environment uses Process Server and Process Center environments. Each Process Server or Process Center is an IBM WebSphere Application Server cell. Some of the components might be familiar from general use in IBM WebSphere Application Server cells, whereas others are unique to IBM Business Process Manager or IBM Business Monitor.

### Cell

A cell is an administrative domain. A cell is a grouping of nodes and servers that are centrally managed, and have access to shared resources. Nodes within a cell typically control one or more application servers. Each application server hosts one or more applications.

### Deployment manager

A deployment manager is the central point of administration of a cell. A deployment manager is a specific type of IBM WebSphere Application Server whose primary task is the management and configuration of the cell in which it exists. You can administer the cell by using either the IBM WebSphere Application Server Integrated Solutions Console or command-line scripting (wsadmin). Both communicate with the deployment manager (not directly to the IBM WebSphere Application Server). The deployment manager communicates with node agents, which communicate with IBM WebSphere Application Servers on the nodes. This configuration allows central administration of



the cell through the deployment manager. The deployment manager maintains the master repository of configuration information and other artifacts for the cell.

A deployment manager is implemented as a JVM.

## **Nodes**

A node is an administrative grouping of application servers for configuration and operational management within one operating system instance. Virtualization allows multiple operating systems on one system. You can create multiple nodes inside one operating system instance, but a node cannot leave the operating system boundaries. You can have vertical nodes that belong to different cells on the same operating system. A stand-alone application server configuration has only one node. With Network Deployment, you can configure a distributed server environment that consists of multiple nodes that are managed from one central administration server.

## **Node agents**

The node agent is a server that enables the deployment manager to remotely manage the node, its IBM WebSphere Application Server, and their applications. A node agent is implemented as a JVM. The node agent is responsible for monitoring the application servers.

## **Clusters**

Clusters are sets of servers that are managed together and participate in workload management. Clusters enable enterprise applications to scale beyond the amount of throughput achievable with a single IBM WebSphere Application Server. Clusters also enable enterprise applications to be highly available. Requests are automatically routed (through the IBM HTTP Server plug-in) to the running servers during a failure. The members of each cluster can be distributed across multiple nodes (referred to as horizontal clustering). Such clusters can increase throughput and provide resilience to both application server and hardware failure.

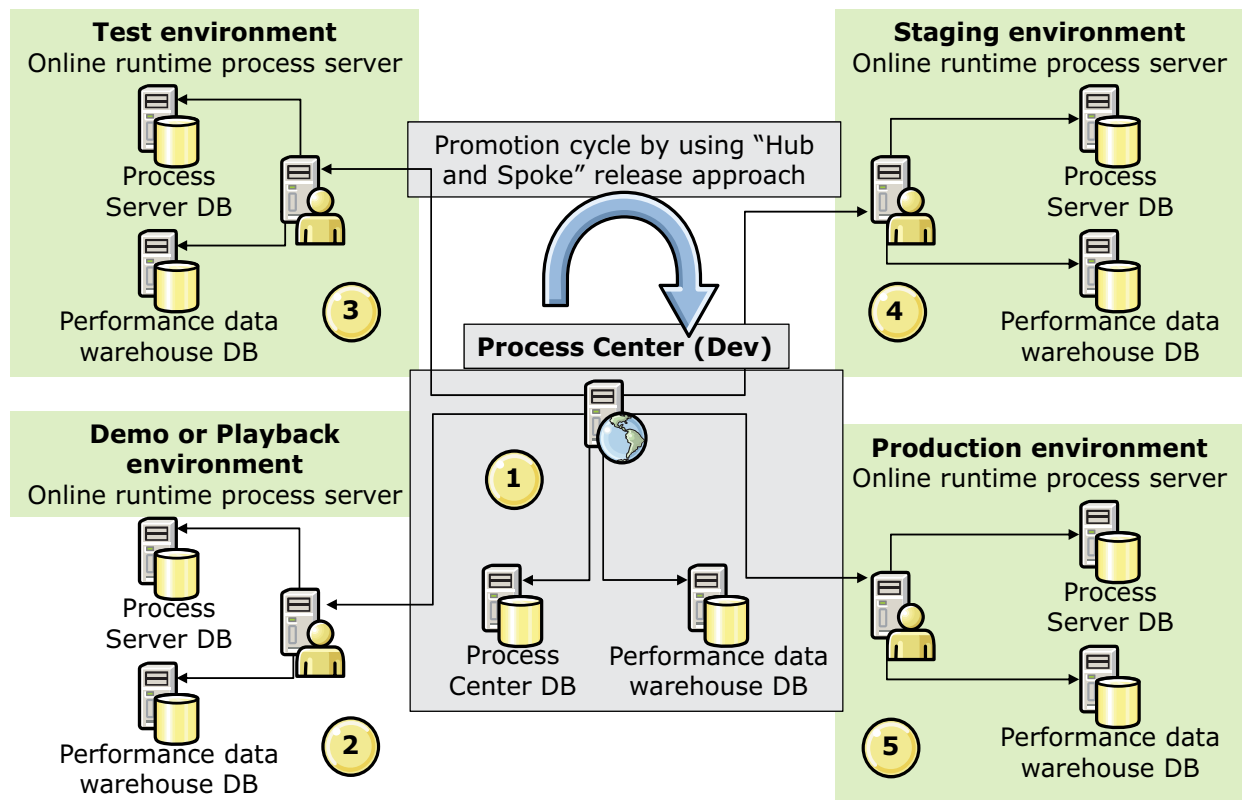
Multiple members of each cluster can also be created on the same node (referred to as vertical scaling). This configuration can provide better use of available resources, and can increase throughput and provide resilience to application server failures. Vertical clusters do not provide resilience to hardware failure.

Resources:

For information about clusters and workload management, see the website:

[http://www.ibm.com/support/knowledgecenter/SSAW57\\_8.0.0/  
com.ibm.websphere.nd.multiplatform.doc/info/ae/ae/crun\\_srvgrp.html](http://www.ibm.com/support/knowledgecenter/SSAW57_8.0.0/com.ibm.websphere.nd.multiplatform.doc/info/ae/ae/crun_srvgrp.html)

## Default environment



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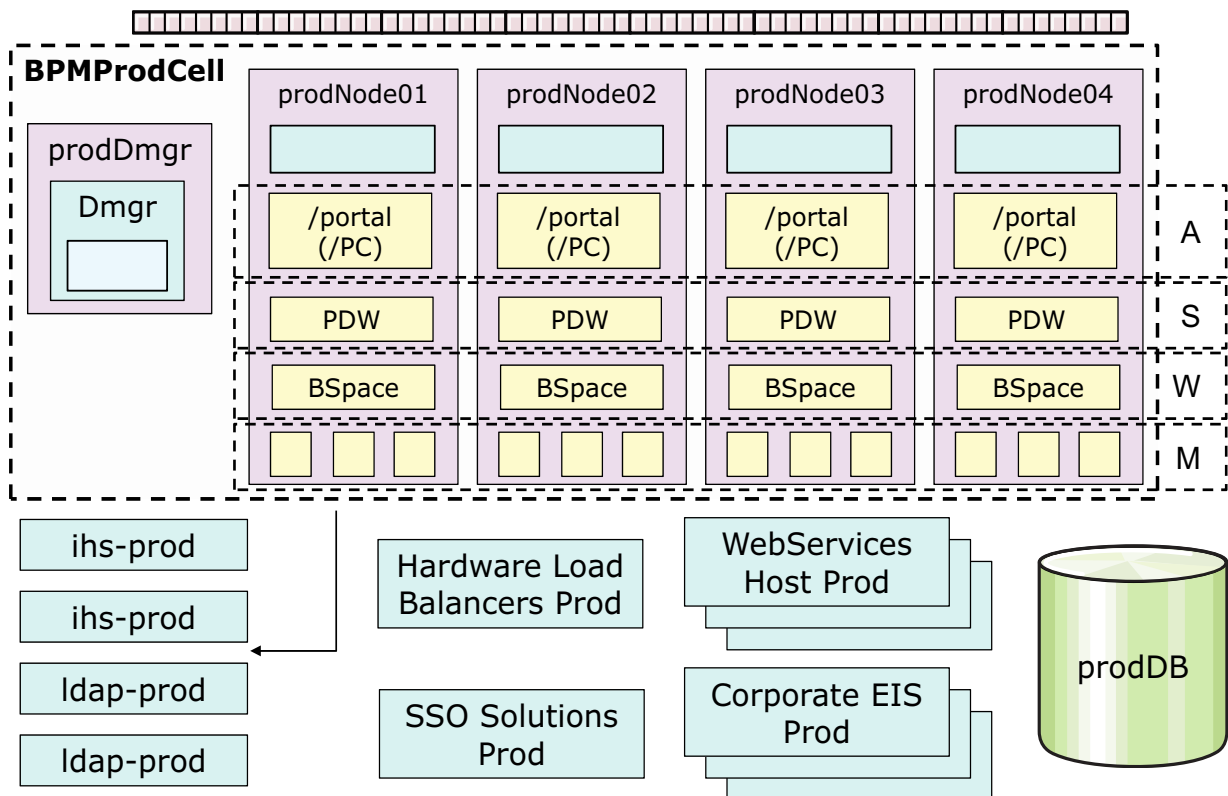
Figure 1-11. Default environment

This slide shows a default environment combination with one central Process Center environment. This combination is installed to a number of associated Process Server environments, with either just the IBM Process Designer, or both the IBM Integration Designer and the IBM Process Designer.

This environment is typically set up in an online Process Server configuration. This configuration illustrates the IBM Business Process Manager Standard server and database components in each environment. The Process Center (Dev) in the "Hub" is the repository. The numbers depict the development and installation lifecycle of a Process Application snapshot within the environment:

1. The Process Application snapshot is created.
2. The Process Application snapshot is released for Playback with the business.
3. The Process Application snapshot is released for functional testing.
4. The Process Application snapshot is released for staging or pre-production testing.
5. The Process Application snapshot is released for distribution to production.

## Example production cell



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Figure 1-12. Example production cell

This slide is an example of an IBM Business Process Manager Process Server runtime deployment environment where process applications are deployed for use in the enterprise. It is known as the production environment. Often, these environments are behind strict firewalls and have special deployment considerations. The distinctions between test and staging are largely superficial. No difference in functionality exists between them, and often corporations have distinct ideas about how test and staging are treated. Some corporations use yet another staging environment called pre-production.

The dotted box defines the BPMProdCell's boundary, and that cell has a deployment manager and one or more nodes. The deployment manager is a WebSphere Application Server construct that does not map into the IBM Business Process Manager lexicon. The nodes themselves are where the real action occurs.

A node contains one or more servers, which are Java virtual machines that are dedicated to a specific set of IBM Business Process Manager tasks. Depending on the type of IBM Business Process Manager topology you choose, each node can have 1 - 5 servers. These servers map directly to the IBM Business Process Manager concepts of AppTarget (where the IBM Business Process Manager runtime engine runs), Support (which is where the IBM Business Process Manager Performance Data Warehouse runs), and others. These servers are then clustered together across node boundaries.

When you have each deployment environment that is hosted within a unique WebSphere Application Server cell, the cell's security configuration can be used and differentiated from other deployment environments or cells. For example, you almost certainly want the staging LDAP server and the production LDAP server to be isolated from the development and testing environment LDAP servers.

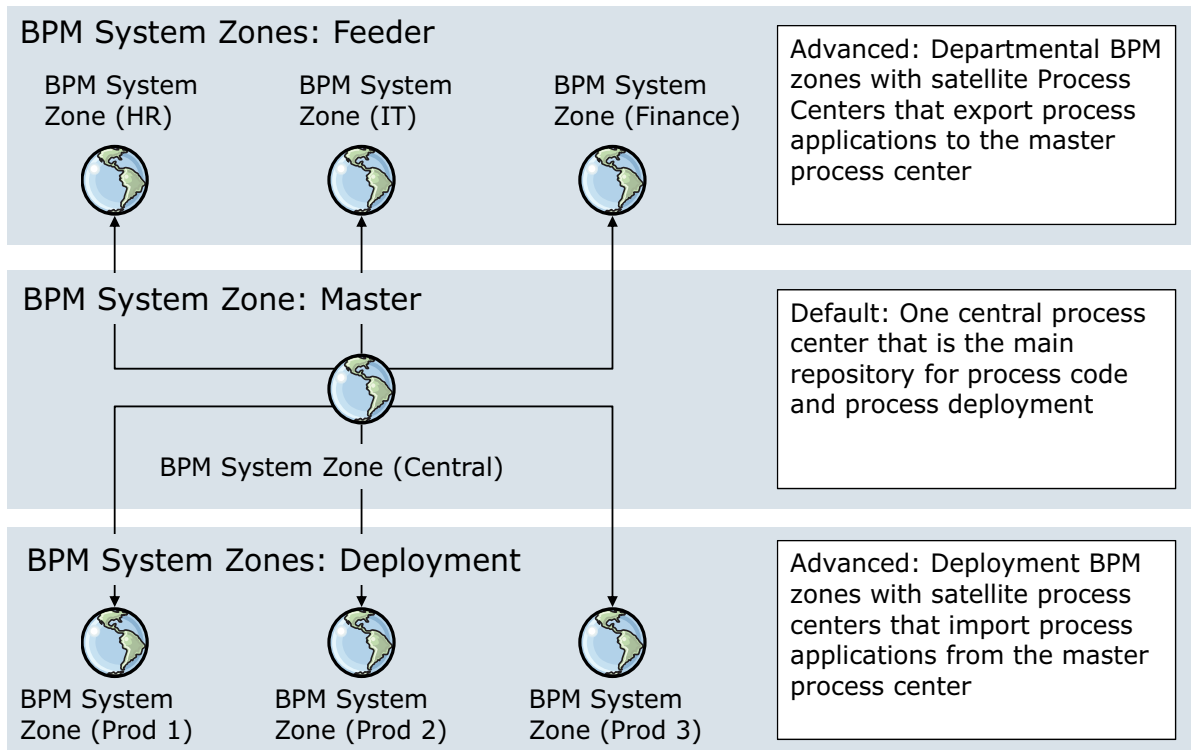
For example, development and test environments might share a common LDAP server, but staging and production each have their own LDAP servers. Furthermore, both stage and production might have four-cluster topologies, where development and test have three-cluster topologies.

In this example, the production environment has the deployment manager (dmgr) broken out onto its own server (physical or virtual), which is not a strict requirement. IBM Business Process Manager and WebSphere Application Server allow a great deal of flexibility in how you define your IBM Business Process Manager environment.

The complications multiply when you consider the environment into which IBM Business Process Manager is being deployed. Each IBM Business Process Manager deployment environment has its own database server, typically a front-end web server. It also has hardware load balancers, Single Sign-On solutions (which can also be hardware), and servers that host web services or any number of corporate Enterprise Information System (EIS) servers.

All of these components talk to each other, and each line of communication introduces another touch point that must be scrutinized from a security point of view. Complexity breeds fragility, which in turn breeds opportunity for exploitation. The antithesis is simplicity. But how does one achieve simplicity when faced with so many product components, each one speaking to another over different protocols? Complexity is tamed by breaking down the universe of connection points and possible security holes into easily understood components with an overall framework for management.

## Satellite feeder environments



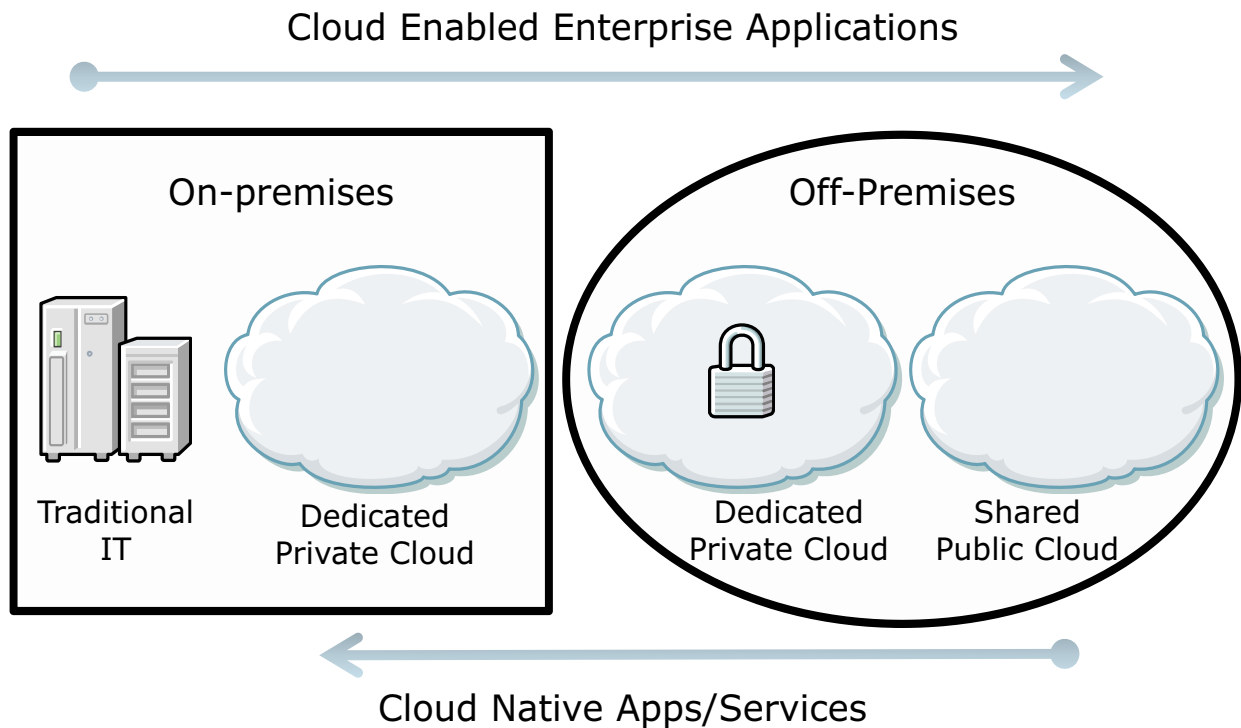
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Figure 1-13. Satellite feeder environments

This slide shows a sample combined environment overview with numerous Satellite IBM Business Process Manager environments combined. The combinations effectively provide a flexible solution to the challenges that arise when you design an enterprise architecture for a complex, geographically separated, and distributed system.

## On-premises, cloud, and hybrid



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Figure 1-14. On-premises, cloud, and hybrid

The options that are discussed to this point apply to on-premises installations, but IBM Business Process Manager can also be deployed fully in the cloud and a hybrid installation. IBM Business Process Manager is run in any environment.

Cloud provides an array of options to organizations:

- All servers on-premises
- Development environment in the cloud, Process Servers on-premises
- Development environment on-premises, Process Servers in the cloud
- Production server in the cloud, the rest is on-premises
- Production server on-premises, the rest is in the cloud
- All servers in the cloud
- Private versus Public cloud

Numerous other considerations must be made when it comes to planning out the IBM Business Process Manager solution:

- Hardware selection and sizing
- Topology

- Workload management
- Environments
  - Development, test, or production
  - High availability
  - Disaster recovery
  - Scalability and resilience
  - Multi-tenancy
  - Federation
- System monitoring
- User management
  - User repository
  - Roles and participants

## Introduction to IBM BPM on Cloud

- Enterprise-grade IBM BPM cloud service for development, testing, and production
- Cloud-based, collaborative, and role-based environment
  - Capture, automate, and manage frequently occurring, repeatable rules-based business decisions
- Ready-to-use development, test, and production environments are available
- Monthly subscription plans
- Available exclusively on IBM Cloud infrastructure
  - As of 2015, over 25 data centers are available worldwide
- Managed by IBM
- Artifacts that are created with IBM BPM on Cloud are compatible with IBM BPM on-premises product
- Free 30-day trial available (see Appendix B)

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*Figure 1-15. Introduction to IBM BPM on Cloud*

IBM Business Process Manager on Cloud is a subscription-based business process management (BPM) cloud service.

IBM Business Process Manager on Cloud provides a full lifecycle IBM BPM environment that includes development, test, and production – with tools and run time for process design, execution, monitoring, and optimization. It is designed to enable business users to get started with process improvement quickly without the need to build and maintain an IT infrastructure.

For more information about IBM BPM on Cloud, see [Appendix B, "IBM BPM on Cloud"](#)



## BPM on Cloud customer focus: Manage and automate decisions

**IBM manages:**

- Uptime
- Monitoring
- Backup
- High availability
- Disaster recovery
- Updates
- Maintenance

**Customers manage:**

- Application development
- Application integration
- Application support

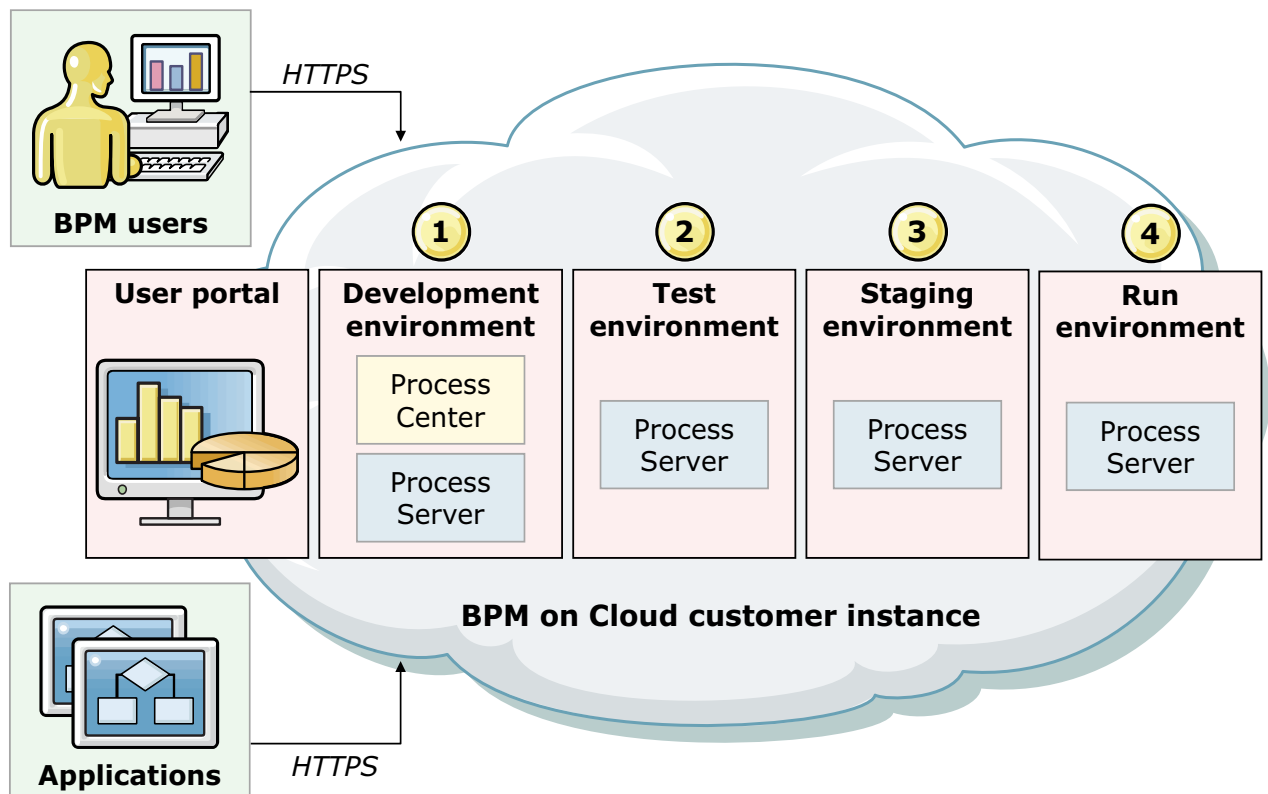


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Figure 1-16. BPM on Cloud customer focus: Manage and automate decisions

## IBM BPM on Cloud: Four runtime environments



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Figure 1-17. IBM BPM on Cloud: Four runtime environments

IBM BPM on Cloud provides four runtime environments for process development:

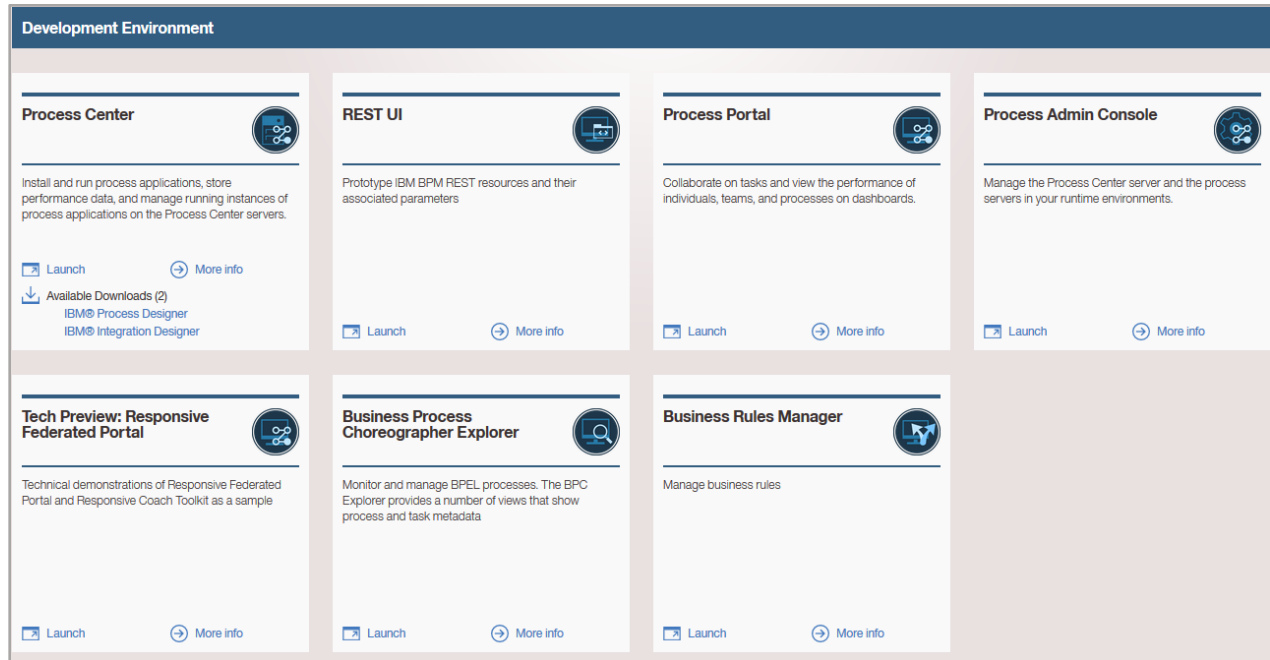
1. Development
2. Test
3. Staging
4. Run

In this diagram:

- **BPM users** include developers, business analysts, business users, and rule authors who access the Process Designer, Rule Designer, and the other various user consoles.
- **Applications** are applications that call services.

## IBM BPM on Cloud user portal

- Access from home page to an array of tools in the three environments



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Figure 1-18. IBM BPM on Cloud user portal

## 1.3. Process Federation Server

## Process Federation Server

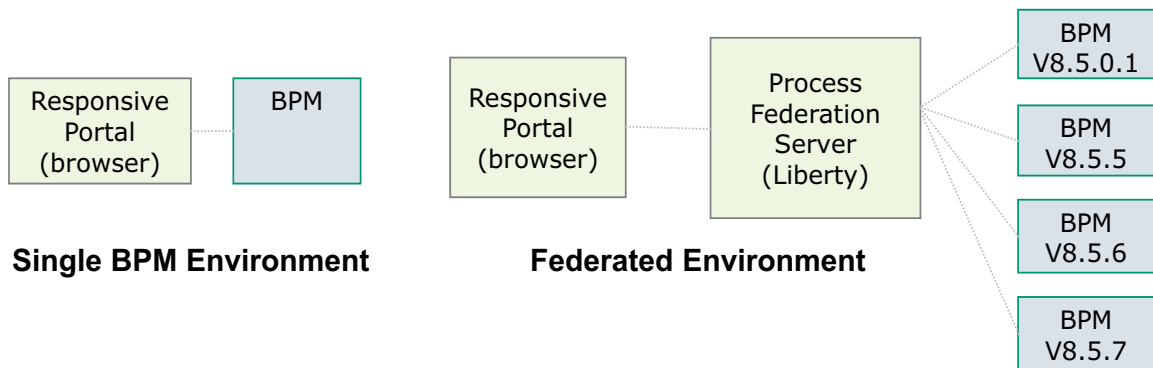
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*Figure 1-19. Process Federation Server*

## Adding Process Federation Server

- Process Federation Server (PFS) enables task workers to access all their work from a single Process Portal.
- Tasks can be federated across
  - Multiple BPM cells
  - Multiple BPM releases
  - BPMN and BPEL tasks



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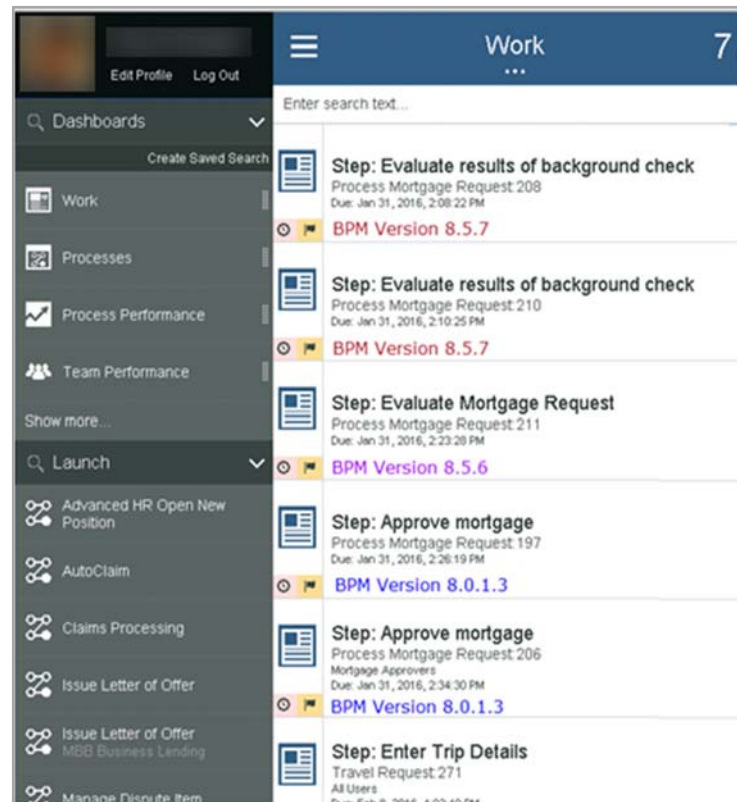
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Figure 1-20. Adding Process Federation Server

IBM BPM V8.0.1.3, IBM BPM V8.5.0.1, and IBM BPM V8.5.5.0 are supported in IBM PFS V8.5.6.0 and IBM PFS V8.5.7.0. To federate these back releases into IBM PFS V8.5.6.0 and IBM PFS V8.5.7.0, APARs are required.

## Process Federation Server benefits

- Unified Task List
- Seamlessly sort, filter, and search across tasks, regardless of BPM system
- Task source system is not annotated by default, but you can add a system name



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Figure 1-21. Process Federation Server benefits

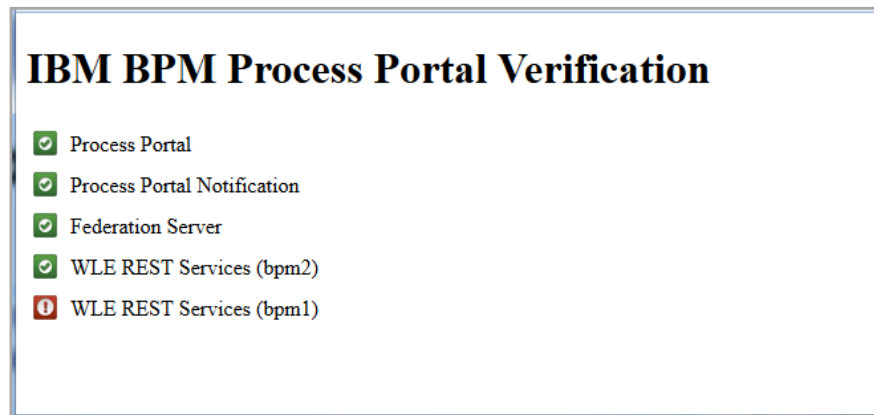
Documentation is available at the following URL:

[http://www.ibm.com/support/knowledgecenter/SSFPJS\\_8.5.7/com.ibm.wbpm.main.doc/topics/cfg\\_fps\\_crtserver.html](http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/topics/cfg_fps_crtserver.html)

## Process Federation Server web test tool

- Process Portal includes a browser-based test page to help ensure that the federated configuration is working by making calls to the Process Portal server, the PFS server, and each configured back end system.

`http://<appServer>:<port>/ProcessPortal/web_test`





## Process Federation Server federationResult

- Requests to the PFS server return a federationResult object that contains a list of information for each back end system.

The screenshot shows a web browser window with the address bar displaying "GET launchable" and a status of "200 OK". The response is displayed in the "JSON" tab, showing a "federationResult" object. The object contains a list of back end system information, including systemID, displayName, systemType, portalSupportUrlPrefix, id, taskCompletionUrlPrefix, version, indexRefreshInterval, and statusCode. The response is structured as follows:

```
[ Object { restUrlPrefix="https://...m.com:9443/rest/bpm/wle", systemID="e1f76598-7c21-4c45-8a23-c25a9e37d1a0", displayName="bpm2", more... }, Object { restUrlPrefix="https://...m.com:9443/rest/bpm/wle", systemID="d9585b4b-2a83-4f71-8cc5-3928830d952d", displayName="bpm1", more... } ]
```

The "federationResult" object is expanded, showing the following properties:

- restUrlPrefix
- systemID
- displayName
- systemType
- portalSupportUrlPrefix
- id
- taskCompletionUrlPrefix
- version
- indexRefreshInterval
- statusCode

The "items" array is also expanded, showing the following objects:

- Object { restUrlPrefix="https://...m.com:9443/rest/bpm/wle", systemID="e1f76598-7c21-4c45-8a23-c25a9e37d1a0", displayName="bpm2", more... }
- Object { restUrlPrefix="https://...m.com:9443/rest/bpm/wle", systemID="d9585b4b-2a83-4f71-8cc5-3928830d952d", displayName="bpm1", more... }

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Figure 1-23. Process Federation Server federationResult

## Process Federation Server systemID

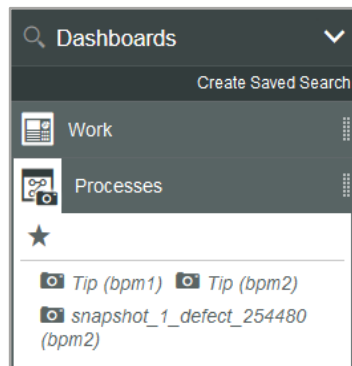
- **systemID:** This identifier is used to uniquely identify the back end system and is used as part of the URL addressability when working on an instance or task from the back end system

```
https://<server>:9443/ProcessPortal/launchInstanceUI?instanceId=3&systemID=d9585b4b-2a83-4f71-8cc5-3928830d952d
```

```
https://<server>:9443/ProcessPortal/launchTaskCompletion?taskId=4&systemID=d9585b4b-2a83-4f71-8cc5-3928830d952d
```

## Process Federation Server displayName

- displayName: The Process Portal displays this string in the launch list when the same dashboard or process is installed on multiple back end systems



- The PFS server might be configured to show only one instance of a process, or a dashboard, or all instances
- By default, dashboards show up once per federated system and processes show up only once

## 1.4. Deployment governance

## Deployment governance

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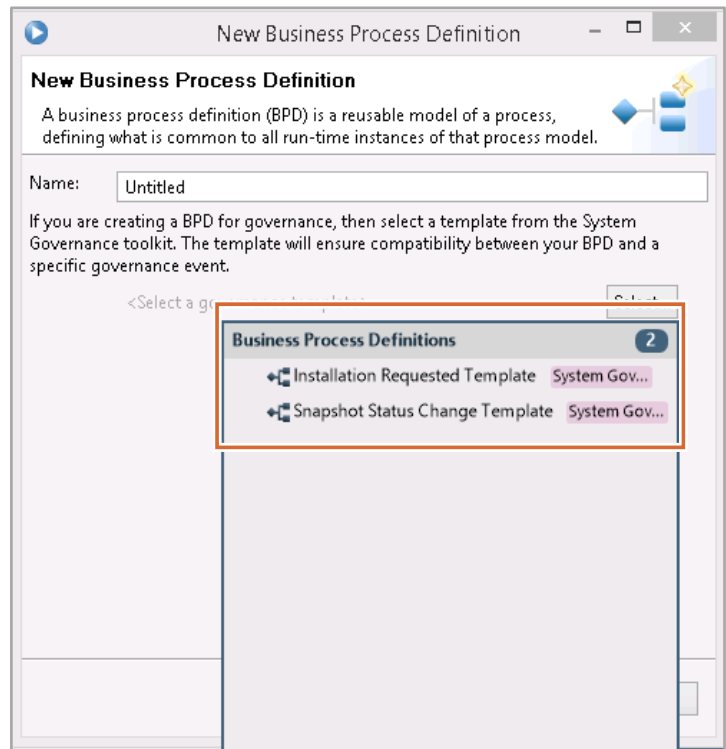
*Figure 1-26. Deployment governance*

## Challenges

- How can you gain visibility and control over what gets installed on Process Servers?
- When snapshot is installed:
  - How do you ensure that proper business approvals were completed?
  - How do you ensure that proper testing is done and all IT organization approvals are secured?

## Good practices

- Create and use Snapshot Install Governance Processes
  - Applies to both online and offline installations
  - Can query Requirement Management systems about the features included in a snapshot and retrieve their status (that is, completed?)
  - Can prevent snapshot installation
  - Can notify interested parties of a successful or aborted installation
- Generate a Governance Business Process Definition from a Governance Template



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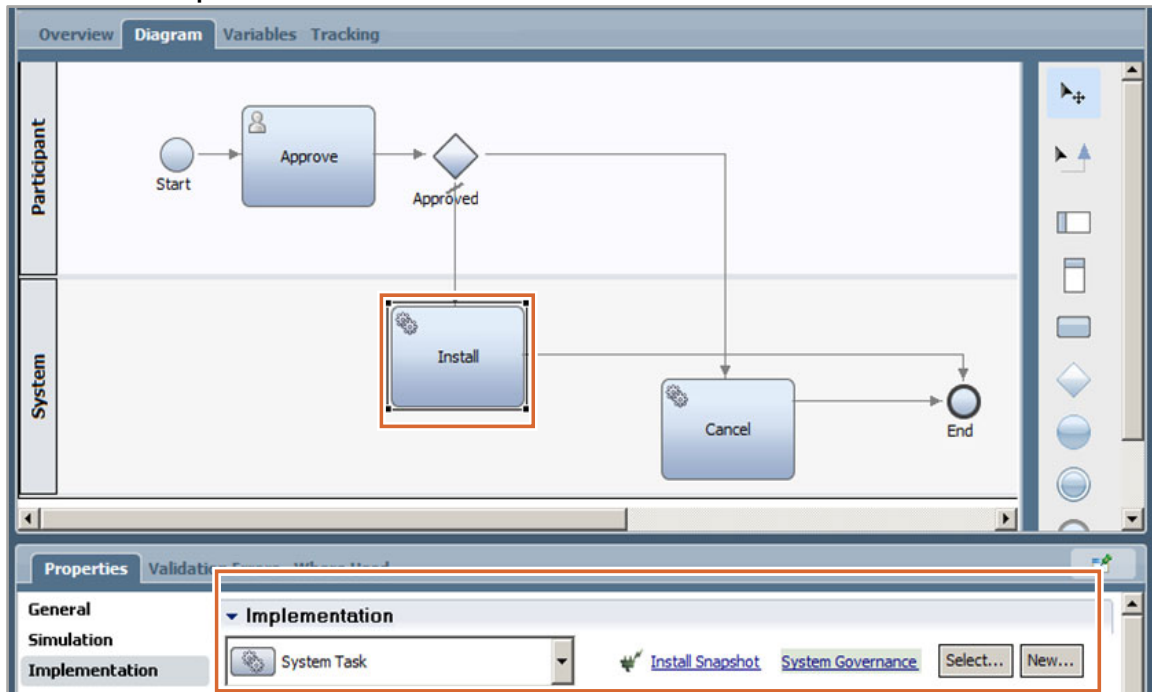
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Figure 1-28. Good practices

The two governance templates available are the Installation Requested Template and the Snapshot Status Change Template.

## Author your governance

- Use Human Services for approval, business rules for decisions, and services to perform the Installation



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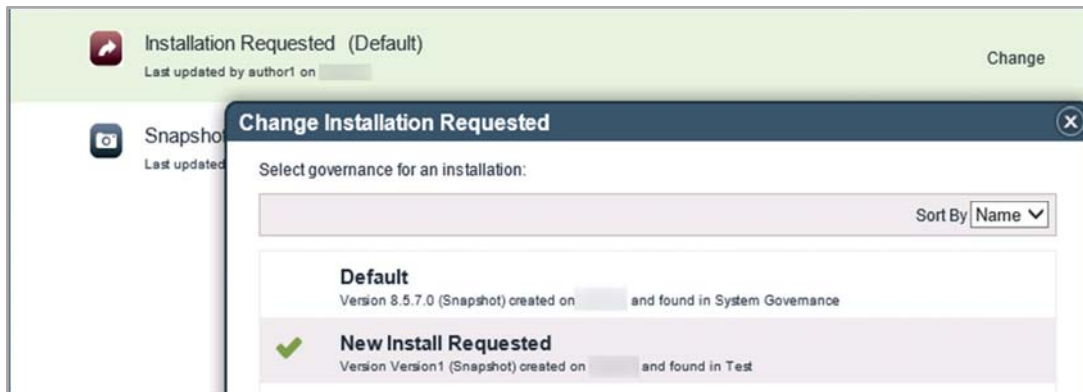
Figure 1-29. Author your governance

Add human services as approval steps. Use rule services in addition to manual approvals. Select from pre-built governance integration services to automate snapshot deployment.



## Selecting governance for an installation

- Associate your Governance Process with the Process App to control and govern Snapshot installation (applies to online and offline Process Servers)



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Figure 1-30. Selecting governance for an installation

You must create a snapshot of your governance process application. You must then change the status of the snapshot to Released. You can then select the snapshot as the governance for the process application.

## Selecting governance for an installation

- When you install a snapshot, the governance process gets automatically invoked
- Some other options to consider
  - Notify users via email
  - Prevent the Snapshot install
  - Check whether all tests were run

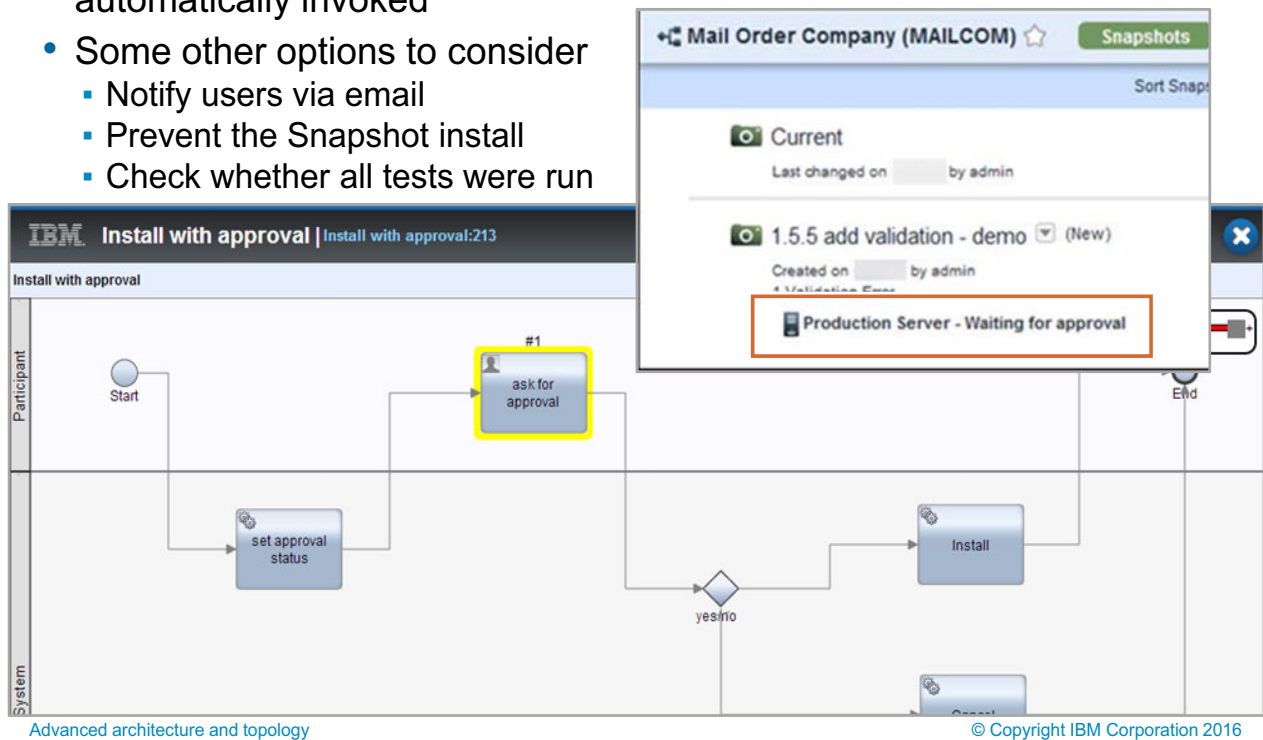


Figure 1-31. Selecting governance for an installation

After the governance process is invoked, the deployed snapshot status changes to reflect the governance process status.

## Unit summary

- Describe IBM Business Process Manager configurations
- Describe IBM Business Process Manager topology considerations
- Explain the purpose and basic function of the Process Federation Server
- Describe deployment governance

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*Figure 1-32. Unit summary*

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## Review questions



1. A good practice is to deploy snapshots to the Process Servers by using which approach?
  - A. Round robin release
  - B. Hub and spoke deployment
  - C. Serial promotion
  - D. Agile release method
  
2. True or False: The Process Federation Server provides a unified task inbox that shows user tasks from multiple different versions of IBM Business Process Manager.
  
3. True or False: You can email status updates, reject a snapshot if administrators disagree, or install to a new environment automatically after gathering the required approvals by using governance processes.

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Figure 1-33. Review questions

Write your answers here:

1.

2.

3.

## Review answers



1. A good practice is to deploy snapshots to the Process Servers by using which approach?

A. Round robin release  
B. Hub and spoke deployment  
C. Serial promotion  
D. Agile release method

The answer is B. The hub and spoke method centers around the Process Server snapshots, and deploying the snapshots to online and offline servers directly from the development environment.

2. True or False: The Process Federation Server provides a unified task inbox that shows user tasks from multiple different versions of IBM Business Process Manager.

The answer is True.

3. True or False: You can email status updates, reject a snapshot if administrators disagree, or install to a new environment automatically after gathering the required approvals by using governance processes.

The answer is True.

---

# Unit 2. External activities and use of the REST API

## Estimated time

01:30

## Overview

This unit describes the advantages and disadvantages of coach development, and explains the advantages of headless implementations. You also learn about services that use the REST API.

## How you will check your progress

- Checkpoint
- Lab exercise
- Demonstration and walk-through

## Unit objectives

- Describe the advantages and disadvantages of a headless implementation
- Follow an activity focused UI
- Adopt a skill driven coach view taxonomy
- Use the REST API in IBM Business Process Manager

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*Figure 2-1. Unit objectives*

## Topics

- Advantages and disadvantages of an external user interface
- Activity focused UI
- Understanding and adopting skill driven coach view taxonomy
- REST API in IBM Business Process Manager

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*Figure 2-2. Topics*



## **2.1. Advantages and disadvantages of an external user interface**

## Advantages and disadvantages of an external user interface

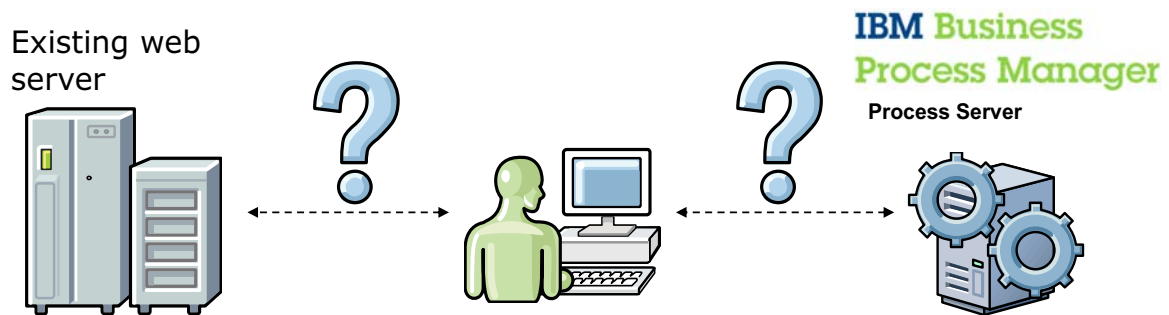
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*Figure 2-3. Advantages and disadvantages of an external user interface*

## External user interface considerations

- It is possible to use existing pages and integrate them with IBM Business Process Manager
- Many organizations undertake studies to determine the cost benefit of replacing user interfaces with coaches



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Figure 2-4. External user interface considerations

When an organization adopts IBM Business Process Manager, it is left with a decision to make. Should you use the existing infrastructure to serve web pages to users, or should you replace the existing infrastructure with the coach capabilities of IBM Business Process Manager? Every organization studies the cost benefits for both approaches. Both approaches require development time and effort, but, which is the best approach for your organization?

## Disadvantages of external user interfaces

- BPM assets are now distributed among multiple systems
  - New versions of BPM assets and deployment must synchronize with the external web pages
  - One-click deployment inside of IBM Business Process Manager is no longer possible
  - Project asset lifecycle governance becomes more complex
- Must create and manage integrations to the existing web server for every activity
- Must create integrations to IBM Business Process Manager from the existing system
- Security exchange, authentication, and authorization decisions become complex, and must be synchronized between systems
- Obtaining metrics on user performance inside their activities is impossible or complicated
- The process data system of record inside IBM Business Process Manager might not be authoritative

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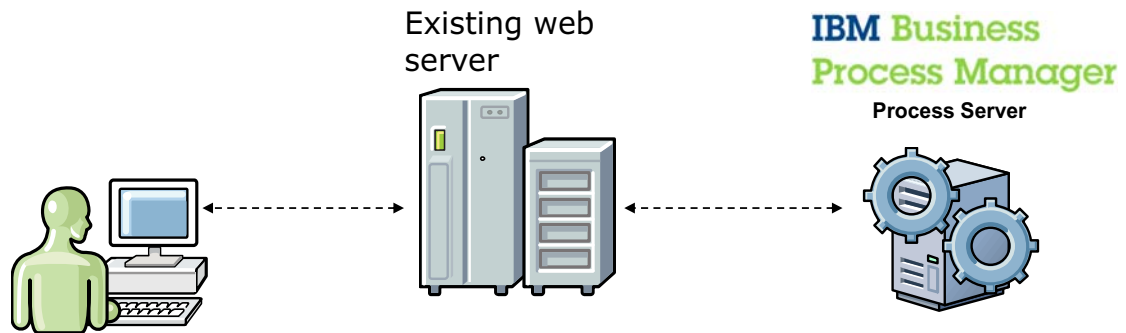
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*Figure 2-5. Disadvantages of external user interfaces*

Externalizing all user interfaces from IBM Business Process Manager presents numerous disadvantages. A few problems developers must consider when designing an external user interface are shown.

## Advantages of external user interfaces

- Decoupled UI from BPM technology
- Can use existing web pages, do not have to re-create screens in coaches
- Web developers do not have to learn the Process Designer



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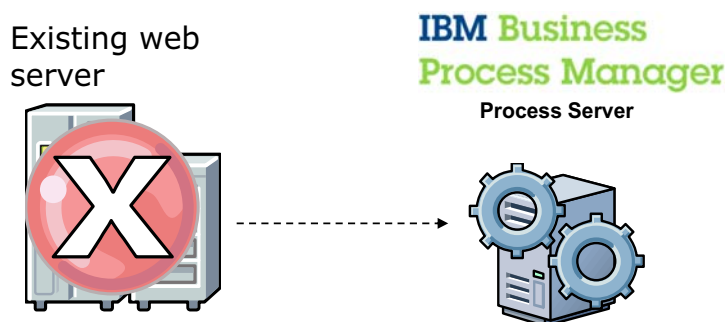
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Figure 2-6. Advantages of external user interfaces

The main advantages of using an existing web server and communicating back to IBM Business Process Manager revolve around the rework time that is required to re-create the user interfaces. Another consideration is the training time that is required for developers to become proficient with coaches.

## Disadvantages of coaches

- New software requires training for web developers
- All user interfaces must be re-created and tested



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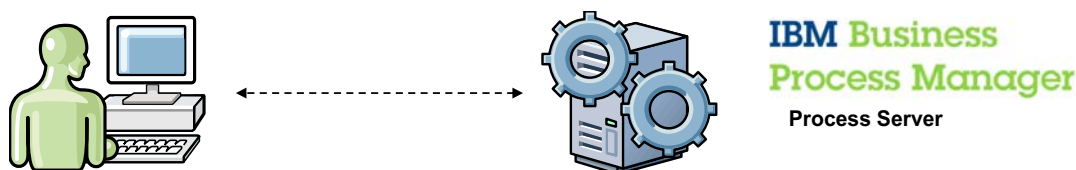
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Figure 2-7. Disadvantages of coaches

The disadvantages of coaches are the advantages of the external user interface. Re-creating the user interfaces in IBM Business Process Manager requires development time.

## Advantages of coaches

- WYSIWYG editor, rapid application development tool to create user interfaces
- Easily adopt responsive web technologies for mobile and desktop browsers
- Coach data is bound server-side without coding
- Can be customized to match corporate themes with CSS
- All advanced features (JavaScript, Ajax, and others) can be used
- Centralizes all BPM assets, eliminating version conflicts and governance complexity
- Enables the collection of BPM metrics at the service level to improve activity performance



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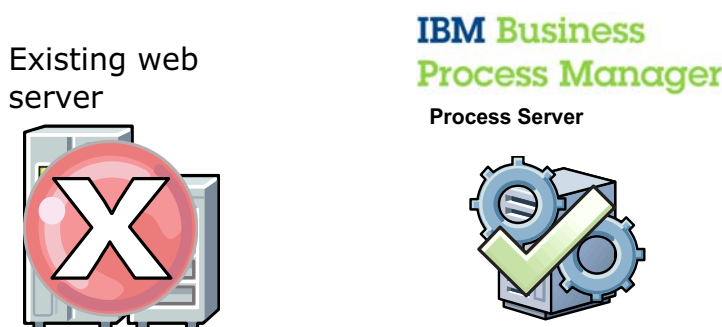
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Figure 2-8. Advantages of coaches

Eliminating or re-creating the existing user interfaces provide numerous advantages, and those benefits extend beyond the creation of the first release of development. If an organization decides to re-create its user interfaces inside IBM Business Process Manager, the long-term sustainability of using coaches is dramatically improved.

## External user interface decision

- Organizations must make their own determination
- External user interface approach becomes two disjointed systems that must synchronize together
- In some cases, the disadvantages of an external user interface outweigh the advantages



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Figure 2-9. External user interface decision

You see the many advantages and disadvantages to each approach, and only the needs of the organization can determine which approach is best. Realize the pros and cons of using pre-existing user interfaces on existing systems. However, occasionally the system must synchronize with existing information and the UI design within an organization. It requires customizing coaches to match the external UI and retrieve external data, or integrate with the existing UI altogether.

Project managers must determine the resource costs necessary to build, deploy, and maintain a more complex application if an external user interface is used. Many clients analyze the costs and determine that creating coaches from existing web pages comes at a much lower cost and reduced project timeline. Compare this approach to building a hybrid framework where an existing system and IBM Business Process Manager must coexist. Even if the project requires obtaining training for web developers to create and implement coaches, by using coaches instead of using an external UI, it ends up taking less time and costing less. Setting up the infrastructure, creating the artifacts to communicate between systems, and the service design and implementation time necessary to synchronize two systems with each other must be planned for before modeling or implementation can occur.



## 2.2. Activity focused UI

## Activity focused UI

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*Figure 2-10. Activity focused UI*

## User interface design approaches

- User-focused design concentrates on the people who use the system and information architecture
  - Frames design in terms of information
  - Centered around each display or page
- Activity-focused design concentrates on human activity
  - Focus shifts to the activity the user must accomplish, not just the individual pages
  - Activity context and transitions between pages are enhanced
- Use activity-focused design when creating coaches

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Figure 2-11. User interface design approaches

You can use IBM Business Process Manager to apply custom functions and style to the standard user interface (coach). A key consideration for customization is how well the design of the interface is applied so as not to interfere with the task.

The best design consideration for a coach is that of an activity-focused design. User interface customization must stay within the parameters of the activity requirements and not detract from it. With a balance of good design and function to the customizations that developers and business users seek, comprehensive coach refinement can overcome the limitations in the standard coach controls. The development effort must center around an activity-focused user interface.

Activity-focused design focuses on human activity, as opposed to user-centered design, which frames design in terms of the specific people who use it. It also differs from information architecture, which frames design in terms of information. When faced with the choice between task, user, or information, choose the task as the central focus of the coach design.

## Design for application maintainability

- Any custom user interface effort must also consider application maintainability
- Do not sacrifice maintainability for the added functions that are brought about with customization

First:	Rick	Middle Initial:	S	Last:	Riordan
DOB:	9-1-1977	SSN:	345-97-1765	Gender:	Male
Age:	32				
Shipping Preference:	UPS				
		Type	Number		
		home	(312) 555-1211		

OK Cancel



### MAINTENANCE

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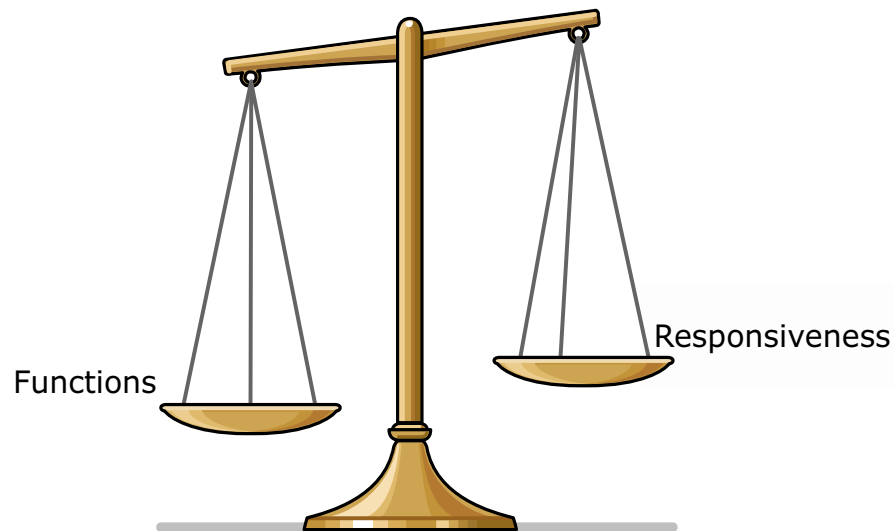
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Figure 2-12. Design for application maintainability

Any custom user interface design effort must be created with application maintainability in mind. This consideration must be at the forefront of the design so that developers do not sacrifice this important factor for the added features that are brought about with customization. For example, it can be enticing to use custom HTML blocks in the Coach Designer for almost everything, but then the coach is not easily editable or readable by other developers. The power and ease of use of the Coach Designer are thus limited.

## Design for application responsiveness

- A good design criterion for any application is the page responsiveness
  - Balance the responsiveness needs and functions enhancements to create a great user experience



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Figure 2-13. Design for application responsiveness

A good design criterion for any application is the page responsiveness. For example, a large amount of data that is retrieved before a coach screen is shown can affect page responsiveness and the overall user experience. In such a case, a delayed user experience is less than desirable.

However, an example of good functional responsiveness is a “type ahead” feature that can be added to your user interface design. It gives the perceived value of increased responsiveness from your application to the user. It increases the positive user experience without a huge maintenance cost.

Using design tools like YSlow and the Firebug Profiler can help achieve fast user interfaces. These tools can also help identify individual elements in a coach that take longer to load, and assist developers in addressing these deficiencies.

Ajax can assist developers in increasing responsiveness and decreasing load times of coaches. If you have a large coach, or maybe a coach with multiple tabs, it might be advantageous to load some of the page immediately to allow users to start working. In the background, or as the users continue their work, you can use Ajax when the users need it. Avoid loading data that is hidden or data that is not needed at the current time.

Be sure to balance the end-use responsiveness needs with interactivity enhancements to create a positive user experience.

## **2.3. Understanding and adopting skill driven coach view taxonomy**

## Understanding and adopting skill driven coach view taxonomy

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*Figure 2-14. Understanding and adopting skill driven coach view taxonomy*

## The challenge

- Coach Views are the building blocks of Human Services and other Coach Views
- How can the team design and build Coach Views to achieve the most efficient reuse and enable rapid agile changes?

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*Figure 2-15. The challenge*



## Suggested good practice

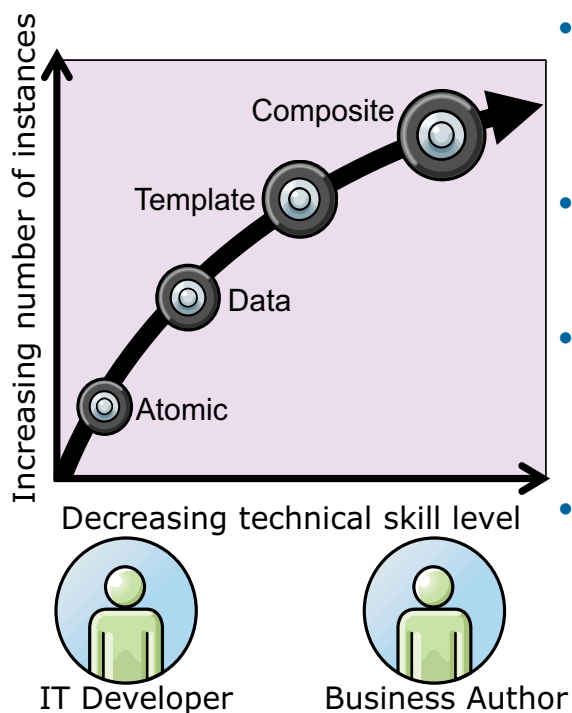
- Adopt Skill Driven Coach View Taxonomy
  - Categorize Coach Views by the skills that are required to develop them
- The Skill Driven Coach View Taxonomy promotes agility and reuse
  - Enables frequent and rapid UI changes with minimum loss of productivity
  - Ensures that the organization applies the right skills

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*Figure 2-16. Suggested good practice*

## Skill-driven coach view taxonomy



- Atomic Coach View (a fundamental Coach View)
  - Extension of the Stock Coach Views
  - New Coach View (Image, Google Map)
- Data Coach View
  - Bound to a specific Business Object
  - Data entry
- Template Coach View
  - Contains elements that are not changeable (banner)
  - Can add Coach Views to the Content Box
- Composite Coach View
  - Is derived from a template Coach View
  - Includes several Data Coach Views
  - Immediately reusable in Human Service with no addition of other Coach Views
  - Requires binding variables
  - Requires customization (exposed variables must be set)

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Figure 2-17. Skill-driven coach view taxonomy

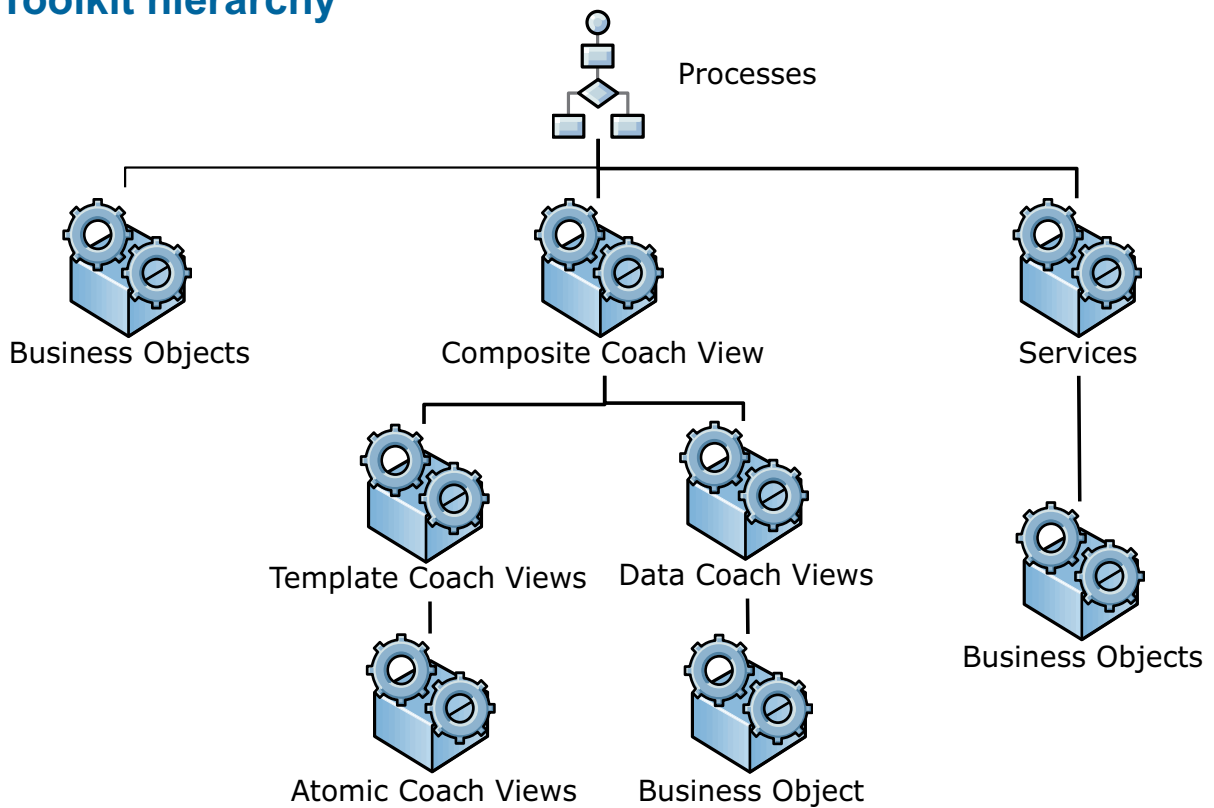
As process applications continue to mature and iterate, development teams must create more complex coach views. The initial development occurs at the atomic level, where development teams create coach views that are considered for reuse. The coach views are new creations or are commonly derived from existing coach views.

The next level of coach view is bound to a business object. Although the data coach views are complex, they are easier for developers to implement because the coach view is already defined.

The third type is the template coach view, which defines other new coach views. A banner composite coach view contains elements that developers cannot change. This coach view shows an increasing maturity in coach view development and allows developers with less technical skills to easily create coaches that conform to organizational standards.

The final stage is to create composite coach views, which combine some of the other types of coach views. Although composite coach views are complex coach views to create, they are much easier to use the coach view on a coach. As you create more mature coach views, the level of technical skill that is required to create front ends for your process applications is reduced. Initially, IT Developers are required to create and use the atomic, data and template coach views. But as the development matures, business authors without advanced technical skills can use data, template, and composite coach views on their coaches easily.

## Toolkit hierarchy



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Figure 2-18. Toolkit hierarchy

Toolkit Hierarchy based on Skill Driven Coach View Taxonomy promotes reuse. Organizations can apply the right skills to deal with technical complexity.

## **2.4. REST API in IBM Business Process Manager**

## REST API in IBM Business Process Manager

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*Figure 2-19. REST API in IBM Business Process Manager*

## What is REST API in IBM BPM? (1 of 2)

- IBM Business Process Manager provides a set of APIs that are implemented based on Representational State Transfer (REST) services
  - A set of REST resources is available for accessing IBM BPM artifacts, including business processes and tasks
  - The IBM BPM REST APIs support various Internet standards
  - The IBM Business Process Manager resources are BPD-related, BPEL-related, or federated resources
  - The resource URIs represent the IBM BPM resources
  - The HTTP methods provide the operations, such as create, read, update, and delete, which can be performed on IBM BPM artifacts

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Figure 2-20. What is REST API in IBM BPM? (1 of 2)

A resource can be any coherent and meaningful concept that might be addressed.

A representation of a resource is typically a document that captures the current or intended state of a resource.

A uniform interface separates clients from servers. This separation of concerns means that clients are not concerned with data storage, which remains internal to each server, so that the portability of client code is improved. Servers are not concerned with the user interface or user state so that servers can be simpler and more scalable. Servers and clients might also be replaced and developed independently; the interface between them is not altered.

## What is REST API in IBM BPM? (2 of 2)

- Clients Initiate requests to servers; servers process requests and return appropriate responses
  - Requests and responses are built around the transfer of representations of resources
- A resource can be any coherent and meaningful concept that might be addressed
- A representation of a resource is typically a document that captures the current or intended state of a resource
- A uniform interface separates clients from servers

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Figure 2-21. What is REST API in IBM BPM? (2 of 2)

## Principles of REST (1 of 3)

- Individual resources are identified in requests
  - Example: Using URIs in web-based REST requests
- Resources are conceptually separate from the representations that are returned to the client
- The client can manipulate the resource through the representations
  - Each message that is sent between the client and the server is self-descriptive and includes enough information to describe how it is to be processed
  - The hypermedia that is hyperlinks and hypertext act as the engine for state transfer
- The server does not send its database
  - The server sends HTML, XML, or JSON that represents records

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Figure 2-22. Principles of REST (1 of 3)



## Principles of REST (2 of 3)

- When a client holds a representation of a resource, including any metadata that is attached, it has enough information to modify or delete the resource on the server, provided it has permission to do so
- If an error occurs during the processing of a REST request, the REST methods return an appropriate HTTP status code to the calling client
  - 200 OK
  - 400 Bad Request
  - 401 Unauthorized
  - 404 Not Found

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*Figure 2-23. Principles of REST (2 of 3)*

## Principles of REST (3 of 3)

- **REST URI**

`http://{host}:{port}/rest/{component}/v1/{resource}?{query}`

Where:

“`http://{host}:{port}`” contains the host address and port

“`/rest/{component}`” is the context root, where component is an IBM REST component

“`/v1/{anyResource}?{query}`”, together with the host address or port and context root, represents the IBM Business Process Manager resource

- **For example:**

**Request:**

`http://localhost:9080/rest/bpm/wle/v1/process/903?parts=all`

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Figure 2-24. Principles of REST (3 of 3)

The resource URIs represent the IBM BPM resources.

The REST resource URIs have the following format:

`http://{host}:{port}/rest/{component}/v1/{resource}?{query}`

Where:

- `{host}:{port}` is the host address and port of the REST API endpoint, for example: `MyProcessServer:9080`
- `/rest/{component}` is the configurable context root, including one of the following IBM BPM REST component names:
  - `/rest/bpm/htm`
  - `/rest/bpm/bfm`
  - `/rest/bpm/federated/htm`
  - `/rest/bpm/federated/bfm`
  - `/rest/bpm/wle`
- `/v1` is the version of the REST resource. REST resources might get updated by IBM; however, the changes are always compatible with existing REST client applications. The following

changes to REST resources are considered to be compatible changes and must be expected in client applications:

- Support for new MIME types or resource representations.
- The addition of new properties to existing JSON objects that are returned to a client. Clients that are not at the latest level ignore these properties.
- `{resource}` is the hierarchically organized part of the resource identification.
- `{'query'}` is the non-hierarchical part of the resource identification. Typically, this part of the resource identification consists of parameters that are passed to the method implementation.

## Testing the REST APIs

- A test tool is provided with the IBM BPM REST APIs
  - You can use this tool to help you learn about the REST APIs, and to test those APIs that you are planning to use in your application
- The REST API test tool is a web application that you can use to prototype the following IBM BPM REST resources and their associated parameters
- URL: `http://host_name:port_number/bpmrest-ui`



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Figure 2-25. Testing the REST APIs

Direct your web browser to the URL for the REST API test tool. The value of the URL depends on how the virtual host and context root were configured for your installation.

The URL takes the following form: `http://host_name:port_number/bpmrest-ui`

Where:

- *host\_name* is the network name for the host of the process server.
- *port\_number* is the port number that the REST API test tool uses. The port number depends on your system configuration. The default port number is 9080. For example, if you wanted to test the REST APIs available on port 9080 on your server, you would open the URL in your browser: `http://myserver1:9080/bpmrest-ui`.
  - In the REST API test tool, select an API.
  - Optional: Enter any associated parameters that you want to include in your test.
  - Click **Execute Call** to start the test.

## Calling the exposed processes

The screenshot shows the IBM Business Process Manager REST API Tester interface. The 'Result Type' is set to 'JSON (Javascript format)'. Under 'Select API Call:', 'Exposed Processes' is selected and highlighted with a red box. The 'Method' is set to 'GET'. The 'Request' is 'https://ws2012r2x64:9443/rest/bpm/wle/v1/exposed/process'. The 'Status' is '200 - OK'. The 'Header' section lists various headers including 'X-Powered-By: Servlet/3.0', 'BPM\_GENERIC\_HEADER: SERVED', 'Cache-Control: no-cache, no-store, max-age=0', 'Content-Type: application/json', 'Content-Encoding: gzip', 'Content-Language: en-US', 'Transfer-Encoding: chunked', and 'Date:'. The 'Result' section shows a JSON response with a status of '200' and a data object containing an 'exposedItemsList' array. The first item in the list is a process with the following details:

```

{
  type: "process",
  itemID: "25.321b9d9e-d51a-43",
  itemReference: "/25.321b9d9e-d51a-43",
  processAppID: "2066.a906039c-7f46-4a13fcb868135",
  processAppName: "HR Recruitment Proci

```

A yellow callout box on the right side of the interface states: "You can get the process ID by calling the exposed processes method".

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Figure 2-26. Calling the exposed processes

To get the IBM Business Process Manager ID for exposed processes, expand the Business Process Manager REST APIs and then under Process API select **Exposed Processes**. When you click **Execute**, it returns a list of all the exposed processes, their item IDs, and snapshot details.

## Retrieving saved searches

The screenshot shows the IBM Business Process Manager REST API Tester interface. On the left, under 'Select API Call', the 'Search API' is expanded, and 'Retrieve Saved Search Definitions List' is selected. Below this, the 'Method' is set to 'GET'. On the right, the 'Request' is shown as 'https://ws2012r2x64:9443/rest/bpm/wle/v1/searches/tasks', the 'Method' is 'GET', and the 'Status' is '200 - OK'. The 'Header' section lists various headers including 'X-Powered-By', 'BPM\_GENERIC\_HEADER', 'Cache-Control', 'Content-Type', 'Content-Encoding', 'Content-Language', and 'Transfer-Encoding'. The 'Result' section displays a JSON object with a 'status' of '200' and a 'data' object containing a 'definitions' array. The first element in the array is a search definition with an 'id' of '6', a 'name' of 'IBM.DEFAULTALLPROCESSLIST\_75', an 'owner' of 'null', an 'organization' of 'byInstance', and a 'shared' status of 'true'.

```

{
  "status": "200",
  "data": {
    "definitions": [
      {
        "id": "6",
        "name": "IBM.DEFAULTALLPROCESSLIST_75",
        "owner": null,
        "organization": "byInstance",
        "shared": true
      }
    ]
  }
}

```

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Figure 2-27. Retrieving saved searches

To retrieve a list of the saved searches, proceed as follows:

1. Expose the variable to be searched in Process Designer.
2. In Process Admin Console, define the saved search and test to see whether it works.
3. In Process Portal, launch the Process Instance and execute the search.
4. Call the search from the REST API tester.
  - You can use the Process Queries API call to return a list of all defined saved search queries. As soon as the REST client page is loaded, expand **BPM REST APIs > Search API > Retrieve Saved Search Definitions List**.
  - IBM Business Process Manager includes default saved searches.

## Tasks list

The screenshot shows the IBM Work dashboard. At the top, there's a header with a menu icon, the word "Work", and a status bar indicating "1 Total Open" task. Below the header is a search bar with the placeholder text "Enter search text...". The main content area displays a task titled "Step: Submit Hiring Request" with a sub-task "Hiring Request Process:56" and a due date of "Apr 28, 2016 4:50 PM". Below the task list, there's a pagination bar showing "1 - 1 of 1 items" and a "25 items per page" dropdown.

At the bottom, a network debugger tool is open, showing a list of network requests. The selected request is a PUT method to the URL "https://ws2012r2x64:9443/rest/bpm/wle/v1/tasks?calcStats=true". The status code is 200 OK. The response headers are visible, including "BPM\_GENERIC\_HEADER: SERVED", "Cache-Control: no-cache, no-store, max-age=0", "Content-Encoding: gzip", and "Content-Language: en-US".

Method	File	D	Request URL	Status code
200 POST	connect	ws2012r2x	https://ws2012r2x64:9443/rest/bpm/wle/v1/tasks?calcStats=true	200 OK
200 POST	handshake	ws2012r2x		
200 GET	current?includeInternalMembersh...	ws2012r2x		
200 POST	connect	ws2012r2x		
200 POST	/	ws2012r2x		
200 PUT	tasks?calcStats=true	ws2012r2x	https://ws2012r2x64:9443/rest/bpm/wle/v1/tasks?calcStats=true	200 OK
200 GET	actions?actions=ACTION_CLAIM,...	ws2012r2x		
200 POST	connect	ws2012r2x		

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Figure 2-28. Tasks list

The portal calls the REST API to produce the task list for the logged in user. By using a browser debugger tool, you can see the REST API call. The tasks API call returns the list of tasks for the user.

## Saved search execution

The screenshot displays the REST API Tester interface for the 'Saved Search Execution' call. The left sidebar shows a list of API calls, with 'Saved Search Execution' selected. The main panel shows the configuration for this call, including the request URL, method (GET), status (200 - OK), headers, and the JSON result.

**Business Process Manager | REST API Tester** Call Tester Service Runner author1 log out IBM

**Result Type:** JSON (Javascript format)

**Select API Call:**

- Run Performance Instance Query
- Search Metadata
- Create Saved Search Definition
- Retrieve Saved Search Definition
- Update Saved Search Definition
- Delete Saved Search Definition
- Retrieve Saved Search Definition List
- Saved Search Execution**
- Automatic Search Execution

**Saved Search Execution**  
The Saved Search Definition can be executed and retrieves a list of task instance entities obtained by using the saved query.

**Method:** GET

**savedSearch:** savedSearch is the ID (numeric) or name (no)

**Fields:** Comma-separated list of fields to be retrieved

**Interaction:**

**Query Filter:** A query table condition language expression

**Request:** https://ws2012r2x64:9443/rest/bpm/wle/v1/tasks?filterByCurrentUser=false&calcStats=false

**Method:** GET

**Status:** 200 - OK

**Header:**

- X-Powered-By - Servlet/3.0
- BPM\_GENERIC\_HEADER - SERVED
- Cache-Control - no-cache, no-store, max-age=0
- Content-Type - application/json
- Content-Encoding - gzip
- Content-Language - en-US
- Transfer-Encoding - chunked
- Date - Thu, 21 Jul 2016 13:57:56 GMT

**Result:**

```
{
  "status": "200",
  "data": {
    "identifier": "TASK.TKIID",
    "query": "IBM.DEFAULTALLTASKSLIST_75",
    "entityTypeName": "TASK",
    "queryExecuteTime": "2016-07-21T13:57:56Z",
    "taskIndexUpdateInterval": 5,
    "attributeInfo": [
      {
        "name": "DUE",
        "type": "TIMESTAMP",
        "content": "TASK.DUE",
        "isArray": false
      }
    ]
  }
}
```

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Figure 2-29. Saved search execution

The portal search can be accomplished inside the REST API tester by copying the parameters from the portal search and by using them inside the Parameters input box. The REST API call returns all the fields that are used in the portal REST API call.

The parameters that are used in the portal saved search execution are:

GET

```
/rest/bpm/wle/v1/tasks[?savedSearch={string}][&fields={string}][&interaction={string}][&queryFilter={string}][&searchFilter={string}][&processAppName={string}][&sort={string}][&size={integer}][&offset={integer}][&filterByCurrentUser={boolean}][&calcStats={boolean}]
```



## Moving tokens with the REST API

- You can use REST APIs to move tokens
- How do you move a token on an instance?
  - Find the token ID with Inspector
  - Get the target ID to move to using the REST API – Current State
  - Get the Process Instance with Inspector
- For more information, see:

[http://www.ibm.com/support/knowledgecenter/SSFTDH\\_8.5.7/com.ibm.wbpm.admin.doc/topics/tmovingtokens.html](http://www.ibm.com/support/knowledgecenter/SSFTDH_8.5.7/com.ibm.wbpm.admin.doc/topics/tmovingtokens.html)

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Figure 2-30. Moving tokens with the REST API

To move a token to a new activity, complete the following steps:

1. Use the Process Inspector in the Process Admin Console to inspect the currently running process instances, and select the instance that contains orphaned tokens that you want to move. Make a note of the process instance ID and also the ID of the orphaned token, which is shown in the execution call stack.
2. Use Process Designer to identify the system ID of the activity where you want to move the orphaned token (the target activity). Record the complete value of that activity, including the bpdid: prefix.
3. To move the token to an activity, in the REST API client, enter the following text:

```
/rest/bpm/wle/v1/task/{taskId}?action={string} [&parts={string}] [&params={string}]
```

The following information identifies the parameters of the API:

- *taskId*: The task ID number of the token you need to move.
- *action*: States the action to be taken (finish).
- *parts*: A string that indicates which parts of the response data should be returned. Valid values are "data", "all" (the default), or "none". The "data" part refers to the external task information.

- *params*: A string that contains a JSON expression that includes the output parameters (variables) for the specified task.
4. Press Enter to complete the move.

## Finishing tasks with the REST API

The screenshot displays the 'Business Process Manager | REST API Tester' interface. On the left, under 'Select API Call:', the 'Finish Task' option is highlighted with a red rectangle. Below this, the 'Finish Task' details are shown: 'Closes a task', 'Method: PUT', 'Task ID: 68', and 'Parameters: Parameters to finish the task or activity'. On the right, the 'Request' details are shown: 'Request: https://ws2012r2x64:9443/rest/bpm/wle/v1/task/68?action=finish&parts=all', 'Method: PUT', 'Status: 200 - OK', and a list of headers including 'X-Powered-By: Servlet/3.0', 'BPM\_GENERIC\_HEADER: SERVED', 'Cache-Control: no-cache, no-store, max-age=0', 'Content-Type: application/json', 'Content-Encoding: gzip', 'Content-Language: en-US', 'Transfer-Encoding: chunked', and 'Date: I'. Below the headers, the 'Result' is shown as a JSON object: { status: "200", ... }. At the bottom right, a table shows the task status change from 'Received' to 'Closed'.

Status	Owner	Subject	Priority	Due Da...	Task Id
Received	author1	Step: Submit Hiring Request	Normal	Apr 28...	68
Closed	author1	Step: Submit Hiring Request	Normal	Apr 28...	68

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Figure 2-31. Finishing tasks with the REST API

Found under the Task API section, you can use the Finish Task REST API call to change a task to closed status. The API takes the argument `action=finish` and the task ID to close the task.

For more information, see:

[http://www.ibm.com/support/knowledgecenter/SSFPJS\\_8.5.7/com.ibm.wbpm.ref.doc/rest/pfs/rest\\_bpm\\_pfs\\_v1\\_tasks\\_get.htm](http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.ref.doc/rest/pfs/rest_bpm_pfs_v1_tasks_get.htm)

## Instructor demonstration: Exploring the REST API



- Explore the REST API tester

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*Figure 2-32. Instructor demonstration: Exploring the REST API*

## Unit summary

- Describe the advantages and disadvantages of a headless implementation
- Follow an activity focused UI
- Adopt a skill driven coach view taxonomy
- Use the REST API in IBM Business Process Manager

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*Figure 2-33. Unit summary*

## Review questions



1. Which design approach concentrates on human activity?
  - A. Activity-focused design
  - B. User-focused design
  - C. Functionality-inspired design
  - D. Multimedia-infused design
2. Which type of coach view requires the least technical skill by developers and is the easiest to use for business authors according to the skill-driven coach view taxonomy?
  - A. Atomic
  - B. Composite
  - C. Template
  - D. Data
3. True or False: The responsive Process Portal uses the same REST API calls that you can use to modify tasks and create dashboards.

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Figure 2-34. Review questions

Write your answers here:

1.

2.

3.

## Review answers (1 of 2)



1. Which design approach concentrates on human activity?

- A. Activity-focused design
- B. User-focused design
- C. Functionality-inspired design
- D. Multimedia-infused design

The answer is A. Activity-focused design concentrates on human activity.

2. Which type of coach view requires the least technical skill by developers and is the easiest to use for business authors according to the skill-driven coach view taxonomy?

- A. Atomic
- B. Composite
- C. Template
- D. Data

The answer is B. The composite coach view is the most mature of the coach views and incorporates elements of the other types of coach views.

## Review answers (2 of 2)



3. True or False: The responsive Process Portal uses the same REST API calls that you can use to modify tasks and create dashboards.  
The answer is True. The same REST APIs you can use are the ones that the responsive portal uses to display your inbox.



## Exercise 1

Exploring the REST API

External activities and use of the REST API

*Figure 2-37. Exercise 1*

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## Exercise objectives



After completing this exercise, you should be able to:

- Examine a failed instance in Process Inspector
- Restart a failed instance and complete the process
- Explore REST APIs by using the REST API tester

---

# Unit 3. CMIS integration

## Estimated time

01:30

## Overview

This unit explores the Content Management Interoperability Services (CMIS) capabilities in IBM Business Process Manager.

## How you will check your progress

- Checkpoint
- Lab exercise

## Unit objectives

- Use a CMIS system with IBM Business Process Manager
- Create content events in a process

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*Figure 3-1. Unit objectives*

## Topics

- CMIS system integration
- Responsive document controls
- Content events

CMIS integration

*Figure 3-2. Topics*

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## 3.1. CMIS system integration

## CMIS system integration

CMIS integration

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*Figure 3-3. CMIS system integration*

## Goals of integration with enterprise content management systems (ECM)



- Incorporate documents and folders into process applications
- Consume events that occurred in enterprise content management (ECM) systems
- Support access to common ECM systems by leveraging the Content Management Interoperability Services (CMIS) standard

CMIS integration

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*Figure 3-4. Goals of integration with enterprise content management systems (ECM)*

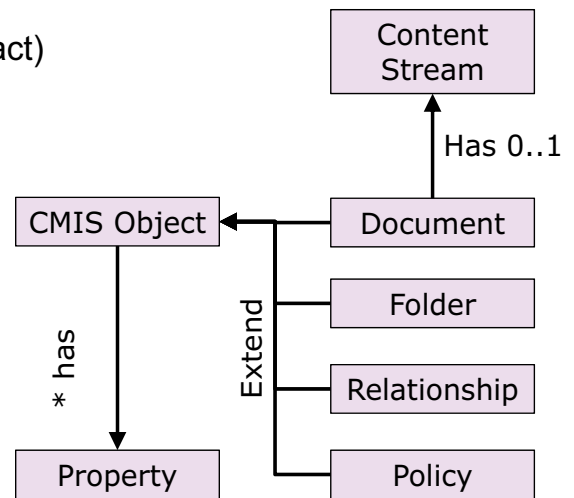
IBM Business Process Manager enables seamless integration with Enterprise Content Management (ECM) systems by providing an embedded CMIS-compliant (Content Management Interoperability Services) internal document store that is known as the BPM document store. This document store addresses the business requirement to include the management of related physical documents in the scope of a business process.

The Organization for the Advancement of Structured Information Standards (OASIS) administers the CMIS open standard. The standard defines an abstraction layer for controlling diverse document management systems and repositories by using web protocols.



## Content Management Interoperability Services

- OASIS Standard approved in May 2010
- Content repository interface via REST and Web Services bindings
  - Strictly typed data model
  - Subtypes can be defined allowing developers to define types beyond the base types
  - Four built-in types (can be purely abstract)
    - Document
    - Folder
    - Relationship
    - Policy
  - Operations
    - Create, Read, Update, and Delete
    - Query
    - Type Discovery



CMIS integration

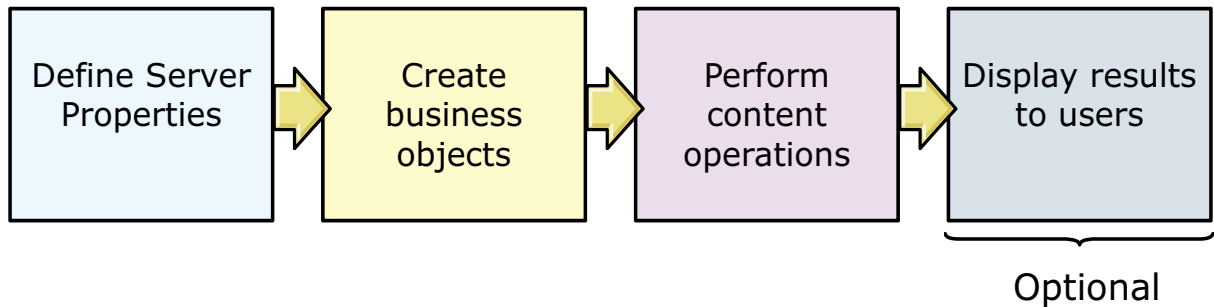
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Figure 3-5. Content Management Interoperability Services

The OASIS CMIS TC works to standardize a Web services interface specification that enables greater interoperability of Enterprise Content Management (ECM) systems. CMIS uses Web services and Web 2.0 interfaces to enable rich information to be shared across Internet protocols in vendor-neutral formats, among document systems, publishers and repositories, within one enterprise and between companies. For more information, see: <https://www.oasis-open.org>.

## Working with documents and folders

- Incorporate documents and content from ECM repositories into IBM Business Process Manager process applications



- Support access to common Enterprise Content Management (ECM) systems by leveraging the Content Management Interoperability Services (CMIS) standard

## Internal document content store

- IBM Business Process Manager contains an internal CMIS repository
- Provides consistent document management for external and internal document stores
- Identical user experience, coach views can connect to internal and external ECM the same way
  - If organizations do not currently have an enterprise ECM solution, you can start small and build



CMIS integration

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Figure 3-7. Internal document content store

## Defining ECM server properties

The screenshot displays the 'Servers' configuration window. On the left, a list titled 'Servers' contains one entry: 'fndemo1 {fndemo1}'. The main area on the right is for configuring the selected server. It includes the following fields and controls:

- Host Name:** fndemo1
- Port:** 9080
- Context Path:** /fncmis
- Secure Server:** ☐
- Repository:** FNOS1
- User ID:** P8Admin
- Password:** [masked with dots]
- Always Use This Connection Information:** ☒
- ECM Document Authorization Service:** <none> [Select... X]
- Event Broadcasters:** <none> [Select... New... X]
- Test Connection:** A button highlighted with a red rectangular box.

CMIS integration

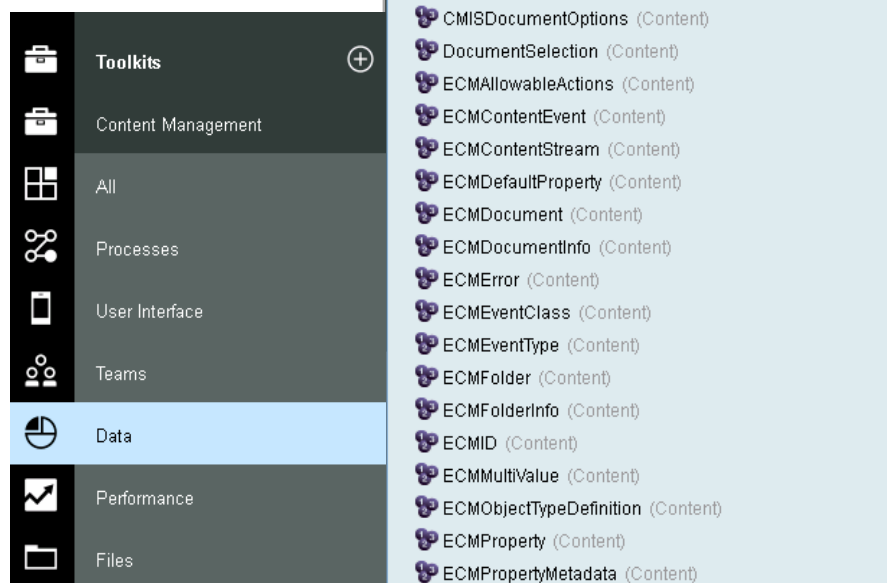
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Figure 3-8. Defining ECM server properties

To define the server properties, on the **Process Application Settings > Servers** tab, add an ECM server to the servers list and provide the connection details.

## Create business objects

- Content Management Toolkit
  - Ajax Services
  - Business Objects
  - Coach Views



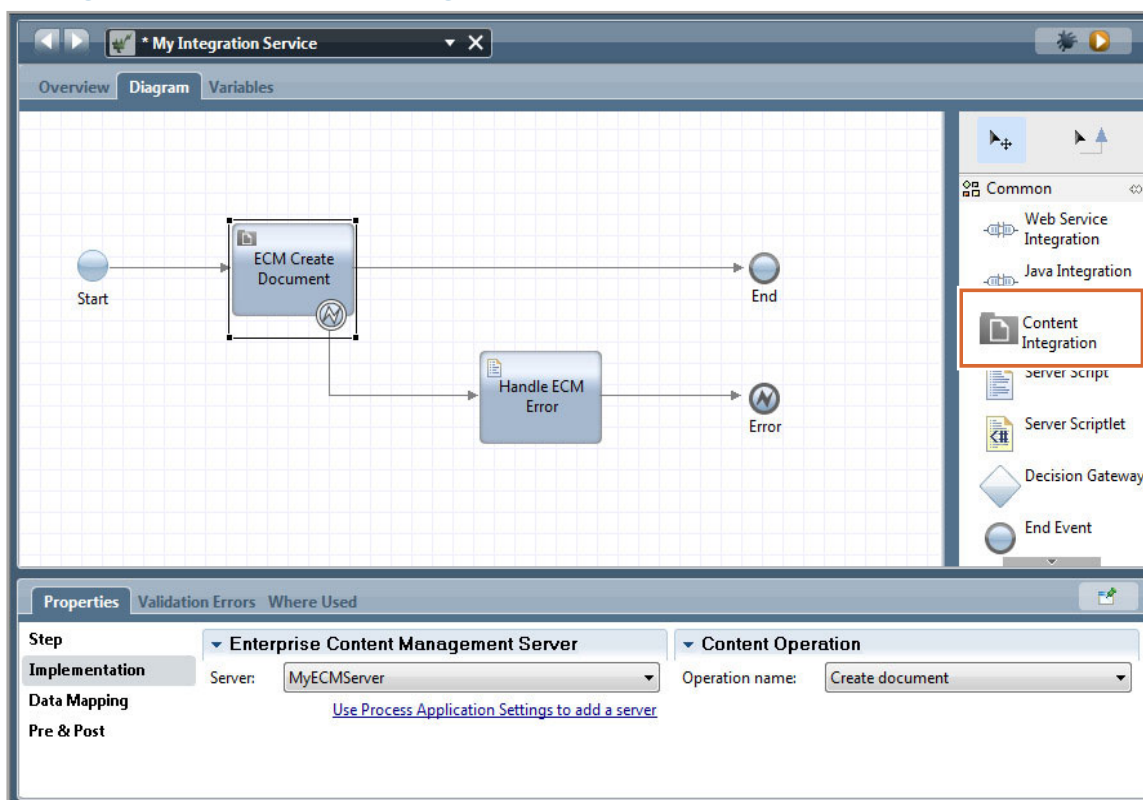
CMIS integration

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Figure 3-9. Create business objects

The next step is to create the business objects that are associated with the document controls.

## Using the Content Integration Step in Services



CMIS integration

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Figure 3-10. Using the Content Integration Step in Services

Third, design the content operations. Create an integration service and add the Content Integration step to the canvas. Configure the Content Integration step by connecting to the server and assigning an operation name. Map the output data to your content variables.

## List of ECM operations (1 of 2)

Operation name	Description
Add document to folder	Add an existing document to a folder
Cancel check out document	Reverse the effect of a checkout
Check in document	Check in the private working copy of a document
Check out document	Create a private working copy of the document
Copy document	Create a document as a copy of the source document
Create document	Create a document of the specified type
Create folder	Create a folder of the specified type
Delete document	Delete the specified document
Delete folder	Delete the specified folder
Get all document versions	Get the list of all documents in the specified version series
Get document	Get the specified information for the document
Get document content	Get the content stream for the specified document

Figure 3-11. List of ECM operations (1 of 2)

This slide and the next shows the extensive list of operations available to perform inside IBM Business Process Manager after the ECM server is configured and selected.

## List of ECM operations (2 of 2)

Operation name	Description
Get documents in folder	Get the set of documents contained in the specified folder
Get folder	Get the specified information for the folder
Get folder by path	Get the specified folder
Get folder tree	Get the set of folders contained in the specified folder or its subfolders
Get type definition	Get the definition of the specified folder or document
Get type descendants	Get the set of descendant types defined for the specified folder or document type
Move document	Move the specified document from one folder to another
Move folder	Move the specified folder from one folder to another
Remove document from folder	Remove an existing document from a folder
Search	Execute a CMIS query statement against the contents of the repository
Set document content	Set the content stream for the specified document object
Update document properties	Update properties of the specified document



## Ajax service content integration search operation

**Content Filters**

**Build Search Filter**

Select Content Filter for a graphical user interface; Data Mapping to write a hand-coded CMIS query.

Method of creating search: Content Filters

**Object Type**

Select Document for document types, for example, email or insurance form; Folder for folder types, for example, case folder or car insurance folder.

Document IBM BPM document Select...

**Properties**

The layout and sorting order of the result set are determined in this pane using server data. Set the layout with the arrows at the base of the pane. Set the sorting order with the column header arrows.

	Name	ID	Version Series	File name
1	New Hire Request	idd_300AED53-0000-C41E-9033-7540F33D7F59	idv_300AED53-0000-CA15-ADE6-BFD05C1B1394	New Hire

Add Remove ← →

☐ Result set sort order specified by process variable js

**Search Criteria**

Refine your search with custom properties. Any additions will not affect the Properties table.

Match Criteria All

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Figure 3-13. Ajax service content integration search operation

When you place a content integration step on the canvas and configure it as a search operation, the **Content Filters** tab is displayed. You can use this tab to configure the search. You can use content filters or data mapping as your method of creating the search. You can change the object type to folder or document. You can configure the folder or document properties and provide a live view. You can provide a sort order and add any additional criteria for your search.

## **3.2. Responsive document controls**

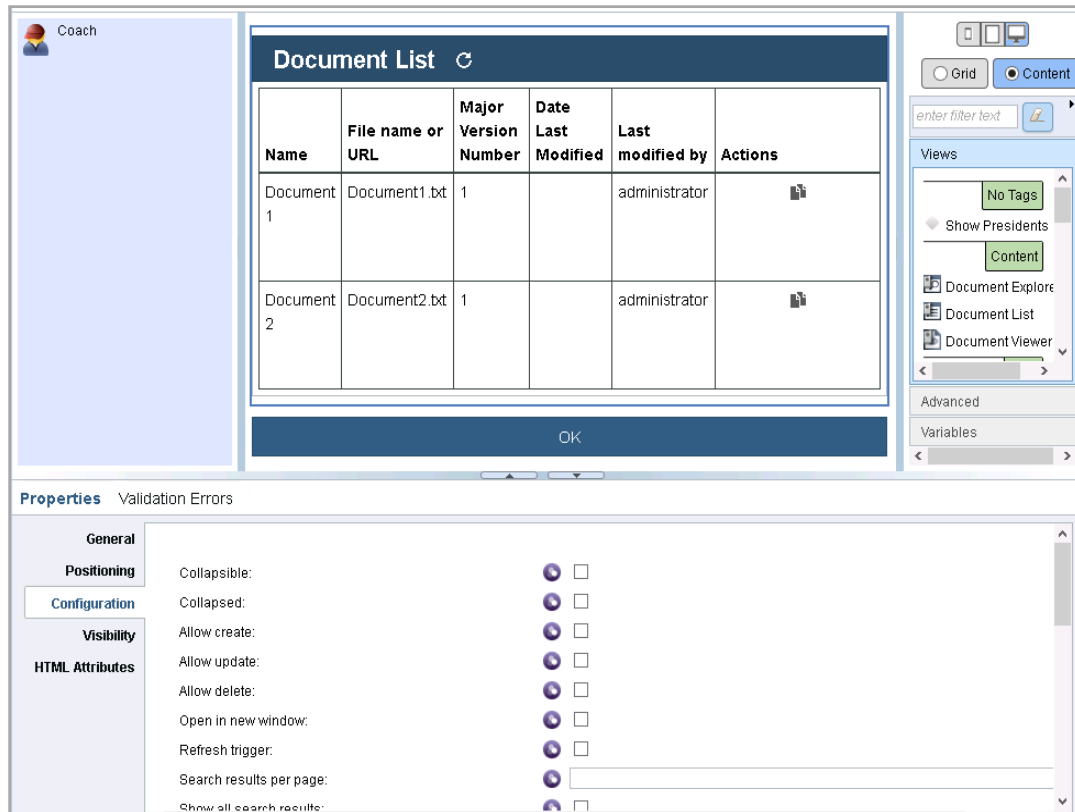
## Responsive document controls

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*Figure 3-14. Responsive document controls*

## Document List coach view



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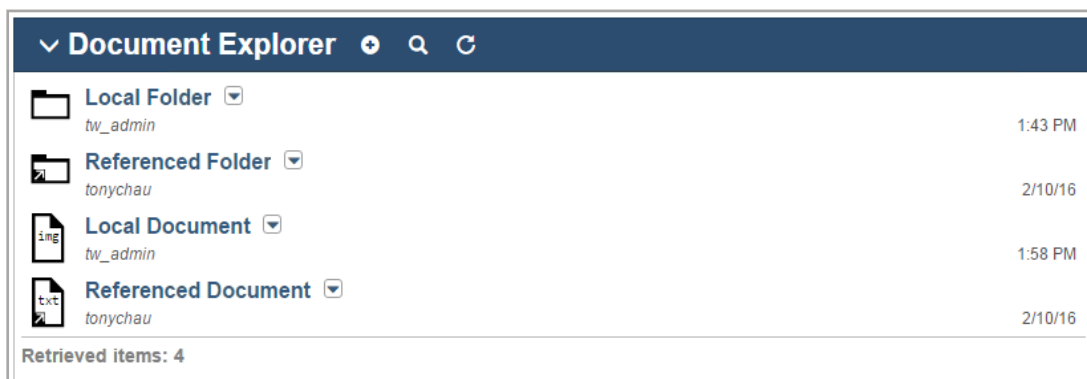
Figure 3-15. Document List coach view

The final optional step is to display the results to users. Add the document coach view to the canvas that is found in the Content section of the palette.

A CMIS query in the document repository generates the Responsive Document List control display of documents.

The document list control contains various configuration options. You can configure the coach view for paging, create, retrieve, update, and delete operations, and even configure the Ajax services that are used to retrieve the documents and metadata from the ECM system.

## Document Explorer coach view



- External ECM via references
- BPM Document upload options
- Document viewer integration
- Client-side search
- Refresh

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Figure 3-16. Document Explorer coach view

Another control available is the Document Explorer control. Use the responsive Document Explorer control to display a list of documents and folders for a process instance that is stored in the IBM BPM content store.

## Document Viewer coach view



- Uses ECMDocumentInfo variable type that contains the URL to the documents
- You can add an external document or folder reference to the IBM BPM managed store
- By default, the document opens in a new browser tab

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Figure 3-17. Document Viewer coach view

The final control type for responsive coach views is the Document Viewer.

By default, the document opens in a new browser tab. To open documents in a Document Viewer control that is bound to the same variable that this responsive Document Explorer is, enable the Use Document Viewer option. You can also configure the coach view to refresh the list of documents based on a boolean trigger variable.

You can add an external document or folder reference to the IBM BPM managed store by using the Document Viewer.

## Troubleshooting

- Web technologies (Firebug console log, Chrome developer tools, and other tools)
- Server logs
- Fiddler trace
- JavaScript debugging (optional)

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*Figure 3-18. Troubleshooting*

For more information about the native and third-party tools you can use to help troubleshoot IBM Business Process Manager:

[http://www.ibm.com/support/knowledgecenter/SSFPJS\\_8.5.7/  
com.ibm.wbpm.mon.trbl.doc/trbl/trouble\\_intro.html](http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.mon.trbl.doc/trbl/trouble_intro.html)

## 3.3. Content events



## Content events

CMIS integration

*Figure 3-19. Content events*

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## Content Event Subscription for BPM Documents

The screenshot shows the 'Event Subscription' configuration window for a 'BPM Document Event'. The window is divided into two main sections: 'Common' and 'Details'.

**Common Section:**

- Name: BPM Document Event
- Type: ECM
- Modified: author1
- Documentation: [\(Edit\)](#)

**Details Section:**

- ECM Server: IBM BPM document store (with a [Learn more](#) link and a note: 'Use the Process Application Settings editor to add a server')
- Event Class: Document
- Object Type: BPM Document Attachment
- Include Subtypes: ☐
- Event Type: Created
- Attached Service: <none> (with 'Select...' and 'New...' buttons)
- Test Subscription... button

**Exposing Section:**

- Event Broadcasters: [Al...rs](#), [Syst...Data](#) (with 'Select...', 'New...', and 'X' buttons)

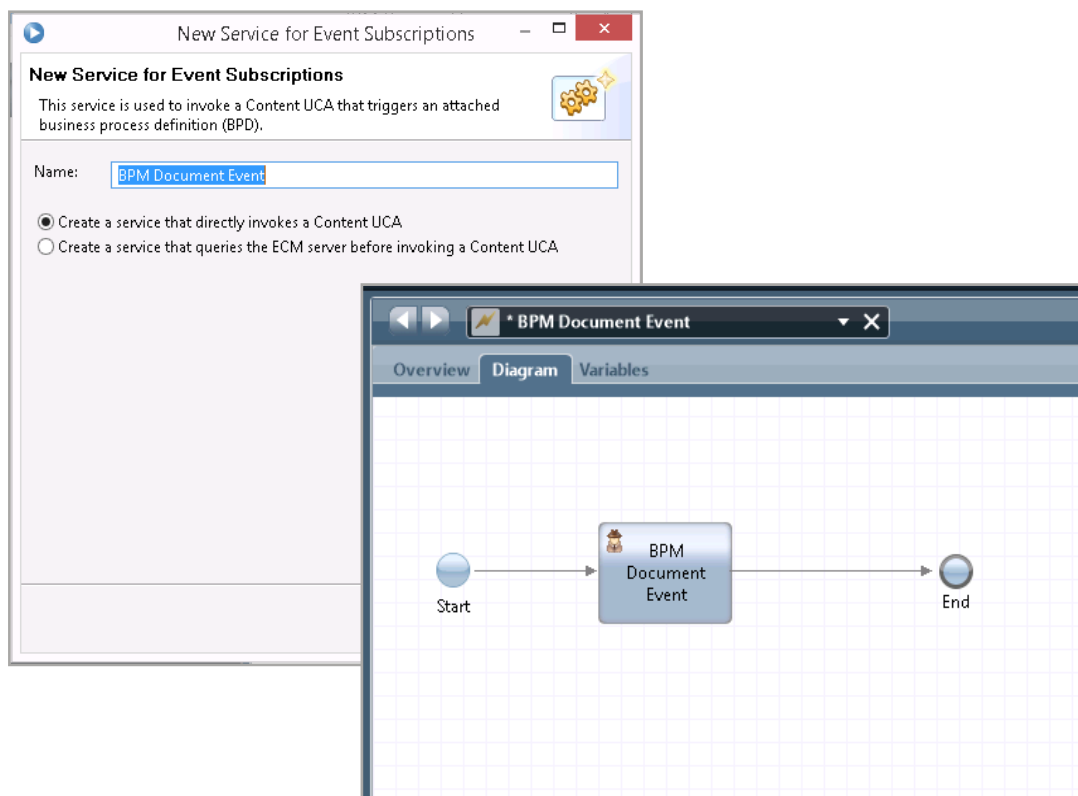
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Figure 3-20. Content Event Subscription for BPM Documents

You create event subscriptions in the library, and this signals IBM Business Process Manager when events occur on the ECM. Both internal and external ECM systems can trigger an event, although limitations exist for the internal ECM system. You must also either select or create an attached service that is run when the document event is triggered.

## Creating the attached service



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Figure 3-21. Creating the attached service

When you create the attached service, IBM Business Process Manager can create a service with an Undercover Agent automatically, or the second option provides logic to query the ECM server before invoking the Undercover Agent. You use the Undercover Agent when implementing the event you model on the process.

## Internal document store outbound ECM operations

ECM Operation	Description
Cancel check out document	Reverse the effect of a checkout
Check in document	Check in the private working copy of a document
Check out document	Create a private working copy of the document
Create document	Create a document of the specified type
Delete document	Delete the specified document
Get all document versions	Get the list of all documents in the specified version series
Get document	Get the specified information for the document
Get document content	Get the content stream for the specified document
Get type definition	Get the definition of the specified folder or document
Get type descendants	Get the set of descendant types defined for the specified folder or document type
Search	Execute a CMIS query statement against the contents of the repository
Set document content	Set the content stream for the specified document object
Update document properties	Update properties of the specified document

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Figure 3-22. Internal document store outbound ECM operations

When using the internal document store, the outbound ECM interactions are limited to the listed operations.

## Internal document store inbound ECM event operations

ECM Operation	Description
Check Out Canceled	User cancels the check out of an existing document
Checked In	User checks in an existing document
Checked Out	User checks out an existing document
Created	User creates a document in the internal document store
Deleted	User deletes a document in the internal document store
Updated	User updates a document in the internal document store

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Figure 3-23. Internal document store inbound ECM event operations

When using the internal document store, the outbound ECM interactions are limited to the listed event types.

## Modeling content events on a process

The screenshot displays the IBM BPM interface. At the top, a process canvas shows a flow with a 'Review Posting' task and a 'Hiring Request Document Start' event. The event is highlighted with an orange border. Below the canvas, the 'Properties' window is open, showing the 'Implementation' tab. The 'Start Event Type' is set to 'ECM Content'. Under 'Event Properties', the 'Attached content UCA' is set to 'Hiring Request Document Start', and the 'Condition' is set to '1'. The 'Consume message' checkbox is unchecked.

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Figure 3-24. Modeling content events on a process

Use start and intermediate events on the process canvas to model content events. By configuring the event as an ECM Content Event type, the process can react to any content event associated with the attached undercover agent.

## Instructor demonstration: Creating CMIS integrations

- Explore the CMIS integration settings
- Create and configure a content event



CMIS integration

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*Figure 3-25. Instructor demonstration: Creating CMIS integrations*

## Unit summary

- Use a CMIS system with IBM Business Process Manager
- Create content events in a process

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*Figure 3-26. Unit summary*



## Review questions



1. True or False: You must integrate an external CMIS system with IBM Business Process Manager to model and implement a content event on a process.
2. When you create a content event subscription and create an attached service, IBM Business Process Manager offers to automatically create:
  - A. A general system service with an undercover agent that is connected in the flow
  - B. An integration service with a web service that is connected in the flow
  - C. A client-side human service with a coach that is connected in the flow
  - D. A subprocess with a content start event
3. Which library artifact when attached to a content event allows the process to react to ECM events?
  - A. Integration service
  - B. Client-side human service
  - C. Web service
  - D. Undercover agent

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*Figure 3-27. Review questions*

Write your answers here:

1.

2.

3.

## Review answers (1 of 2)



1. True or False: You must integrate an external CMIS system with IBM Business Process Manager to model and implement a content event on a process.

The answer is False. If your organization does not have an enterprise CMIS, IBM Business Process Manager includes an internal document store.

2. When you create a content event subscription and create an attached service, IBM Business Process Manager offers to automatically create:

- A. A general system service with an undercover agent that is connected in the flow
- B. An integration service with a web service that is connected in the flow
- C. A client-side human service with a coach that is connected in the flow
- D. A subprocess with a content start event

The answer is A. The wizard creates a general system service with the required undercover agent to trigger an event on a process.

## Review answers (2 of 2)



3. Which library artifact when attached to a content event allows the process to react to ECM events?

- A. Integration service
- B. Client-side human service
- C. Web service
- D. Undercover agent

The answer is D. When you implement the event with an Undercover Agent, any services that use the UCA in the service flow trigger the event on the process.

## Exercise 2

Handling content events in a process

CMIS integration

*Figure 3-30. Exercise 2*

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## Exercise objectives

After completing this exercise, you should be able to:

- Define ECM folders
- Implement content events on a process



---

# Unit 4. Adding localization

## Estimated time

01:30

## Overview

This unit explores how to add localization to a coach.

## How you will check your progress

- Checkpoint
- Lab exercise
- Demonstration and walk-through

## Unit objectives

- Add localization to a coach

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*Figure 4-1. Unit objectives*

## Topics

- Adding localization

Adding localization

*Figure 4-2. Topics*

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## 4.1. Adding localization

## Adding localization

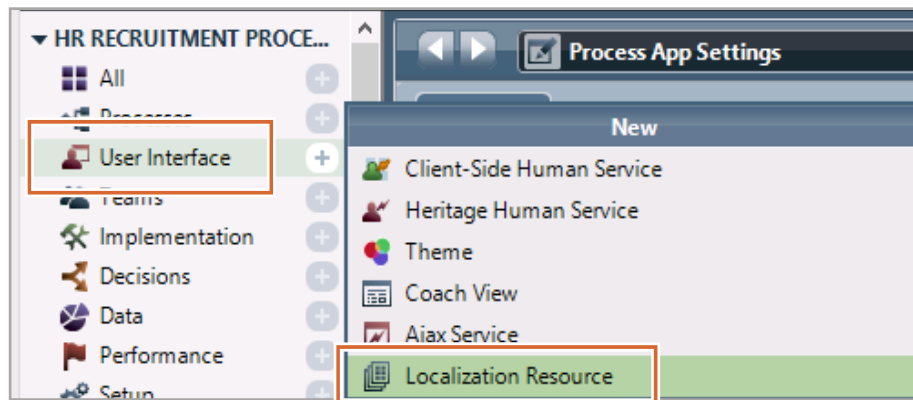
Adding localization

*Figure 4-3. Adding localization*

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## Creating a localization resource

- Coaches are built with a default language
- Localization resources can translate pages into other languages
- Create a localization resource in the **Library > User Interface** category



Adding localization

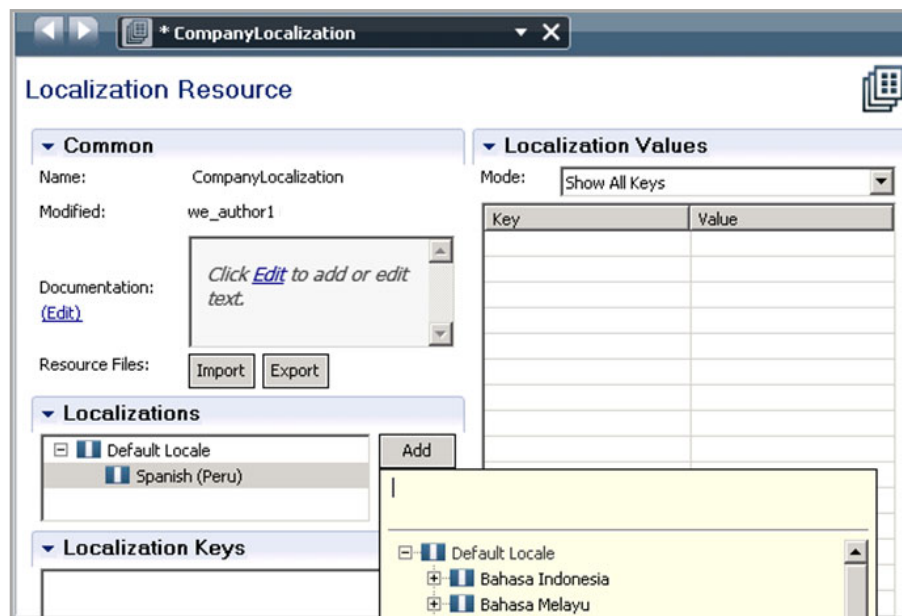
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Figure 4-4. Creating a localization resource

If you want coaches that are translated into different languages, you must localize the coaches to change the language on the screen to the user's language. You can do this by creating a localization resource from the **Library > User Interface** category.

## Creating localization

- You can import existing resource files or export them to other programs
- The localization resource contains a default locale that is used when user-selected locale does not match the localizations that you create



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Figure 4-5. Creating localization

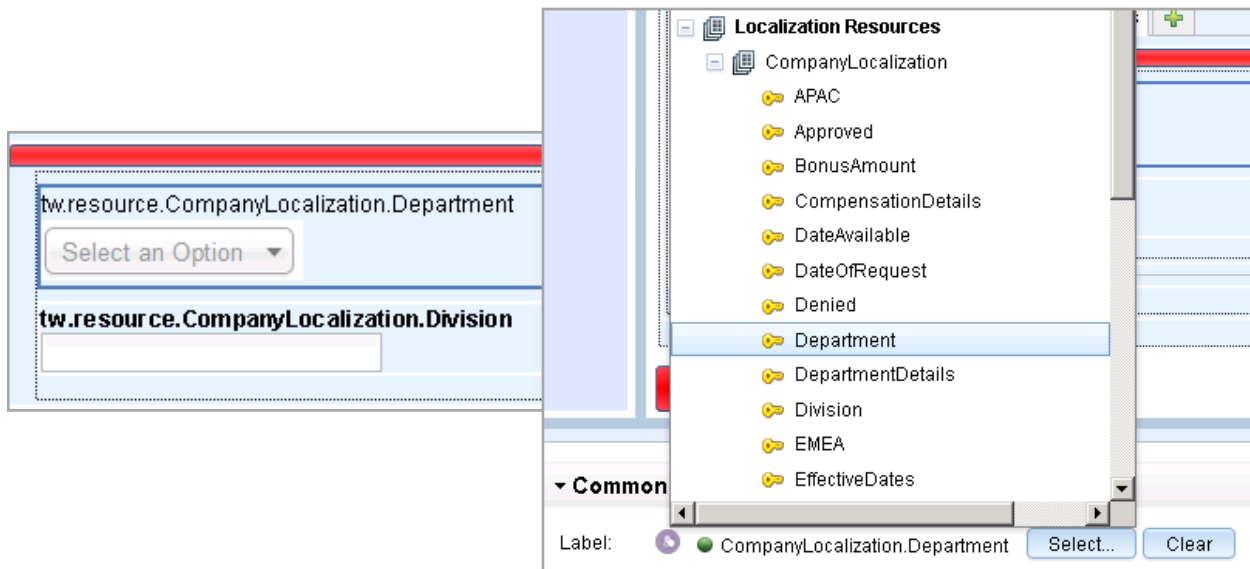
To add the stored localization keys:

- Select the localization key to edit.
- Add a localization value for the default locale, and press Ctrl+Enter until all keys are completed.
- Select the next locale and input the keys.

If you have existing localization resources in your organization, import them into IBM Business Process Manager. When creating your localization, a default locale is already created for you. You add the locales to the resource, and when a user selects a locale that does not match the locales available, the default locale values are shown.

## Assign keys to labels on the coach

- Add the localization resource to the view or coach service under the **Variables** tab in the coach view
- Assign the localization resource bundle key to the label



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Figure 4-6. Assign keys to labels on the coach

By changing the label of your control to a variable, the label on the coach palette also changes to reflect the variable name of the localization resource key.

## Test localization

- Set the user profile by using the portal language preference
  - When you select the language, the portal requires the user to log out and log back in
  - Testing the changes inside the portal replicates the user experience

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Figure 4-7. Test localization

Use the preferences menu in process portal to set the locale. To see the changes in the portal, users must log off and log back in to the portal. This test most accurately reflects the process participant user experience.

## Instructor demonstration: Localize a coach



- Create a localization bundle
- Create keys
- Enable localization on a coach
- Test the localization

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*Figure 4-8. Instructor demonstration: Localize a coach*

## Unit summary

- Add localization to a coach

Adding localization

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*Figure 4-9. Unit summary*



## Review questions



1. Which of the following tabs do you use to add a localization resource to the view or coach service in the coach view?
  - A. Overview
  - B. Diagram
  - C. Variables
  - D. Implementation
  
2. True or False: IBM Business Process Manager localizes a coach that is based on the language selection setting in the browser options.

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Figure 4-10. Review questions

Write your answers here:

1.

2.

## Review answers



1. Which of the following tabs do you use to add a localization resource to the view or coach service in the coach view?
  - A. Overview
  - B. Diagram
  - C. Variables
  - D. Implementation

The answer is C. Add the localization resource to the view or coach service under the Variables tab in the coach view.

2. True or False: IBM Business Process Manager localizes a coach that is based on the language selection setting in the browser options.

The answer is False. Localization language is set in the Process Portal User Profile settings.

## Exercise 3

Localizing a coach

Adding localization

*Figure 4-12. Exercise 3*

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## Exercise objectives

After completing this exercise, you should be able to:

- Create a localization resource
- Implement the localization on a coach
- Test the localization



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*Figure 4-13. Exercise objectives*

---

# Unit 5. Designing complex process applications

## Estimated time

01:30

## Overview

A business object model (BOM) represents the business artifacts in a process that also account for the data elements that a developer typically uses. When the BOM is identified, developers use appropriate methods to implement the data elements. This unit covers the BOM and optimal business objects that are used as the data architecture for the complex needs of a process.

## How you will check your progress

- Checkpoint
- Lab exercise

## Unit objectives

- List the steps for designing a process data model
- Determine how process visibility is implemented
- Determine where process data is stored
- Design an architecture for optimal data transfer into and out of the process
- Explain how to implement optimal business objects in a process

## Topics

- Creating the business object model
- Optimal handling of data

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*Figure 5-2. Topics*

## **5.1. Creating the business object model**



## Creating the business object model

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*Figure 5-3. Creating the business object model*

## Creating the business object model (1 of 2)

When you consider data and how it is used, think of the four data views

- The Process Owner perspective
  - Helps the developer define the major business objects that the process deals with
  - Identifies the data that is used to determine which paths are taken, how long each task takes, and who does each task
- The Analyst perspective
  - Helps developers define the data structures for the performance snapshots that are taken throughout the process
  - Informs developers where in the process these snapshots must be captured

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Figure 5-4. Creating the business object model (1 of 2)

When you consider data and how it is used, think of the four data views:

- The process owner view
- The process analyst view
- The process participant view
- The application developer view

By considering these four data views, you can build your data model and system architecture early in the implementation of the process. Until all perspectives are analyzed, it is difficult to build the data model. It requires more initial work than usual, but it pays off in the end when you have fewer changes to the data model because of new and unexpected requirements. Some hints on what information you can get from each perspective:

- The Process Owner perspective helps the developer define the major business objects that the process deals with. The owner data model also identifies the data that is used to determine which paths are taken, how long each task takes, and to whom to assign each task.
- The Analyst perspective helps the developer define the data structures for the performance snapshots that are taken throughout the process, and informs the developer where in the process these snapshots must be captured.

## Creating the business object model (2 of 2)

- The Participant perspective
  - Helps developers define the process payload (the data that is passed to and from tasks)
  - Helps them define the data system architecture that is required to retrieve and modify data within activities
- The Process Application Developer perspective
  - Must incorporate all the perspectives and ensure that the needs of all process participants are met
- Sometimes, a judgment call must be made on what is in scope and not in scope, and submit unmet requirements to a backlog for inclusion in a future release
- Agile software development dictates that developers avoid coding for future requirements
  - Plan and model business objects with future requirements in mind, but do not implement future requirements

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Figure 5-5. Creating the business object model (2 of 2)

- The Participant perspective helps developers define the process payload (the data that is passed to and from tasks). It also helps them define the data system architecture that is required to retrieve and modify data within activities.
- The Process Application Developer perspective must incorporate all the perspectives and ensure that the needs of every process participant are met. Sometimes, a judgment call must be made on what is in scope and not in scope during the current release cycle, and submitting unmet requirements to a backlog for inclusion in a future release. Agile software development dictates that developers avoid coding for future requirements. Developers must plan and model business objects with future requirements in mind, but not implement future requirements.

## Steps for determining your data model

1	Identify the flow data
2	Gather visibility requirements from the process owner and determine business objects
3	Gather reporting requirements from the process analyst and determine data snapshots
4	Gather task level data requirements from the process participants and determine the process payload
5	Determine the data variables from the perspective of the process developer
6	Consolidate the four data views
7	Determine where the data is stored
8	Add appropriate tracking information

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Figure 5-6. Steps for determining your data model

## 5.2. Optimal handling of data

## Optimal handling of data

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*Figure 5-7. Optimal handling of data*

## Large variables

- For simplicity, many developers create one large object for a top-level process and include business objects as members of the larger object
  - This approach can sometimes lead to degraded performance
  - Group related variables into larger top-level objects, code for simplicity and maintenance
- Map the subobjects to the inputs and outputs of the activities
  - If the activity requires only a small amount of data from the top-level object, do not send large objects into each activity
- Possible trouble areas
  - Parallel activities
  - Performance
- Be careful if a complex type contains hundreds of fields
  - Reconsider the data model because such a large variable type might cause performance issues and maintenance problems

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*Figure 5-8. Large variables*

Large business variables can be problematic. If one large complex type holds nested complex types, this complex larger type can pass parts of the larger object into and out of the activities on the process. When considering this pattern, it is important to consider how the business objects affect parallel activities and system performance.

## Pass versus lookup

- Every time the server accesses an external repository (database, web service, and others) the system incurs a performance cost
- Consideration must be made for every data element in the process on how to handle the data
  - Is it necessary for the data to be immediately persisted to a database?
  - Can an external system change the data in the middle of a process instance?
  - Is the data static throughout the process instance?

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*Figure 5-9. Pass versus lookup*

It is not always clear what data must be passed to an activity (in the payload) and what data must be looked up from within an activity. In general, if you can, it is a good idea to look up data early in the process and pass the data to any activities that require the data. It provides system performance advantages that are compared to looking up data multiple times throughout the process instance lifetime.



## When to look up data

Determine how often an external system changes a record

- No changes during the process lifespan
  - Look up data at the beginning of the process, map to the business object, and pass the data to every activity that requires the data
- Changes during the process lifespan, but not likely during an activity
  - Look up data before every activity, or look up data at the beginning of an activity that requires the data
- Changes while a user performs an activity
  - Look up data before every coach
  - If data is highly dynamic, consider Ajax or a manual retrieval button on the coach

Use the early lookup pattern for any data that is not likely to change outside the process. When sharing data with an external system of record (SOR) while the process is running, this pattern is not ideal. If the data changes during the lifecycle of a process instance, look up the data within each activity to make sure that it is not stale.

## Authoritative data

- IBM Business Process Manager is the system of record (SOR) for process data
- Persist the business data that is collected or created during a process instance to a business data system of record
  - If you have an existing database, use an integration to persist the data to the organizational database
  - If the data and the process are new to the organization, create a database external to IBM Business Process Manager to store the business data

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*Figure 5-11. Authoritative data*

Although IBM Business Process Manager might collect authoritative business data during a process, you must persist this data to an authoritative business data system of record. The Business Performance Data Warehouse is the authoritative data for process performance data only.

## Data to look up one time

- Static lists of data
  - Lists of static choices that are not dependent on dynamic data, such as a list of states that are displayed on a coach
- Records
  - If an external system cannot change a record, look up or create the record and pass that record along to process participants for changes
- Data that never changes in the lifespan of a process
  - Look up or access the data one time at the beginning of a process, and pass the data along to each activity
- Always persist the record data at the end of the process to a business data system of record

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Figure 5-12. Data to look up one time

A common example of passing data would be to create a list of states that are required on multiple coaches as a select box. That list of data does not change during the process execution, and that data can be shared between activities that require a list of states.

A common example that would not be ideal for the early lookup pattern would be a requirement to show customer information from an external system that can be altered anytime during the process. To get the most recent information, create a reusable service to look up the customer record and include that service before every coach that shows the data. Following this pattern eliminates showing stale data.

## Instructor demonstration: Designing complex process applications

- Identify the four data perspectives and how they influence development in Process Designer
- Create optimal business objects



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*Figure 5-13. Instructor demonstration: Designing complex process applications*

## Unit summary

- List the steps for designing a process data model
- Determine how process visibility is implemented
- Determine where process data is stored
- Design an architecture for optimal data transfer into and out of the process
- Explain how to implement optimal business objects in a process

## Review questions



1. True or False: The Process Application Developer perspective must consider all of the other perspectives.
2. True or False: To be safe, developers must create library artifacts that are not used in the current release cycle, but might be used in future revisions of the process application.
3. True or False: IBM Business Process Manager is the system of record for business data.
4. True or False: For simplicity, map an entire complex object to every activity that requires a subobject of the large complex object.

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Figure 5-15. Review questions

Write your answers here:

- 1.
- 2.
- 3.
- 4.

## Review answers



1. True or False: The Process Application Developer perspective must consider all of the other perspectives.  
The answer is True.
2. True or False: To be safe, developers must create library artifacts that are not used in the current release cycle, but might be used in future revisions of the process application.  
The answer is False. Agile software development dictates that developers must avoid coding for future requirements.
3. True or False: IBM Business Process Manager is the system of record for business data.  
The answer is False. IBM Business Process Manager is the system of record for process data. Use existing systems or create an external system of record for all business data.
4. True or False: For simplicity, map an entire complex object to every activity that requires a subobject of the large complex object.  
The answer is False. Map the subobjects to the inputs and outputs of the activities. Do not map the entire object unless it needs all of the data.

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Figure 5-16. Review answers

---

# Unit 6. Advanced routing

## Estimated time

01:30

## Overview

This unit covers routing tasks to process participants by using the advanced routing capabilities in IBM Business Process Manager. It focuses on routing by using a team filter service and dynamically generated teams.

## How you will check your progress

- Checkpoint
- Lab exercise



## Unit objectives

- Explain user distribution in a process application
- Determine the best source for team data
- Model decision authority for a process
- Determine when to implement various types of routing
- Create a routing design by using a team filter service

Advanced routing

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*Figure 6-1. Unit objectives*

## Topics

- Team data and lanes
- Team filters
- Experts team

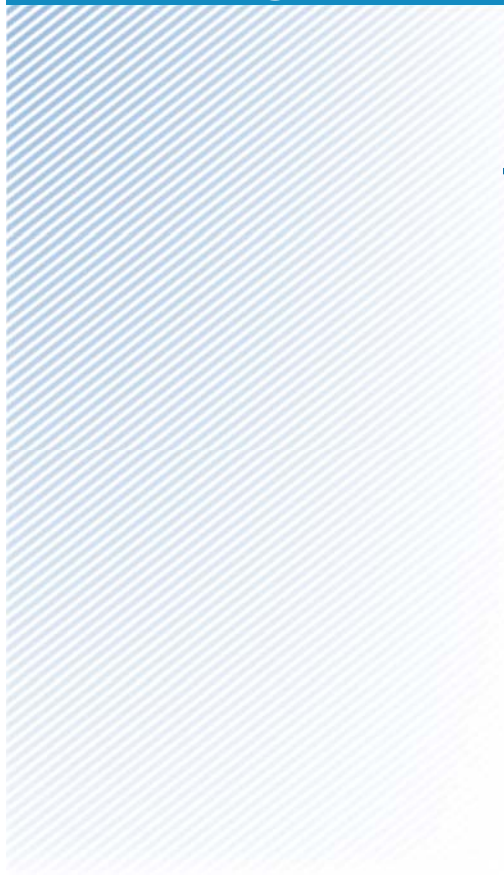
Advanced routing

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*Figure 6-2. Topics*

## 6.1. Team data and lanes

## Team data and lanes



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*Figure 6-3. Team data and lanes*

## Team data and lanes

- Team members come from two sources:
  - System of record (SOR)
  - User list
- System administrators have governance over SOR change control procedures
- User lists are more dynamic, and they are set up so business people can administer the group
- Lanes communicate how advanced routing works with a compact number of lanes

Advanced routing

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Figure 6-4. Team data and lanes

Team member data can come from two sources: a system of record or a user list. When team groups come from a system of record, such as LDAP or a relational database, then system administrators or external data administrators have governance over the change control procedures. Team members that come from a user list are more dynamic and are set up so business users can administer the group.

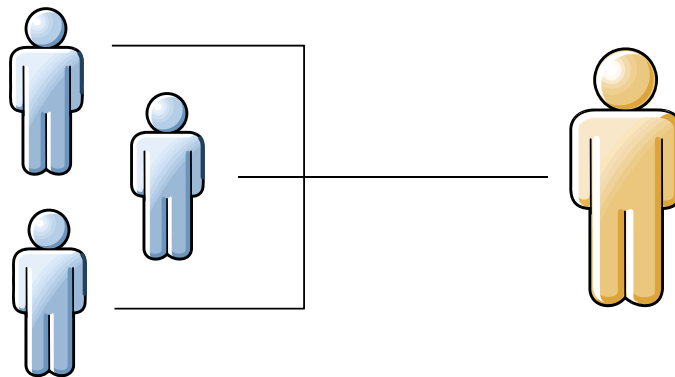
You should consider these things when examining team data from either source:

- The system of record data source
  - Does your company currently use an external security provider, such as LDAP or Active Directory?
  - Is this security provider already integrated with IBM Business Process Manager?
  - If not already established, must users be stored and administered internally or externally?
- User list
  - Do developers have access to the Process Server Console to create groups?
  - If you have limited permissions to the Process Server Console, is there a dedicated IBM Business Process Manager system administrator to create groups?
- Lanes

- Developers want a diagram to be clear for the business audience, but do not want to confuse the audience with a massive process diagram that has numerous lanes and activities.
- With advanced routing, you can avoid adding lanes by setting the routing on an activity, but the diagram must still be readable and answer the question, “Who does what?”
- It is important to remember to communicate how advanced routing works with a compact number of lanes and without getting too technical in the explanation.

## Organizational data

- The requirements of everyday business often demand complex routing rules because many organizations have complex process requirements
- One goal of BPM is process improvement
  - The first release of a project is not the end of the software development project
  - It represents the beginning of a process improvement cycle
- Simplifying a process might be the end goal, but the journey to achieve that goal might take a long time
- Integrate your company organizational chart into your process model



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Figure 6-5. Organizational data

Modeling organizational data can be difficult, as most organizational charts constantly change and become web-like, instead of being rigid. However, be sure to integrate the company organizational chart into your process model.

The requirements of everyday business often demand complex routing rules because many organizations have complex process requirements. Remember, a goal of BPM is process improvement, so the first release of a project is not the end of the software development project. It represents the beginning of a process improvement cycle. Simplifying a process might be the end goal, but the journey to achieve that goal might be a long one.

## Types of routing

The different types of routing and distribution types

- Types:
  - Lane
  - Team
- Distribution:
  - None
  - Last user
  - Load balance
  - Round robin

The screenshot shows the 'Assignments' configuration panel in IBM Business Process Manager. It contains two dropdown menus. The first, labeled 'Assign to:', has a list of options: 'Lane', 'Lane', and 'Team'. The second, labeled 'User distribution:', has a list of options: 'None', 'None', 'Last user', 'Load balance', and 'Round robin'.

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Figure 6-6. Types of routing

Several routing and distribution types are available to ensure that tasks get to the right person. If you have experience with IBM Business Process Manager, you probably are familiar and use some of the routing and distribution types.

The Lane option assigns the task to the lane that the activity is in. Team assigns the task to a team designated by a string or JavaScript object.



## 6.2. Team filters

## Team filters

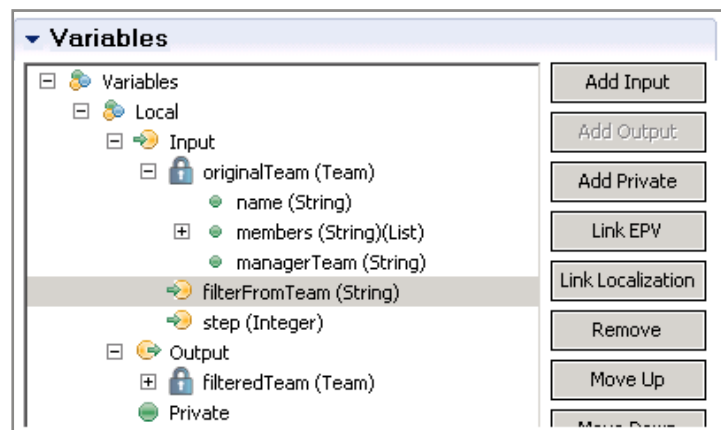
Advanced routing

*Figure 6-7. Team filters*

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## Creating team filters

- Create a team filter with the template
- You can add as many inputs to the team filter as necessary
  - The originalTeam (Team) is automatically added as a default
- The output contains a list of strings that stores the user names, teams, or security groups that are part of the filtered team
- When filtering, if an originalTeam member contains a team or a security group and you want to remove a user name, you must:
  - Create a list of users that the team or security group contains
  - Remove the user when found
  - Return the filtered list



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Figure 6-8. Creating team filters

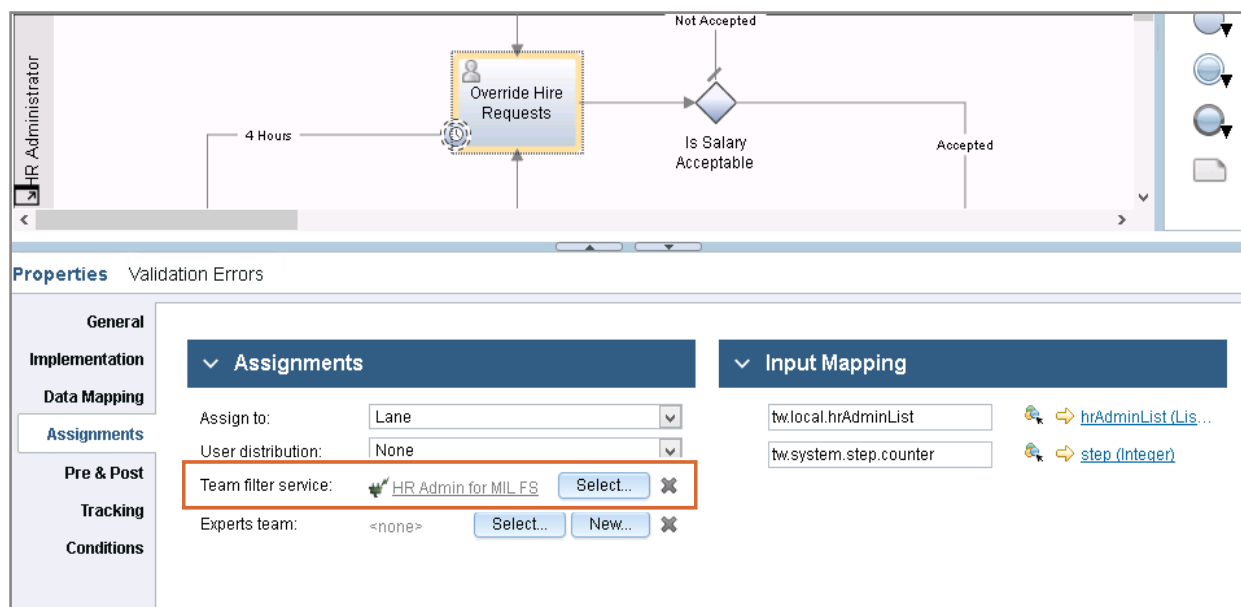
The quickest way to create a team filter is to use the team filter template. This template defines the required inputs and outputs of the service. From there, you can add any number of inputs necessary to filter the filteredTeam object.

The Team object contains a name (String) that is the name of the team. It also contains a managerTeam (String) object that is the name of the team that manages the filteredTeam. Finally, the members (String)(List) object contains a list of user names, teams, or security groups that are part of the filtered team. When users log in to the portal, IBM Business Process Manager checks this list to see whether the user is assigned to this filtered team, and if so, shows the task inside the user's portal inbox.

When filtering, it is possible that the originalTeam contains a security group or a team. Therefore, if you aim to remove a user from this team, you must first retrieve the members of the team manually before removing the user.

Because the filtered team service is run when a token is created, you have no way to use the debugger in the Process Designer to step through the filter service at the BPD level. Debug your filter service with the service debugger, and if further debugging is necessary at the BPD level, use the system log and log.debug (message) to assist you.

## Applying a team filter service



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Figure 6-9. Applying a team filter service

Apply the team filter to any activity on a process. The inputs to the team filter can take a list of users and can output the filtered team. If the process runtime variables do not affect the final team list, the input is optional – you can generate the list inside the team filter. When you select an integration service to implement the team filter service for your activity, the input mapping section appears and you can map your process variables to the integration service inputs. The output of your team filter service is the team that the activity is assigned to.

## 6.3. Experts team

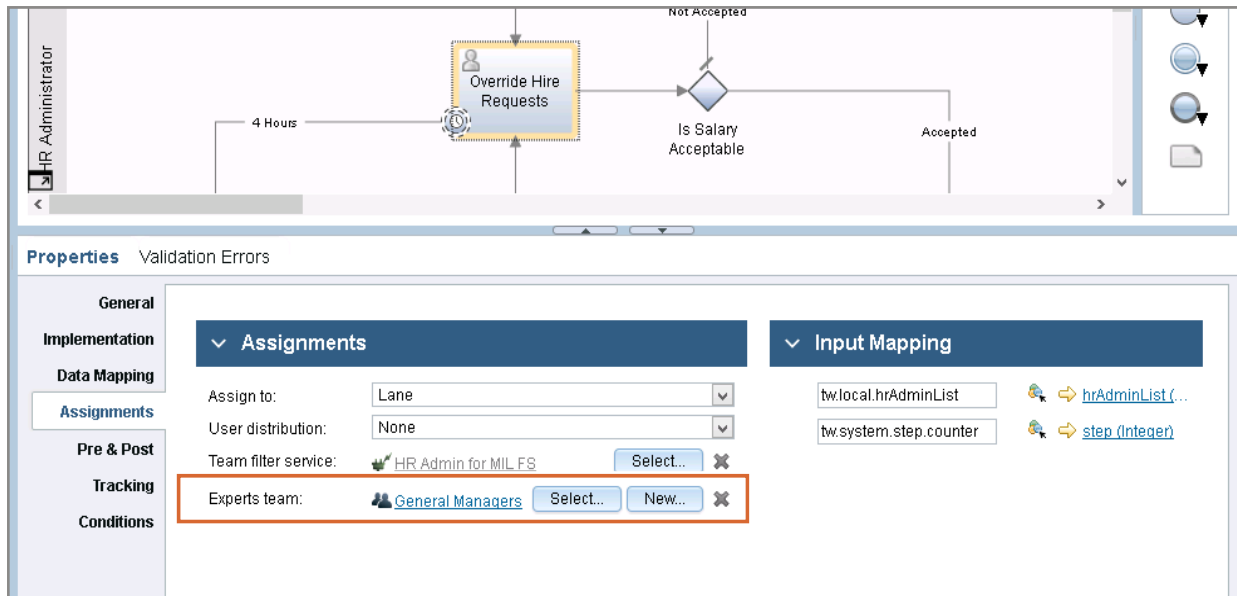
## Experts team

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*Figure 6-10. Experts team*

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## Designating an experts team



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Figure 6-11. Designating an experts team

Business users that work with your process applications can collaborate or request assistance from expert users who are associated with a task or activity. The list of experts appears in the Experts panel in the Process Portal environment. An activity must be associated with a human service before it can be assigned experts.

Each activity in Process Portal can list two types of experts:

- Users who completed this activity in the past, based on historical analysis. This list is limited to a small group of users who completed the activity most frequently.
- The second type of expert consists of users that belong to a team that is explicitly specified in the web Process Designer as an expert group for this activity.

### Procedure

To explicitly specify an expert group for an activity, open the business process diagram in Process Designer and select the activity. In the **Properties > Assignments > Assignments** section, specify the relevant team in the **Experts team** field. If you didn't already create a team that defines the experts for this task, you can create a team to use.

## Instructor demonstration: Advanced routing

- Routing options
- *Assign to overview*
- User distribution



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*Figure 6-12. Instructor demonstration: Advanced routing*



## Unit summary

- Explain user distribution in a process application
- Determine the best source for team data
- Model decision authority for a process
- Determine when to implement various types of routing
- Create a routing design by using a team filter service

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*Figure 6-13. Unit summary*

## Review questions



1. True or False: It is good to integrate your company organizational chart into your process model.
2. True or False: When using a JavaScript expression to custom route a task, you can omit the `USER:` string when routing a task to a user.
3. When should you use custom routing?
  - A. When you assign a task to a group that has many users
  - B. When assigning a task to the team assigned to the lane
  - C. When you want to assign a task to a list of `String()` variables that contains a list of user IDs
  - D. When the logic and algorithms are too complex for other types of routing
4. To implement the “four eyes” policy, you use what type of routing?
  - A. Custom
  - B. List of users
  - C. Team
  - D. Routing policy

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Figure 6-14. Review questions

Write your answers here:

- 1.
- 2.
- 3.
- 4.

## Review answers (1 of 2)



1. True or False: It is good to integrate your company organizational chart into your process model.  
The answer is True.
2. True or False: When using a JavaScript expression to custom route a task, you can omit the `USER:` string when routing a task to a user.  
The answer is True.
3. When should you use custom routing?
  - A. When you assign a task to a group that has many users
  - B. When assigning a task to the team assigned to the lane
  - C. When you want to assign a task to a list of `String()` variables that contains a list of user IDs
  - D. When the logic and algorithms are too complex for other types of routingThe answer is D. Custom routing allows developers to create a string to assign tasks to users or security groups.

## Review answers (2 of 2)



4. To implement the “four eyes” policy, you use what type of routing?

- A. Custom
- B. List of users
- C. Team
- D. Routing policy

The answer is D. Use a routing policy to implement the “four eyes” policy.

## Exercise 4

Implementing the “four eyes” policy

Advanced routing

*Figure 6-17. Exercise 4*

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## Exercise objectives

After completing this exercise, you should be able to:

- Implement the “four eyes” policy by using a team filter



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*Figure 6-18. Exercise objectives*

---

# Unit 7. Managing complex tasks and process interactions

## Estimated time

01:30

## Overview

Process application interactions depend on comprehensive solutions to function correctly. Without the correct approach to implementing complex tasks and interactions, the business process becomes inefficient. This unit covers the methods that developers use to build effective complex tasks and interactions.

## How you will check your progress

- Checkpoint
- Lab exercise
- Demonstration and walk-through

## Unit objectives

- Manage parallel activity execution
- Implement a parallel task approval within a single process instance
- Manage messaging between processes
- Determine how to access data that is shared across multiple process activities
- Cancel a process at any time



## Topics

- Parallel tasks and messaging

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*Figure 7-2. Topics*

## **7.1. Parallel tasks and messaging**

## Parallel tasks and messaging

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*Figure 7-3. Parallel tasks and messaging*

## Parallel tasks

- An implementation requirement that has more than one process activity that is accomplished at any time
- Four main points about parallel tasks:
  - Data flow
  - Sharing data among tasks
  - Variable number of tokens
  - Canceling parallel tasks

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*Figure 7-4. Parallel tasks*

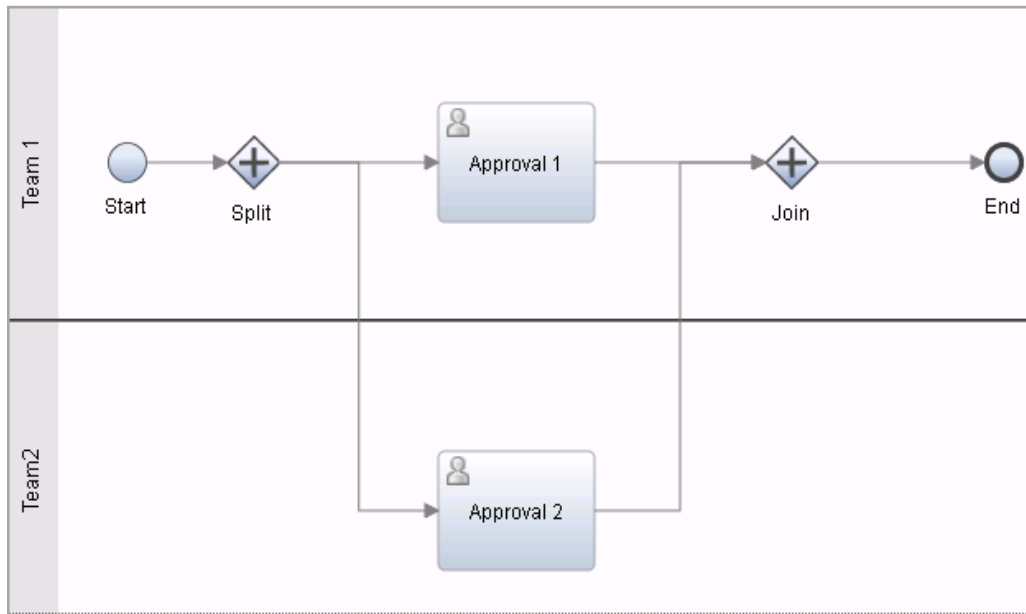
A common implementation requirement is to have more than one process activity that is accomplished at any time. Some interdependencies between these tasks might exist, so it is important to model your process to allow for both multi-participant task accomplishment and data sharing between each.

When attempting to model and implement parallel tasks, consider the following topics:

- Data flow
- Sharing data among tasks
- Variable number of tokens
- Canceling parallel tasks

## Data flow

- With parallel tasks, output data flows out of both tasks
  - If you map the output variable for both tasks to the same complex business object, the task that completes last overwrites the data from all prior tasks



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Figure 7-5. Data flow

With parallel tasks, output data flows out of both tasks. If you map the output variable for both tasks to the same complex business object, the task that completes last overwrites the data from all prior tasks. To avoid this problem, do not map to the entire complex object as an input; map to the business objects inside the large complex business object. Consider what data might be overwritten when mapping the outputs. Some post-processing might be required to consolidate the input from the parallel activities to repopulate the complex object that is output from both activities. Using a list object that holds the numerous complex object outputs is one approach you can use to avoid losing data.

## Sharing data among tasks

- Tasks do not automatically share data, nor do they listen for messages
- In many cases, it is necessary for parallel tasks to “see” what happened in other tasks, such as updated information or recommendations vital to the accomplishment of the task

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*Figure 7-6. Sharing data among tasks*

In many cases parallel tasks must “see” what happened in other tasks, such as updated information or recommendations vital to the accomplishment of the task. Remember, the data that is mapped as an input variable is set when the process token arrives at the task. Tasks do not automatically share data, nor do they listen for messages.

## How variables are passed (1 of 2)

- When working with variables in IBM Business Process Manager, you must understand how variables are passed
- Several factors determine whether variables pass by value or pass by reference, as described in the following table:

From	To	Pass by
Process activity	Nested process	Value, if simple business object (variable type)
Process activity	Nested process	Reference, if complex business object (variable type)
Process activity	Service	Value
Service	Nested service	Value, if simple business object (variable type)
Service	Nested service	Reference, if complex business object (variable type)

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Figure 7-7. How variables are passed (1 of 2)

Also, when passing variables:

- If you pass a variable by value, the process or service that receives the value can manipulate it. The change does not affect the original value unless the receiving process or service returns the variable as an output.
- If you pass a variable by reference, the changes that are made by the process or service that receives the reference affect the original value. These changes affect the variable even if the receiving process or service does *not* return the variable as an output.

Because of the way IBM BPM handles variables, you should follow these guidelines:

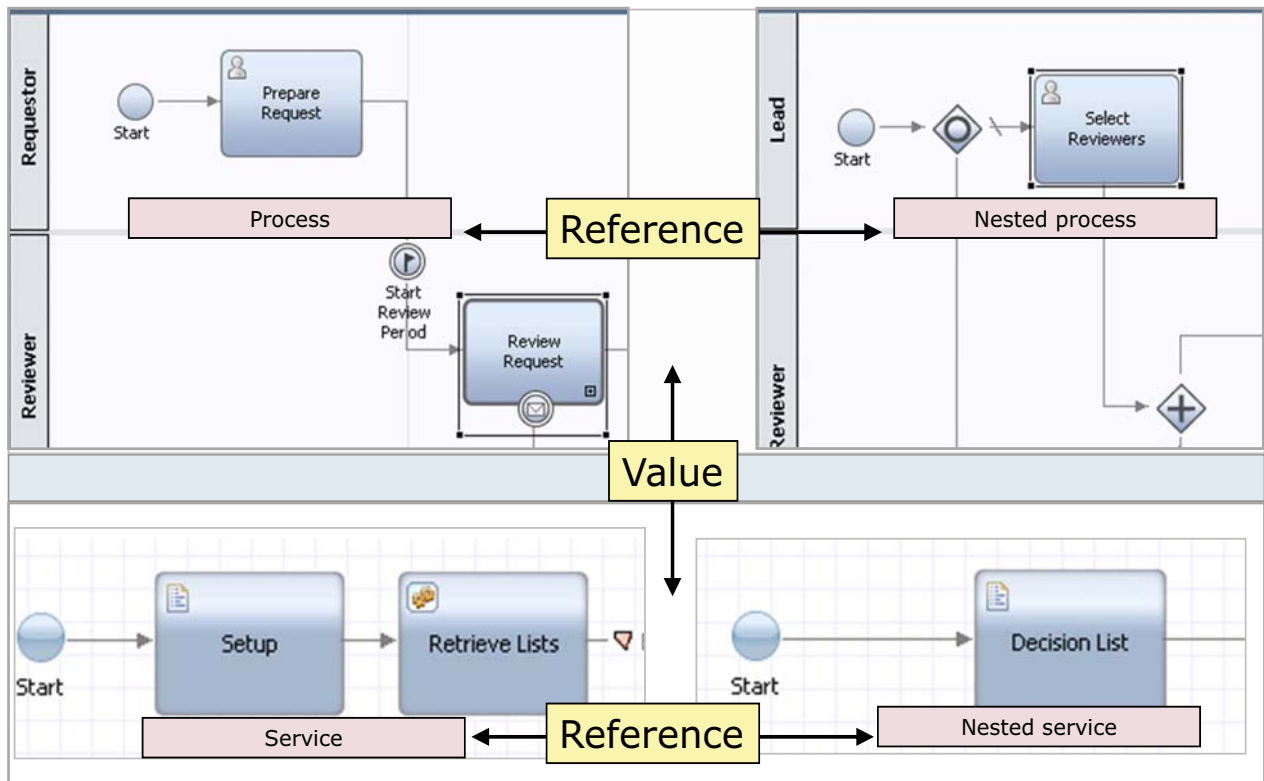
- If the variable is a simple type, declare the variable as an input and an output in nested processes, services, and nested services.
- If the variable is a complex type, you must declare the variable as an input. Although the output declaration is not required (because you pass complex types by reference), it is a good idea to also declare the variable as an output. Creating the output variable ensures that other developers are aware that the nested process, service, or nested service returns a complex variable.
- Always use an identical name and data type for a set of input and output variables for data that is passed in, processed, and then passed back.

## How variables are passed (2 of 2)

- Changes in the referenced complex object values are reflected at a nested level
- Pass by value creates a copy of the object, so changes are not reflected unless remapped back to the object
- Always map complex variable inputs as outputs
  - Even though you can pass the variable by reference, mapping variables as outputs increases maintainability and clarity



## Passing complex objects



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Figure 7-9. Passing complex objects

For example, a complex object is created at the highest level process. When the variable is mapped to a nested process, you pass the object by reference, so any changes made to the object in the nested process are reflected in the parent process.

When an activity creates a task, the service creates a copy of the complex object, and the values are passed to the service. Changes to this object are not reflected in the process unless the object is remapped to the parent object, or the object is designated as a shared object.

When the service passes the complex object to a nested service, you pass the object by reference, so any changes that are made at the nested service level are reflected at the parent service level.

## Shared objects

- Using the shared object check box on the business object **Properties > General > Behavior** section designates the variable as shared
  - The values of the complex object are persisted automatically to a data store
  - At each process, service, or message event boundary, the local variables with the same object key are refreshed from the data store
  - The save service is a data validation service that is invoked after updates to the shared business object are merged and before they are saved

The screenshot shows the 'Behavior' tab of a business object configuration. Under 'Definition type', a dropdown menu shows 'Complex type'. The 'Shared object' checkbox is checked. For 'Save Service', a lightning bolt icon is followed by the text 'Shared Object Save Service', a 'Select...' button, and a close icon (X).

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Figure 7-10. Shared objects

Shared business objects apply only to a complex structure type. The data within a shared business object is shared between business processes and tasks.

Shared business objects allow concurrent modification. For example, two users can view and modify the same shared business object instance in a human service. When users trigger a boundary event, the data of the shared business object instance is saved. Only the fields that each user modifies are saved. Therefore, if two users modify different fields, both changes are saved. If both users modify the same field, the last user's update is saved. In addition to having multiple users, you can have a situation with automated steps, for example, a server script that modifies shared business objects.

You can send data from one process to a second process by using a message event or by using the unique key of the shared business object to load the data into the second process. To load the data, get the unique identifier key and then use the key to load the instance.

For example, in the following code, `sharedBusinessObjectKey` would be obtained by running:

```
tw.local.myVariable.metadata("key");
tw.local.myVariable =
new tw.object.mySharedBusinessObject(sharedBusinessObjectKey);
```

A shared business object uses database resources. The data within a shared object is persisted to the database and synchronized across all scopes when any of the following events occur:

- The shared object is created.
- The state of a process instance is persisted and automatic synchronization is enabled for the process.
  - If you use linked processes, at run time, the setting of the top-level business process definition is taken.
- The state of a task or service instance is persisted and automatic synchronization is enabled for the service definition.
  - If you use nested services, the setting of the top-level server definition is taken.
- If automatic synchronization is not enabled for the process, or the service implementation does not support automatic synchronization, you must invoke the JavaScript `save()` method on the shared business object to persist the object data. You must use the `load` method to load the latest data from the data store into the variable.

Each shared object is logically connected to the business process instance that created it. When the business process instance is deleted (for example, when you delete a business process instance that was running in the Inspector), the shared object data in the database is also deleted. If you clear the **Shared Object** check box later, the business object is not accessible to other instances at run time. If the shared business object is created within a human service that can be started and not bound to a business process instance, the shared business object is connected to the activity task instance. In such cases, the shared business object is deleted if the task instance is deleted. If a shared business object is deleted from the database, the behavior of the tasks or processes that reference the shared business object is undefined.

If you want to create shared business objects that have a long lifetime, design a business process that acts as a factory (that is, it is based on a factory method pattern). The result is that your shared business objects remain in the database until the factory business process is deleted.

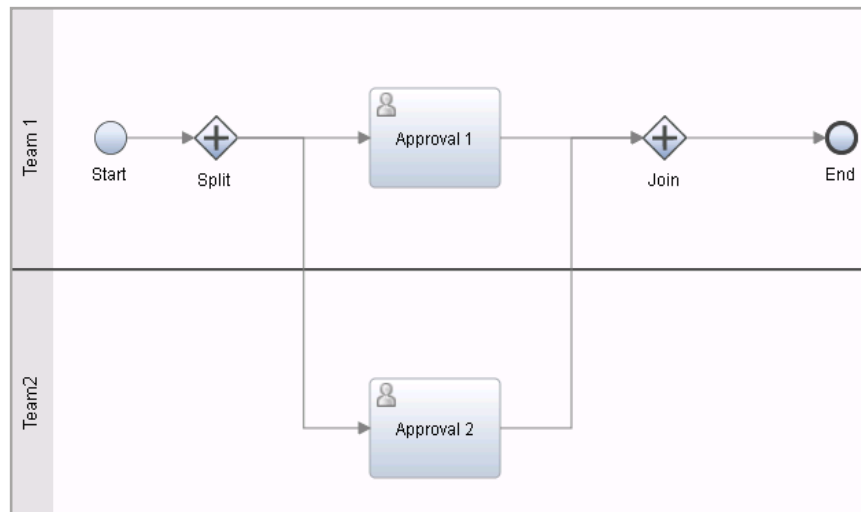
An output shared business object is for an external service, such as a web service, and an Advanced Integration service returns a new and typically updated copy of the original input shared business object. Therefore, if your application is working with an external service or an Advanced Integration service, your application should not reference the input shared business object, and you can expect an updated value. It should reference the new output shared business object.

The system incurs a performance cost for designating variables as shared, so you should not designate objects as shared unless those variables must be accessed from another step inside or outside the process.

The `save` service is a data validation service that is invoked after updates to the shared business object are merged and before they are saved. The service must have three input parameters of this shared business object type. One parameter of type `BPMBOPropertyChange (List)`, and one output parameter of type `BPMBOValidationError (List)` that indicates whether the merged data is valid.

## Variable number of tokens

- As tokens are created in the process, all tokens must run to the end to allow the process to complete
- With parallel tasks, it is inevitable to have a variable number of tokens that flow through your process
- A conditional join might be necessary to consume all the tokens



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Figure 7-11. Variable number of tokens

As tokens are created in the process, all tokens must run to the end to allow the process to complete. With parallel tasks, it is inevitable to have a variable number of tokens that flow through your process. A conditional join might be necessary to consume all the tokens.

## Canceling parallel tasks

- The dynamics of a parallel task often allow for certain tasks to bring a process or the parallel tasks to a stop
  - The process requirements and implemented rules dictate how and when the process would be canceled or closed
- To cancel a parallel task, consider how the cancellation affects all the process activities or tokens when:
  - Canceling and enclosing the process
  - Canceling only the parallel tasks in question with a unique ID (for example, Task ID)
  - Sending a cancel message

## Messaging patterns

- Message events are used to represent a point in your process where an incoming message is received
- Processes listen for these messages, which can originate from multiple sources:
  - An internal web service message
  - A message posted to the JMS listener
  - Calling an undercover agent (UCA) in a service
- These messages trigger events such as start or cancel a process
  - The message can trigger an event at the process or nested process level

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Figure 7-13. Messaging patterns

Message listeners are an important component of your process design. Messages can trigger responses that are based on the message payload, and they are a key component to managing the process and data flow. You should realize that the message itself can originate from multiple sources at any time in your process. When creating an Intermediate Message Event (IME), you can set two options:

- **Durable**, which is the default setting. This option determines whether the IME responds to a message that was sent before the IME listened. If this option is turned off, the IME responds only to messages that were sent after the IME listened.
- The **Consume** option is used to determine whether the IME consumes an incoming message. If consumed, the message is not available to any other message events in the process instance. If it is not consumed, other IMEs in the process can also receive the same message.

## Message events

- The message start event functions as a start event based on a received message in your process
- In contrast to the message start event, message intermediate events can be placed anywhere in the flow of your process
- Message intermediate events are commonly used to:
  - Cancel a task
  - Restart a task
  - Update a process state
  - Cancel a process
  - Stop or resume the flow of a process

## Parallel tasks and messaging

- All message intermediate events need a correlation ID
  - If you have parallel tasks, the process instance ID is not enough
- A common scenario is a parallel task process where a rejection within one task requires the termination of all the other incomplete tasks
- For a parallel task, you must implement a good pattern to accomplish the cancellation
- Canceling a process at any time requires cleanup steps that might include a notification to process participants that the process is canceled

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*Figure 7-15. Parallel tasks and messaging*

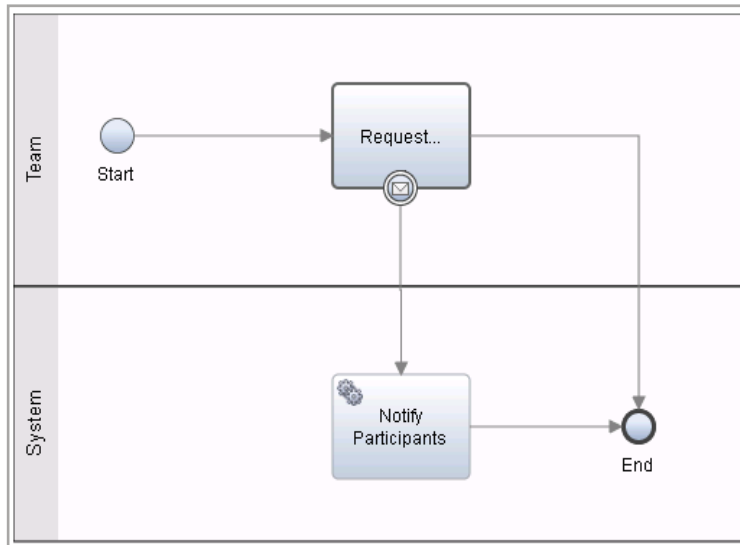
Often you must cancel a task or even an entire process instance. Message intermediate events are useful for this purpose.

When you create parallel process tasks, it is common for those tasks to influence each other. A common scenario is a parallel task process where a rejection within one task requires the termination of all the other incomplete tasks. Canceling tasks would not be necessary in a multi-instance loop because you might use an end condition; however, for a parallel task, you must implement a good pattern to accomplish the cancellation. Remember, canceling a process at any time might require cleanup steps that include a notification to process participants that the process is canceled.



## Nested process cancellation pattern

- To cancel a process, create a higher-level process and place the nested process on the canvas with a single attached message intermediate event
  - This approach replaces any terminate events that might be in the process, and allows elegant cleanup of tasks after the cancellation



- Through user education, business users must understand that this high-level process is the cancellation pattern, and the implementation details are found in the nested process

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Figure 7-16. Nested process cancellation pattern

To use this cancellation pattern, wrap your entire process in a nested process and attach a message intermediate event to listen for a cancellation at the highest level activity. This approach replaces any terminate events that might be in the process, and allows elegant cleanup of tasks after the cancellation.

Using this design pattern, most of the process is not apparent to participants who view the process because the top-level process does not show all the details; it shows only the administrative cancellation implementation details. Through user education, business users must understand that the top-level process enables the cancellation pattern, and the implementation details are found in the nested process.

Use this pattern to start any new top-level process. Even if a cancellation is not part of the requirement, include this simple pattern for all processes because of its simplicity. This pattern allows developers to use a top-level cancellation if they encounter a situation where they might need this feature as they complete their process implementation.

## Unit summary

- Manage parallel activity execution
- Implement a parallel task approval within a single process instance
- Manage messaging between processes
- Determine how to access data that is shared across multiple process activities
- Cancel a process at any time

## Review questions



1. What type of variable gets passed by reference from a process to a subprocess?
  - A. Simple
  - B. Complex
  - C. List of String()
  - D. Dates
2. True or False: If two parallel activities map their output to the same complex business object, you must use an external system of record to ensure that the variable is not overwritten.
3. True or False: Complex objects pass by value when passed from the process level to the service level.

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Figure 7-18. Review questions

Write your answers here:

1.

2.

3.

## Review answers



1. What type of variable gets passed by reference from a process to a subprocess?
  - A. Simple
  - B. Complex
  - C. List of String()
  - D. Dates

The answer is B. You pass complex variables by reference from process to subprocess and service to subservice.

2. True or False: If two parallel activities map their output to the same complex business object, you must use an external system of record to ensure that the variable is not overwritten.

The answer is False. Select the **Shared Object** check box on the business object to avoid overwriting output variables, and use the `save ()` method to persist the object.

3. True or False: Complex objects pass by value when passed from the process level to the service level.

The answer is True.

## Exercise 5

Building a cancellation pattern

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*Figure 7-20. Exercise 5*

## Exercise objectives



After completing this exercise, you should be able to:

- Implement an undercover agent (UCA) to cancel the hiring request
- Implement a cancellation pattern in a process application

---

# Unit 8. Implementing a multi-instance loop

## Estimated time

01:30

## Overview

In many cases, developers must create a variable number of tasks of a single activity based on business data. This unit covers the creation of a multi-instance loop on an activity based on the data that is only available at run time, and the special conditions that are required to effectively implement this solution.

## How you will check your progress

- Checkpoint
- Lab exercise
- Demonstration and walk-through

## Unit objectives

- Determine when to use a multi-instance loop
- Implement multi-instance loops in IBM Business Process Manager
- Implement complex end conditions in a multi-instance loop

Implementing a multi-instance loop

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*Figure 8-1. Unit objectives*



## Topics

- Multi-instance loops

Implementing a multi-instance loop

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*Figure 8-2. Topics*

## 8.1. Multi-instance loops

## Multi-instance loops

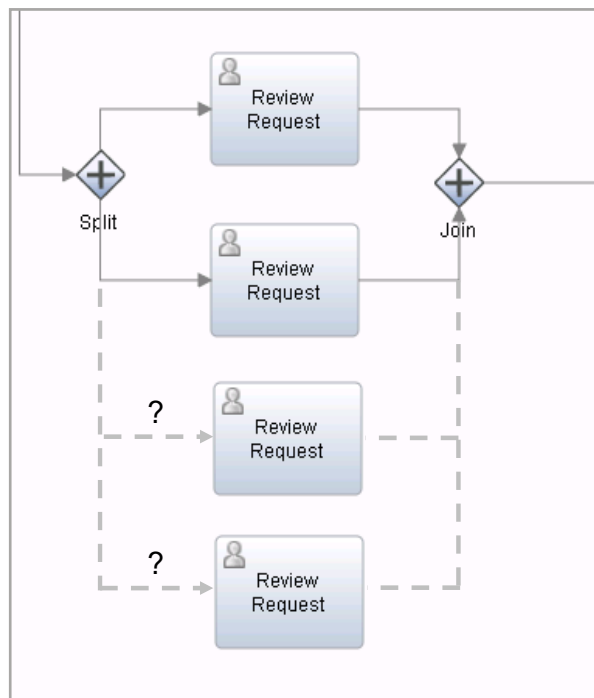
Implementing a multi-instance loop

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*Figure 8-3. Multi-instance loops*

## Multi-instance loops (MILs)

- How do you model a loop when a variable number of tasks are needed at run time based on business data?
- For what other scenarios would you use a multi-instance loop?



Implementing a multi-instance loop

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Figure 8-4. Multi-instance loops (MILs)

You saw a pattern to handle parallel tasks in a BPD, but how do you model a loop when a variable number of tasks are needed at run time based on business data? This requirement can be fulfilled with a multi-instance loop. The difference between simple looping and multi-instance looping is simple: looping tasks are created and run serially, while multi-instance loops are created and run in parallel.

An example of a multi-instance loop implementation is a loan approval task where multiple signature authorities complete tasks in parallel or in sequence before the process activity “approve the loan” can be considered complete. Multi-instance loops create one token for each instance where simple loops create only one task for all instances.

The trick to getting multi-instance loops to work is to understand how to assign those task instances to multiple users and how to get the data returned to the process. You need a list to hold the users who might complete the activity to get the task to the right person. Most likely, you need special routing to assign tasks to the right person or group. You also need a list to hold the results that come back from the users, similar to creating a simple split to create parallel tasks.

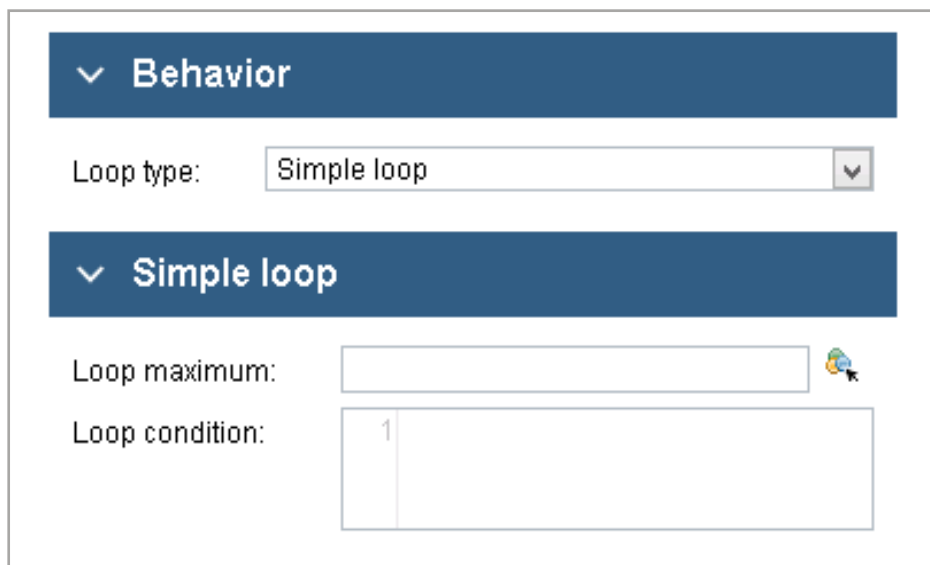
The system variable `tw.system.step.counter` is the index into those lists. The scope of this system variable is limited to the BPD level and does not map to the service level. If you plan to use the step variable before, during, or after your loop, you must manually map the step variable to a local variable in your service.

**MIL tips:**

- Use a list to hold the users who might be assigned the activity to get the task to the right person.
- Most likely, you need special routing to assign tasks to the right person or group.
- You also need a list to hold the results that come back from the users, similar to creating a simple split to create parallel tasks.
- The system variable `tw.system.step.counter` functions as your index into those lists. If you plan to use the step variable before, during, or after your loop, you must manually map the variable to a local variable in your service.

## Simple loop configuration

- Simple loops: Tasks are created and performed serially



The image shows a configuration interface for a simple loop. It features two main sections: 'Behavior' and 'Simple loop'. The 'Behavior' section has a 'Loop type' dropdown menu set to 'Simple loop'. The 'Simple loop' section has a 'Loop maximum' input field and a 'Loop condition' input field. The 'Loop condition' field contains the number '1'.

Implementing a multi-instance loop

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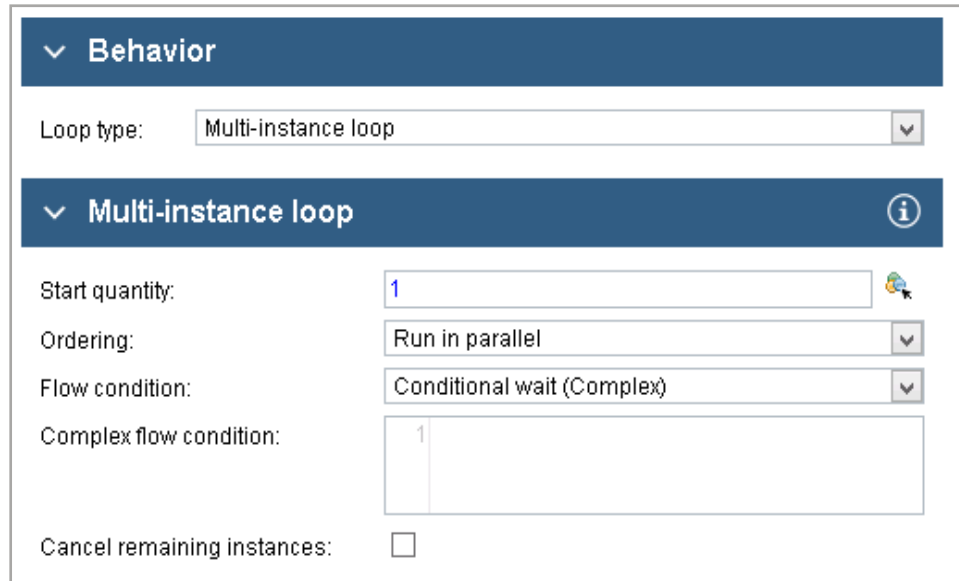
Figure 8-5. Simple loop configuration

In a simple loop, the loop completes when all the tasks that are created complete the loop.

The loop can implement many different types of artifacts to include subprocesses, linked processes, and simple activities.

## Multi-instance loop configuration options

- Multi-instance loops: Greater control over your instances
- Ordering: Run sequentially or in parallel



The screenshot shows a configuration panel for a multi-instance loop. It has two main sections: 'Behavior' and 'Multi-instance loop'. In the 'Behavior' section, the 'Loop type' is set to 'Multi-instance loop'. The 'Multi-instance loop' section contains several options: 'Start quantity' is set to 1, 'Ordering' is set to 'Run in parallel', 'Flow condition' is set to 'Conditional wait (Complex)', and 'Complex flow condition' is set to 1. There is also a 'Cancel remaining instances' checkbox which is currently unchecked.

Implementing a multi-instance loop

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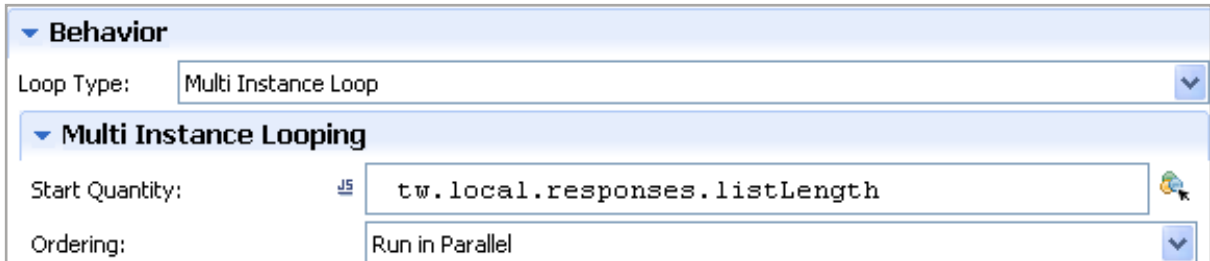
Figure 8-6. Multi-instance loop configuration options

If the loop requires a condition to determine whether the loop should continue, use a multi-instance loop type. A multi-instance loop gives you more control over the instances you create with the loop. The different types of multi-instance loops:

- Sequential: Each task is created after the last one completes
- Parallel: All instances are created when the loop is created

## Setting up a multi-instance loop (1 of 2)

- The pattern for setting up a multi-instance loop:
  - Choose the loop type to be a multi-instance loop
  - This example sets the number of tasks created (start quantity) to the number of responses that are stored in a list (array)
  - Choose to run in parallel or serial



**▼ Behavior**

Loop Type: Multi Instance Loop

**▼ Multi Instance Looping**

Start Quantity: `tw.local.responses.listLength`

Ordering: Run in Parallel

[Implementing a multi-instance loop](#)

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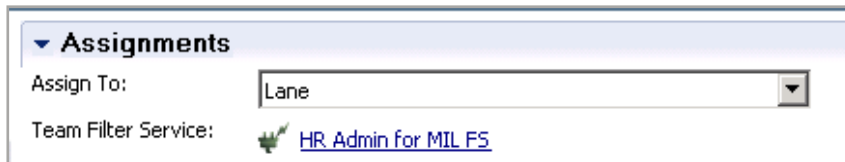
Figure 8-7. Setting up a multi-instance loop (1 of 2)

Set up the multi-instance loop on the step tab of the activity. You can choose to run tasks in parallel or run serially, but the true advantage to the multi-instance loop is realized when you run tasks in parallel. On the flow condition, you can either wait for all to finish, or set up a condition so that every time one activity finishes, it checks whether an exit criteria resolves to true. You can use the check box to cancel any of the remaining instances when the flow condition resolves to true, and the multi-instance loop can release the token down the path.



## Setting up a multi-instance loop (2 of 2)

- Assign a team filter for the lane participants

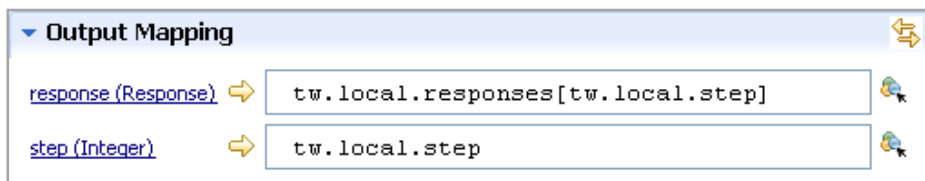


▼ **Assignments**

Assign To: Lane

Team Filter Service: [HR Admin for MIL FS](#)

- Sharing data with parallel tasks
  - If the order of the output list must remain intact, use this pattern

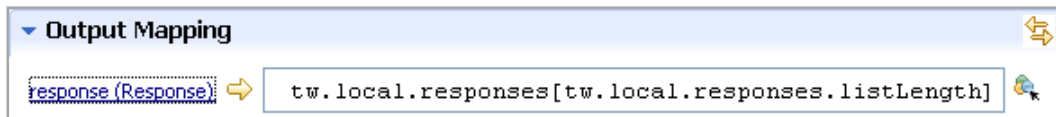


▼ **Output Mapping**

[response \(Response\)](#) → `tw.local.responses[tw.local.step]`

[step \(Integer\)](#) → `tw.local.step`

- Otherwise, use an initialized list variable without elements, and add to the end of the list



▼ **Output Mapping**

[response \(Response\)](#) → `tw.local.responses[tw.local.responses.listLength]`

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Figure 8-8. Setting up a multi-instance loop (2 of 2)

Many times, you must route your tasks to individual users. For example, you might assign the tasks to a team, and it creates four tasks for the group. When members of the group view their inbox, they see all four tasks in their inbox.

Use a team filter service to route the tasks that are created from the multi-instance loop. For each task in the multi-instance loop, your team filter must output only the user or users to assign the task. The team filter allows input variables to create the resulting team.

Set up your variables so they store the output correctly, and they do not overwrite one another. Two common ways exist to map the output data. The first is to send into the activity the `tw.system.step.counter` variable. When the step is sent out as an output, use the step as the array indexes for the variables you are trying to map to. If the order of the output variable array is important, use this approach.

The other approach is to use the list length and save the output to the end of the array; but with this approach, you cannot keep the order of the array intact. This approach provides only the order of activities that were completed as part of the loop.

## Multi-instance loop end conditions

- Use a multi-instance loop end condition when you want to specify what the multi-instance loop should do when an instance completes
  - For example, if you want the loop to terminate after one decision returns false, use a JavaScript condition to express this rule

The screenshot shows the 'Behavior' editor with the 'Multi Instance Looping' section expanded. The 'Loop Type' is set to 'Multi Instance Loop'. The 'Start Quantity' is set to the JavaScript expression `tw.local.responses.length`. The 'Ordering' is set to 'Run in Parallel'. The 'Flow Condition' is set to 'Conditional Wait (Complex)'. The 'Complex Flow Condition' is set to the JavaScript expression `1 !tw.local.responses[tw.local.step].decision;`. The 'Cancel Remaining Instances' checkbox is checked.

Implementing a multi-instance loop

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Figure 8-9. Multi-instance loop end conditions

The flow condition of the multi-instance loop is powerful. It is the only mechanism that makes it easy for you to examine the process state as soon as a parallel activity completes. You can then determine whether to continue the remainder of those activities. If you cannot use a multi-instance loop, you must set up message listeners on all of the parallel activities to cancel the remaining instances. You would also need a conditional join.

The flow condition provides a simple way to create end conditions that are associated with parallel tasks. When the flow condition resolves to true, the loop terminates and the token moves out of the multi-instance loop and down the flow. If you require the cancellation of all remaining tokens, select the **Cancel Remaining Instances** check box.

## Multi-instance loops and performance

- Never place a system activity as the first activity of a MIL
  - System lane activities lock an event manager engine thread until the activity is complete, so creating multiple instances of the loop can cause deadlock in the system until these activities complete
  - If possible, do the system lane activities that are required before the MIL
- Multi-instance loops create N number of tokens since each nested process that is created gets a new token
- Be wary of exit criteria: The MIL can create more tokens than what the BPD model can complete and thus cause a loop that never completes

Implementing a multi-instance loop

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*Figure 8-10. Multi-instance loops and performance*

Consider a few things when you implement a multi-instance loop. If you are enclosing a subprocess because they are serially processed, as mentioned before, the first activity should not be a system activity. Use a user task as the first activity of a nested process, and serialization is not a problem. Also, a multi-instance loop creates as many tokens as you have instances of the activity. It is possible to create so many tokens that the process would never complete.

## Instructor demonstration: Implementing a multi-instance loop



- View the multi-instance loop settings
- Create a multi-instance loop

Implementing a multi-instance loop

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*Figure 8-11. Instructor demonstration: Implementing a multi-instance loop*

## Unit summary

- Determine when to use a multi-instance loop
- Implement multi-instance loops in IBM Business Process Manager
- Implement complex end conditions in a multi-instance loop

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*Figure 8-12. Unit summary*

## Review questions



1. Which type of multi-instance loop end condition runs a script every time an activity finishes?
  - A. Simple
  - B. Complex
  - C. Executable
  - D. All of the above
  
2. True or False: Never place a system activity as the first activity of a MIL.

Implementing a multi-instance loop

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Figure 8-13. Review questions

Write your answers here:

- 1.
  
- 2.

## Review answers



1. Which type of multi-instance loop end condition runs a script every time an activity finishes?
  - A. Simple
  - B. Complex
  - C. Executable
  - D. All of the above

The answer is B. The complex flow condition runs a JavaScript code block every time that an instance completes the loop.

2. True or False: Never place a system activity as the first activity of a MIL.

The answer is True. System lane activities lock an event manager engine thread until the activity is complete, so creating multiple instances of the loop can cause deadlock in the system until these activities complete. If possible, do the system lane activities that are required before the MIL.

## Exercise 6

Implementing a multi-instance loop

Implementing a multi-instance loop

*Figure 8-15. Exercise 6*

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## Exercise objectives



After completing this exercise, you should be able to:

- Set up the inputs and outputs to a multi-instance loop
- Determine the behavior and start quantity of a multi-instance loop
- Apply the correct exit criteria for a multi-instance loop

Implementing a multi-instance loop

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*Figure 8-16. Exercise objectives*

---

# Unit 9. Integrating with external systems

## Estimated time

01:30

## Overview

Integrations with external systems are accomplished through integration services in IBM Business Process Manager. This unit covers the integration services that are used to connect to other systems for increased effectiveness of the business process application.

## How you will check your progress

- Checkpoint
- Lab exercise
- Demonstration and walk-through

## Unit objectives

- Explain how to build integration services in IBM Business Process Manager
- Describe the outbound web service integrations and the most common issues that generate connection complexities
- Employ the System Data toolkit Integration Services when other solutions for external system connection are needed
- Create an inbound web service integration
- Create an event-based undercover agent

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*Figure 9-1. Unit objectives*

## Topics

- Building outbound integrations
- System toolkit integration services
- Building inbound integration services

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*Figure 9-2. Topics*

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## 9.1. Building outbound integrations

## Building outbound integrations

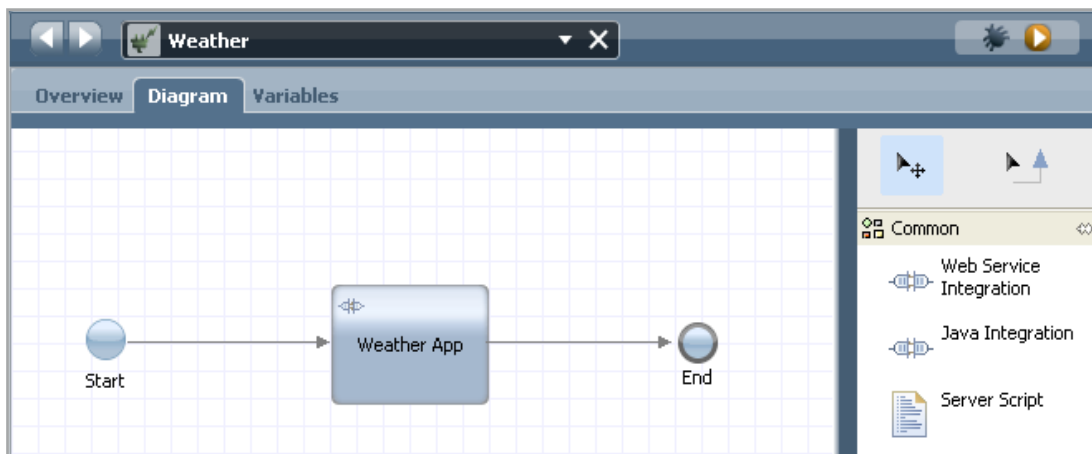
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*Figure 9-3. Building outbound integrations*

## Building outbound integration services

- Most outbound integrations (connection with external systems) can be modeled with the artifacts that are found in the Process Designer client application service modeler library palette
  - Both the Java and web service integration components can be found here



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Figure 9-4. Building outbound integration services

Most outbound integrations (connections with external systems) can be modeled with the artifacts that are found in the Process Designer client application service modeler library palette. Both the Java and web service integration components can be found there.

The web service integration component uses a WSDL discovery SOAP-based web service invocation method to connect to your external web services. This function generates the variable type and auto-maps inputs and outputs.

However, some WSDLs do not always work well for integrating with other systems, or are not compatible with the web service connection. When you encounter this problem, use a system toolkit integration service or a Java integration.

## Integration types

- To accomplish the appropriate integration with an external web service, it is important to have a good understanding of the process implementation requirements
  - Try the built-in integration services first (web service integration); for the supported WSDLs, it is remarkably quick and easy
  - If a particular WSDL is not supported or more control is needed over a particular request, try the **Call WebService via SOAP** service
  - If all else fails, create a Java connection of your own that uses either SOAP or HTTP protocols

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*Figure 9-5. Integration types*

When you are ready to connect an external system, start by creating an integration service. On the integration service palette, you find a web service connector and a Java connector to accomplish your integration. During the upcoming exercise, use the WSDL discovery method.

The alternative is to use the Java connection options by using custom JAR files that are created with the custom Java connector class. Understand that all integration connections are Java connections, so the Java option allows for custom connection types when needed.



## Java integration

- All integration connections are Java connections, so the Java option allows for custom connection types when needed
- Any static API available in Java can be accessed with a Java integration that is based on your Java connector class
  - Integration services that are based on a Java component require a Java class found in custom-built Java connectors to work

The screenshot shows a 'Discovery' panel with the following fields:

- Java Class:** A text field containing 'helloworld.HelloWorld' with a 'Select...' button to its right.
- Method:** A dropdown menu showing 'String HelloSayer(String)'.
- Translate JavaBeans:** An unchecked checkbox.

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Figure 9-6. Java integration

Any static API available in Java can be accessed with a Java integration that is based on your Java connector class, as it provides great flexibility. Integration services that are based on a Java component require a Java class found in custom-built Java connectors to work.

You can use the Java connector to attach a custom JAR file directly into a process application or toolkit. JAR files have versions just like other assets in the process application or toolkit and are installed alongside the model when installing a process application to a server. If the Java classes are later updated, the version can be updated, and the classes are refreshed in a controlled manner to ensure that developers control the governance over the upgrade path. Developers can test the new JAR file and avoid regression errors in the existing process application.

If you want the result of the serialized Java method to return to the integration service as an XML element, select the **Translate JavaBeans** check box. The content of the element is based on the properties of the object class. When you select the **Translate JavaBeans** check box, the variable type that you select in the integration service for the value that is returned from the Java method must be `XML`Element or `ANY`.

## Web service integration

- An outbound integration is accomplished through an integration connection that accesses a SOAP web service
- For protected WSDL authentication, you can select the **Protected WSDL** check box in the implementation properties for the web service integration component, and then enter the user name and password in the provided fields

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Figure 9-7. Web service integration

An outbound integration is accomplished through an integration connection that accesses a SOAP web service. Use an integration service when integrating to an external system. The web service integration provides a Web Services Description Language (WSDL) Uniform Resource Identifier (URI) discovery feature that automatically lists all the advertised WSDL operations. The advantage of the WSDL connection is the discovery of available operations. This feature allows developers to create variable types for each operation automatically. The disadvantage is that not all WSDL definitions can be read properly.

SOAP messages are exchanged in a request/response format. When the system sends a request to a web service, the web service returns the requested values. These values are specified in a SOAP message, which is a block of XML code that contains several elements.

All SOAP messages must contain a SOAP envelope element, which identifies the XML code as a SOAP message. Some WSDLs require that SOAP headers also be passed with each request. A SOAP header is an element in a SOAP message that is contained in the SOAP envelope message and provides detailed information about the SOAP message. IBM Business Process Manager supports passing a SOAP header with each request for a WSDL SOAP operation that requires it. The two types of SOAP headers are: headers that are directly specified as part of the SOAP binding, and headers that are not.

IBM Business Process Manager supports the following runtime authentication mechanisms that do not require client certificates:

- Protected WSDL
- HTTP basic authentication (described in RFC 2627)
- UsernameToken authentication

For protected WSDL authentication, you can select the **Protected WSDL** check box in the implementation properties for the web service integration component, and then provide the user name and password in the provided fields.

## Connecting to a web service

Consider:

- If the WSDL Discovery does not work, test for WS-I compliance first
- If the WSDL Discovery does not pull back the operations that are needed to match the business requirement, test the endpoint with a third-party tool like SOAP UI
- If you require Protected WSDL security, ensure that the web service has the right connection settings
- If endpoints change depending on the different environments (development and production), use an environment variable to store the WSDL URI and all the other settings that change between environments

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*Figure 9-8. Connecting to a web service*

The slide shows common questions to ask when WSDL discovery does not work. Later in the unit, you learn how to mitigate these issues.

Check WSDL for WS-I compliance with the soapUI WS-I compliance test:

<http://www.ibm.com/support/docview.wss?uid=swg21439805>

## 9.2. System toolkit integration services

## System toolkit integration services

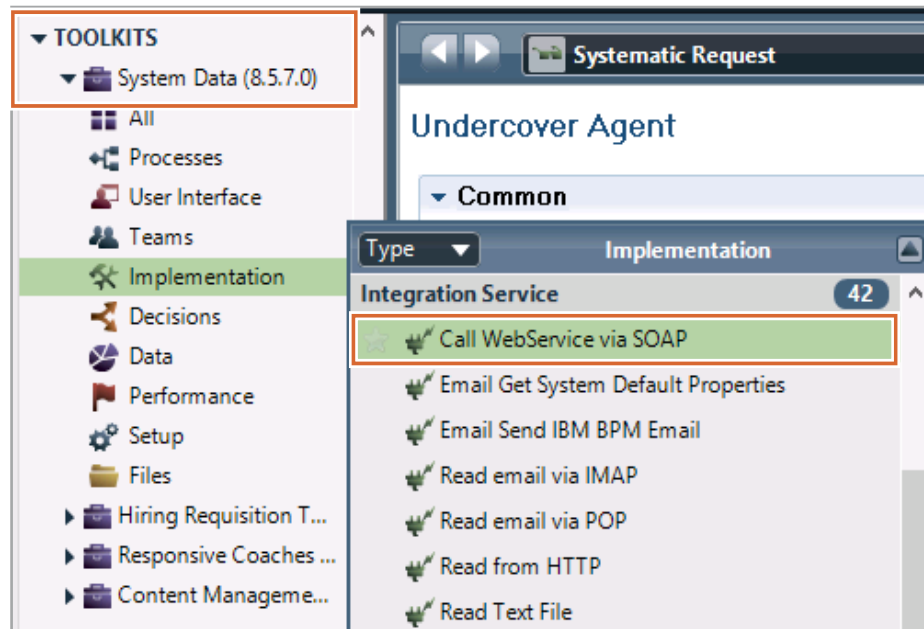
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*Figure 9-9. System toolkit integration services*

## System toolkit integration services

- The System Data toolkit includes an integration service, **Call WebService via SOAP**, which provides a different function than the web service integration component



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Figure 9-10. System toolkit integration services

A series of prebuilt integration services are provided in the system toolkit. Search through the integration service options for unique SOAP or HTTP protocol integration services. Special connections of this type are initiated through the system toolkit implementation library.

The SOAP integration service type generation or automatic mapping from XML to business objects does not occur when you use this approach. You must create the variables manually from the published WSDL.

The System Data toolkit also includes an integration service for dealing with HTTP called Read from HTTP. The HTTP integration service is also a Java integration component that uses Java classes and HTTP methods to invoke the connection and return the data in a structured form such as REST.

## Guidelines (1 of 2)

- Advantages to the custom SOAP integration service
  - If the target endpoint is different for testing and production, you can define the endpoint of the web service call at run time, which can make it easier to promote to different environments
  - Provides complete control in both directions
  - After it is created, the same connection can be reused for many integrations
- Disadvantage of the SOAP integration service
  - Requires knowledge of SOAP envelopes and translation between business objects and XML

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Figure 9-11. Guidelines (1 of 2)

It is important to understand the differences between creating a SOAP integration service and the HTTP integration service. While both are used to integrate with external systems, both have their advantages and disadvantages.



## Guidelines (2 of 2)

- Advantages of the HTTP integration service
  - Maximizes the use of pre-existing, well-defined HTTP features such as caching and security enforcement
  - Minimizes adding application features that must be included in other HTTP protocol web services, such as SOAP
  - Returns XML or some other “well-known” entity type in response to simple HTTP method queries
  - IBM Business Process Manager can use XML easily through the XMLElement variable type
- Disadvantage of the HTTP integration service
  - If mapping between XML and other variable types is necessary, it must be done manually

## Instructor demonstration: Integrating with external systems

- Demonstrate building an integration service
- View the system toolkit integration services



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*Figure 9-13. Instructor demonstration: Integrating with external systems*

## **9.3. Building inbound integration services**

## Building inbound integration services

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*Figure 9-14. Building inbound integration services*

## Building inbound integration services

- Creating an inbound web service is similar to creating any other artifact in the library, but when a message is received, the system must react
- Many times these inbound messages are intended to affect the flow of a process
  - Associate the inbound web service with a UCA and a receive message event on a BPD

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Figure 9-15. Building inbound integration services

IBM Business Process Manager can publish web services in the same way that it connects to web services. Using a SOAP connection, external applications can call the IBM Business Process Manager web service to Initiate a particular process, service, or set of services.

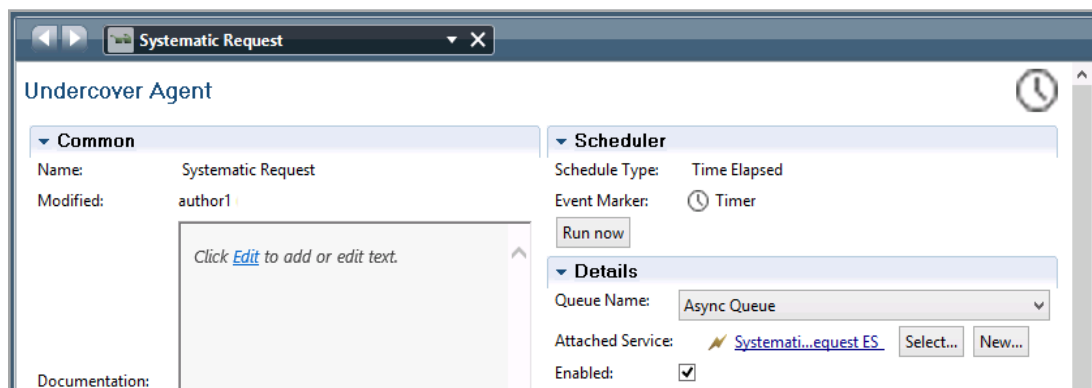
Creating an inbound web service is similar to creating any other artifact in the library, but when a message is received, the system must react. Many times the inbound messages are intended to affect the flow of a process. You can affect the flow by associating the inbound web service with a UCA and a receive message event on a BPD.

Until now, UCAs were created but were only triggered internally through test harnesses or internal services. UCAs exposed to external systems by an inbound web service accomplish the same task, but can now be triggered from external systems.

Inbound web services are not always required to use a UCA (stand-alone services can be associated with the web service if needed). But to affect a process, use a UCA with a message start event or message intermediate event on a BPD.

## Event-based undercover agents (UCA)

- A UCA is a listener that waits to receive a message from an event
  - When a UCA is triggered, it starts a service in response to the event, and that service defines the inputs and outputs for the UCA
  - By creating a caller service with the UCA inside of it, the service can be run to trigger the UCA; the caller service must be used as the attached service for an inbound web service
  - When the inbound web service is started with the caller service-defined inputs, the UCA is triggered, and the message is sent to the listeners defined in the BPDs



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Figure 9-16. Event-based undercover agents (UCA)

Undercover agents (UCAs) are a feature of IBM Business Process Manager that can be complicated to understand. To simplify, a UCA is a listener that waits to receive a message from an event. A message might trigger these events, or they might be triggered on a specific schedule (time based). When a UCA is triggered, it starts a service in response to the event, and that service defines the inputs and outputs for the UCA. By creating a caller service with the UCA inside it, the service can be run to trigger the UCA. The caller service must be used as the attached service for an inbound web service. When the inbound web service is started with the caller service-defined inputs, the UCA is triggered, and the message is sent to the listeners defined in the BPDs.

Use the Variable implementation to define the input variable and pass it on to the listener.

If you need to modify the incoming variable before the data is sent to the listener, use the Service implementation. This action might require a database lookup, stripping of variables that are not needed for the listener, or something else that requires changing the incoming data.

## Instructor demonstration: Inbound integration

- Demonstrate creating an event-based undercover agent
- Demonstrate creating an inbound integration



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*Figure 9-17. Instructor demonstration: Inbound integration*

## Unit summary

- Explain how to build integration services in IBM Business Process Manager
- Describe the outbound web service integrations and the most common issues that generate connection complexities
- Employ the System Data toolkit Integration Services when other solutions for external system connection are needed
- Create an inbound web service integration
- Create an event-based undercover agent



## Review questions



1. True or False: IBM Business Process Manager supports protected WSDL authentication.
2. If the WSDL discovery does not work, what is the first thing you must check?
  - A. WS-I compliance
  - B. Network bandwidth capacity
  - C. Updates to Java on the server
  - D. The server hydraulic fluid level
3. A UCA enabling service defines what?
  - A. The input variables of the UCA
  - B. The output variables of the UCA
  - C. When the UCA is triggered, the service that is executed
  - D. All of the above

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Figure 9-19. Review questions

Write your answers here:

1.

2.

3.

## Review answers



1. True or False: IBM Business Process Manager supports protected WSDL authentication.  
The answer is True.
2. If the WSDL discovery does not work, what is the first thing you must check?
  - A. WS-I compliance
  - B. Network bandwidth capacity
  - C. Updates to Java on the server
  - D. The server hydraulic fluid levelThe answer is A. Always check WS-I compliance on all web service endpoints.
3. A UCA enabling service defines what?
  - A. The input variables of the UCA
  - B. The output variables of the UCA
  - C. When the UCA is triggered, the service that is executed
  - D. All of the aboveThe answer is D. The enabling service is the service that is run when the UCA is triggered. The service defines the inputs and outputs of the UCA.

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Figure 9-20. Review answers

## Exercise 7

### Building web service connections

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*Figure 9-21. Exercise 7*

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## Exercise objectives



After completing this exercise, you should be able to:

- Create an event-based undercover agent
- Build an inbound web service connection
- Build an outbound web service to message the inbound web service

---

# Unit 10. Course summary

## Estimated time

00:30

## Overview

This unit summarizes the course and provides information for future study.

## Unit objectives

- Explain how the course met its learning objectives
- Access the IBM Training website
- Identify other IBM Training courses that are related to this topic
- Locate appropriate resources for further study

Course summary

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*Figure 10-1. Unit objectives*

## Course objectives

- Describe IBM Business Process Manager topology considerations and typical system configurations
- Use the REST API tester to integrate with external systems
- Integrate with a Content Management Interoperability Services (CMIS) system and use content events in a process
- Translate a coach into numerous languages through localization
- Design an IBM Business Process Manager data architecture for a process application with complex business data
- Model all decision authority for a process and employ complex logic for task routing and assignments
- Construct complex task and process task-to-task interaction controls
- Identify and solve common integration issues

[Course summary](#)

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*Figure 10-2. Course objectives*

## To learn more on the subject

- IBM Training website: [www.ibm.com/training](http://www.ibm.com/training)
- IBM Redbooks: [www.redbooks.ibm.com](http://www.redbooks.ibm.com)
- To stay informed about IBM training, see the following sites:
  - IBM Training News: <http://bit.ly/IBMTrainEN>
  - YouTube: [youtube.com/IBMTraining](http://youtube.com/IBMTraining)
  - Facebook: [facebook.com/ibmtraining](http://facebook.com/ibmtraining)
  - Twitter: [twitter.com/websphere\\_edu](http://twitter.com/websphere_edu)
- IBM Business Process Manager help topics
  - These help topics can be found inside of the IBM Business Process Manager Process Designer tool
- IBM Community Wikis
  - Move beyond the information that this student book provides by going to the IBM community wiki
  - The URL for the wiki is: <https://developer.ibm.com/bpm>



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- IBM offers resources for:
  - Product information
  - Training and certification
  - Documentation
  - Support
  - Technical information



- To learn more, see the IBM Cloud Education Resource Guide:
  - [www.ibm.biz/CloudEduResources](http://www.ibm.biz/CloudEduResources)

Course summary

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Figure 10-4. Enhance your learning with IBM resources

## Unit summary

- Explain how the course met its learning objectives
- Access the IBM Training website
- Identify other IBM Training courses that are related to this topic
- Locate appropriate resources for further study

Course summary

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*Figure 10-5. Unit summary*

## Course completion

**You have completed this course:**

Process Implementing with IBM Business Process Manager  
Standard V8.5.7 - II

**Any questions?**



[Course summary](#)

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*Figure 10-6. Course completion*

---

# Appendix A. List of abbreviations

## A

<b>Ajax</b>	Asynchronous JavaScript and XML
<b>AMD</b>	Asynchronous Module Definition
<b>APAR</b>	authorized program analysis report
<b>API</b>	application programming interface

## B

<b>B2B</b>	business-to-business
<b>BAL</b>	Business Action Language
<b>BOM</b>	business object model
<b>BPD</b>	business process definition
<b>BPEL</b>	Business Process Execution Language
<b>BPM</b>	business process management
<b>BPMN</b>	Business Process Model and Notation

## C

<b>CEO</b>	chief executive officer
<b>CMIS</b>	Content Management Interoperability Services
<b>CS</b>	coach service
<b>CSS</b>	Cascading Style Sheets
<b>CSV</b>	comma-separated values
<b>CV</b>	coach view

## D

<b>DB</b>	database
<b>DB2</b>	Database 2
<b>DOM</b>	Document Object Model

## E

<b>EAR</b>	enterprise archive
<b>ECM</b>	enterprise content management
<b>EIS</b>	Enterprise Information System

<b>EJB</b>	Enterprise JavaBeans
<b>ENV</b>	environment variable
<b>EPV</b>	exposed process value
<b>ERP</b>	enterprise resource planning
<b>ESB</b>	enterprise service bus
<b>G</b>	
<b>GB</b>	gigabyte
<b>GUI</b>	graphical user interface
<b>H</b>	
<b>HR</b>	human resources
<b>HS</b>	human service
<b>HTML</b>	Hypertext Markup Language
<b>HTTP</b>	Hypertext Transfer Protocol
<b>HTTPS</b>	Hypertext Transfer Protocol Secure
<b>I</b>	
<b>IE</b>	Internet Explorer
<b>IME</b>	intermediate message event
<b>I/O</b>	input/output
<b>IP</b>	Internet Protocol
<b>IT</b>	information technology
<b>J</b>	
<b>J2C</b>	J2EE Connector architecture
<b>J2EE</b>	Java 2 Platform, Enterprise Edition
<b>JAR</b>	Java archive
<b>JDBC</b>	Java Database Connectivity
<b>JMS</b>	Java Message Service
<b>JNDI</b>	Java Naming and Directory Interface
<b>JSAPI</b>	JavaScript API
<b>JSON</b>	JavaScript Object Notation
<b>JVM</b>	Java virtual machine

**K**

**KPI** key performance indicator

**L**

**LDAP** Lightweight Directory Access Protocol

**M**

**MIL** multi-instance loop

**MIME** Multipurpose Internet Mail Extensions

**O**

**OASIS** Organization for the Advancement of Structured Information Standards

**OMG** Object Management Group

**OS** operating system

**P**

**PC** Process Center

**PDF** Portable Document Format

**PDW** Performance Data Warehouse

**PFS** Process Federation Server

**PI** project interchange

**POJO** plain old Java object

**PS** Process Server

**R**

**REST** Representational State Transfer

**RFC** Request for Comments

**RUP** Rational Unified Process

**S**

**SCA** Service Component Architecture

**SDK** software development kit

**SLA** service level agreement

**SMTP** Simple Mail Transfer Protocol

**SOA** service-oriented architecture

<b>SOAP</b>	a lightweight, XML-based protocol for exchanging information in a decentralized, distributed environment. Usage note: SOAP is not an acronym; it is a word (formerly an acronym for Simple Object Access Protocol)
<b>SOR</b>	system of record
<b>SQL</b>	Structured Query Language
<b>SSL</b>	Secure Sockets Layer
<b>SSO</b>	single sign-on
<b>T</b>	
<b>TS</b>	task service
<b>U</b>	
<b>UCA</b>	undercover agent
<b>UI</b>	user interface
<b>UML</b>	Unified Modeling Language
<b>URI</b>	Uniform Resource Identifier
<b>URL</b>	Uniform Resource Locator
<b>USB</b>	Universal Serial Bus
<b>V</b>	
<b>VM</b>	virtual machine
<b>W</b>	
<b>W3C</b>	World Wide Web Consortium
<b>WAR</b>	web archive
<b>WS</b>	web services
<b>WS-I</b>	Web Services Interoperability
<b>WSDL</b>	Web Services Description Language
<b>WYSIWYG</b>	what you see is what you get
<b>X</b>	
<b>XML</b>	Extensible Markup Language
<b>XPath</b>	XML Path Language
<b>XSD</b>	XML Schema Definition
<b>XSL</b>	Extensible Stylesheet Language
<b>XSLT</b>	Extensible Stylesheet Language Transformation





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# Appendix B. IBM BPM on Cloud

## Estimated time

00:00

## Overview

In this unit, you learn about BPM on Cloud.

## Introduction to IBM Business Process Manager on Cloud

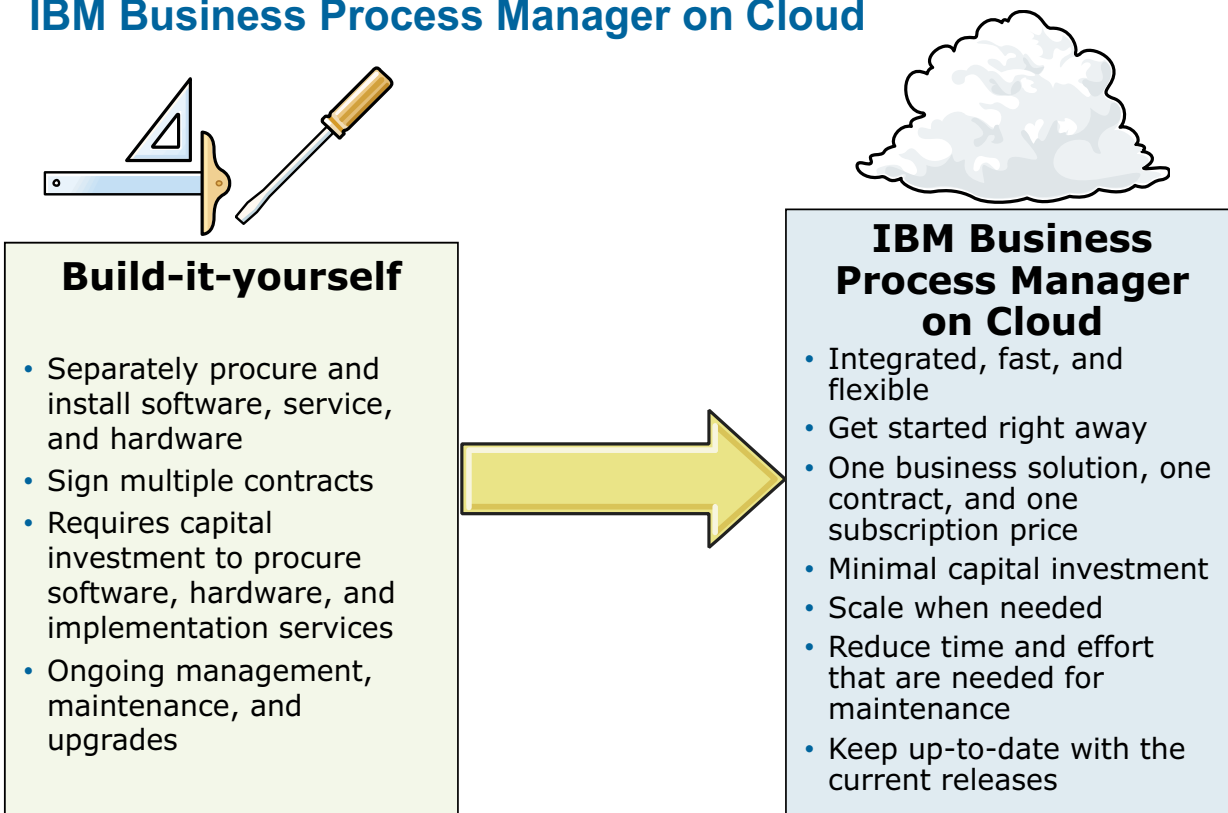
- Enterprise-grade BPM cloud service for development, testing, and production
- Cloud-based, collaborative, and role-based environment
  - Capture, automate, and manage frequently occurring, repeatable rules-based business decisions
- Ready-to-use development, test, and production environments are available
- Monthly subscription plans
- Available exclusively on IBM Cloud infrastructure
  - As of 2015, over 25 data centers are available worldwide
- Managed by IBM
- Artifacts that are created with IBM Business Process Manager on Cloud are compatible with IBM Business Process Manager on-premises product

IBM Business Process Manager on Cloud

© Copyright IBM Corporation 2016

*Figure B-1. Introduction to IBM Business Process Manager on Cloud*

## Accelerate decision management solution deployment with IBM Business Process Manager on Cloud



IBM Business Process Manager on Cloud

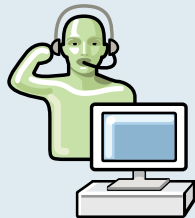
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Figure B-2. Accelerate decision management solution deployment with IBM Business Process Manager on Cloud

## IBM Business Process Manager on Cloud customer focus: Manage and automate decisions

**IBM manages:**

- Uptime
- Monitoring
- Backup
- High availability
- Disaster recovery
- Updates
- Maintenance

**Customers manage:**

- Application development
- Application integration
- Application support

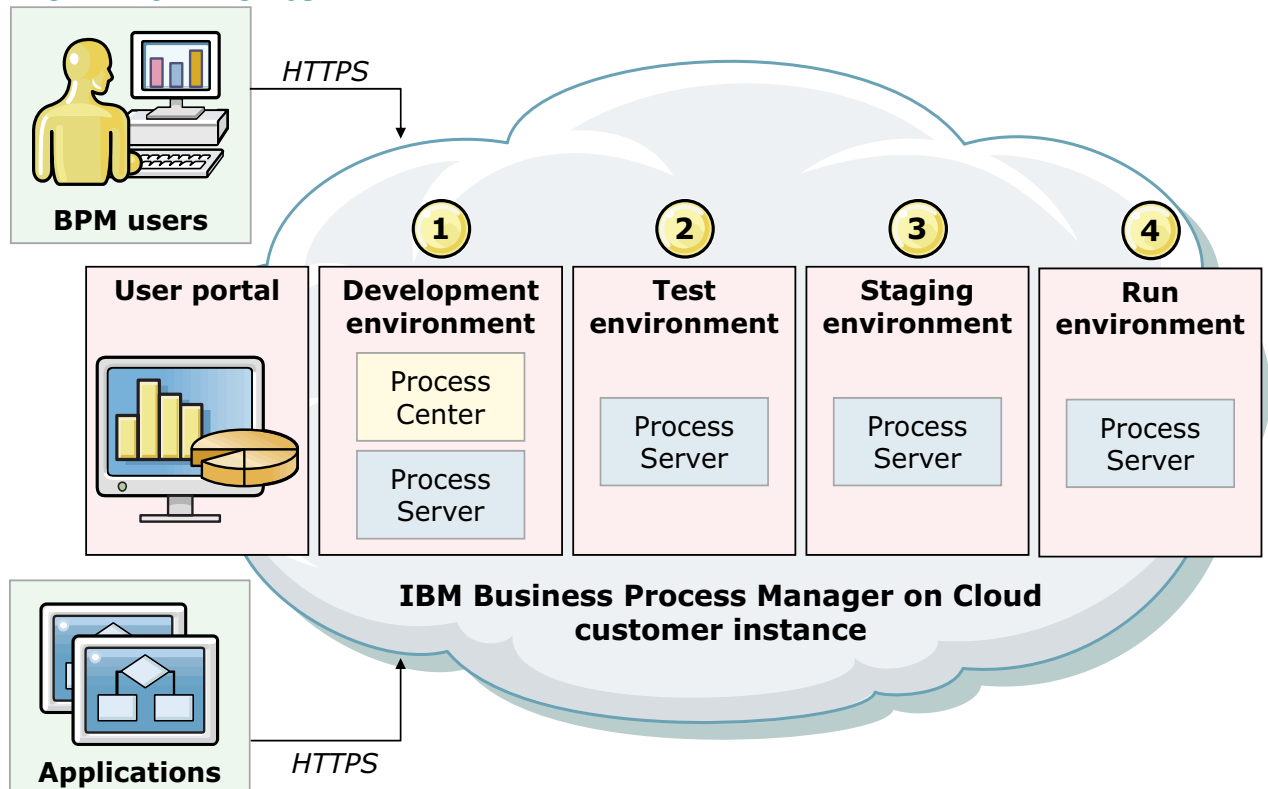


IBM Business Process Manager on Cloud

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Figure B-3. IBM Business Process Manager on Cloud customer focus: Manage and automate decisions

## IBM Business Process Manager on Cloud: Four runtime environments



IBM Business Process Manager on Cloud

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Figure B-4. IBM Business Process Manager on Cloud: Four runtime environments

IBM BPM on Cloud provides four runtime environments for process development:

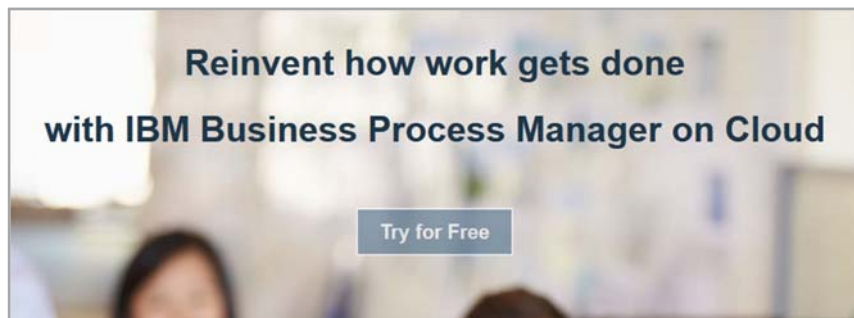
1. Development
2. Test
3. Staging
4. Run

In this diagram:

- **BPM users** include developers, business analysts, business users, and rule authors who access the Process Designer, Rule Designer, and the other various user consoles.
- **Applications** are applications that call services.

## IBM Business Process Manager on Cloud free trial

- Free 30-day trial for IBM Business Process Manager on Cloud is available
- Go to the following website and click **Try for free** to sign up:  
<https://www.bpm.ibmcloud.com/#home>



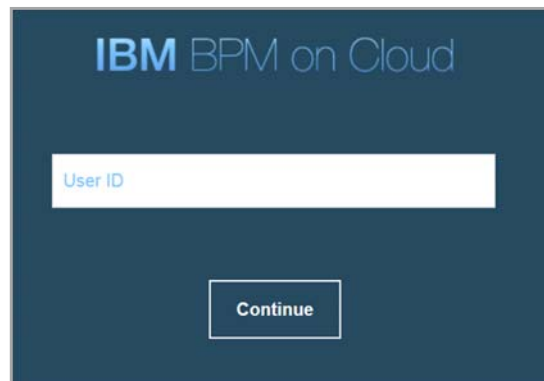
IBM Business Process Manager on Cloud

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*Figure B-5. IBM Business Process Manager on Cloud free trial*

## Activating access and logging in to IBM Business Process Manager on Cloud

- Welcome email includes the following information:
  - Link to activate IBM Business Process Manager on Cloud access
  - Link to IBM Business Process Manager on Cloud instance
- Activation link is tied to a specific email
- After activating access, you can log in to your IBM Business Process Manager on Cloud instance



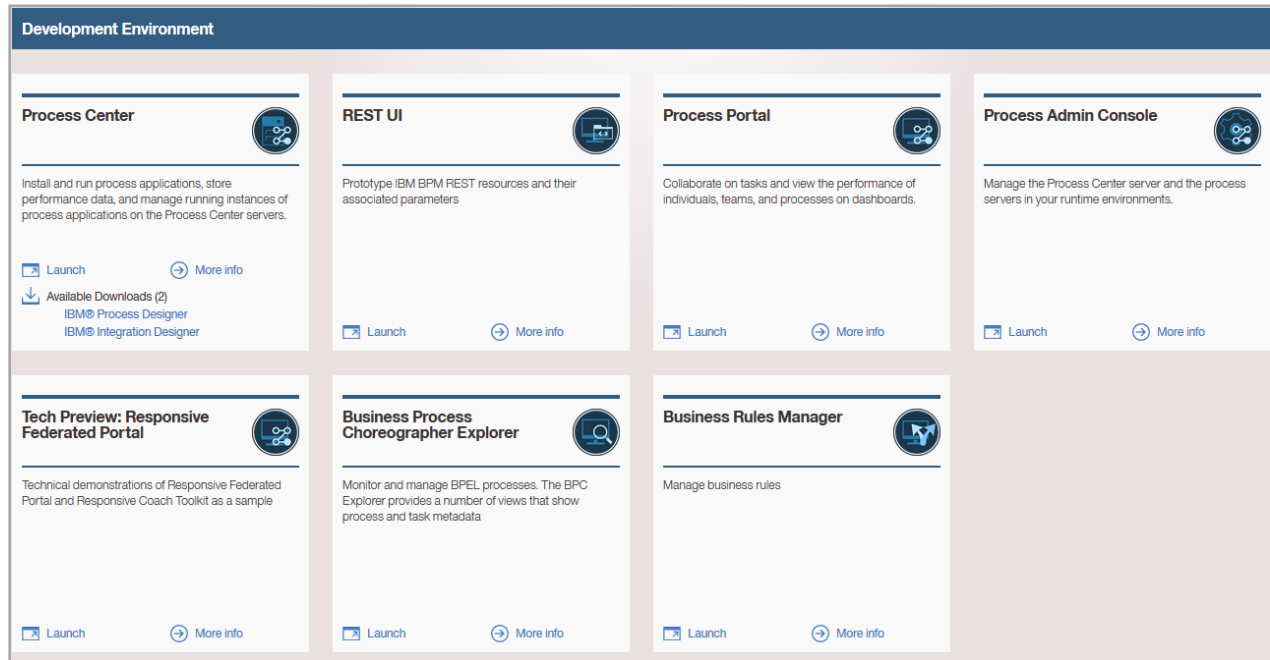
IBM Business Process Manager on Cloud

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*Figure B-6. Activating access and logging in to IBM Business Process Manager on Cloud*

## IBM Business Process Manager on Cloud user portal (1 of 3)

- Access from home page to an array of tools in three environments:
  - Development



IBM Business Process Manager on Cloud

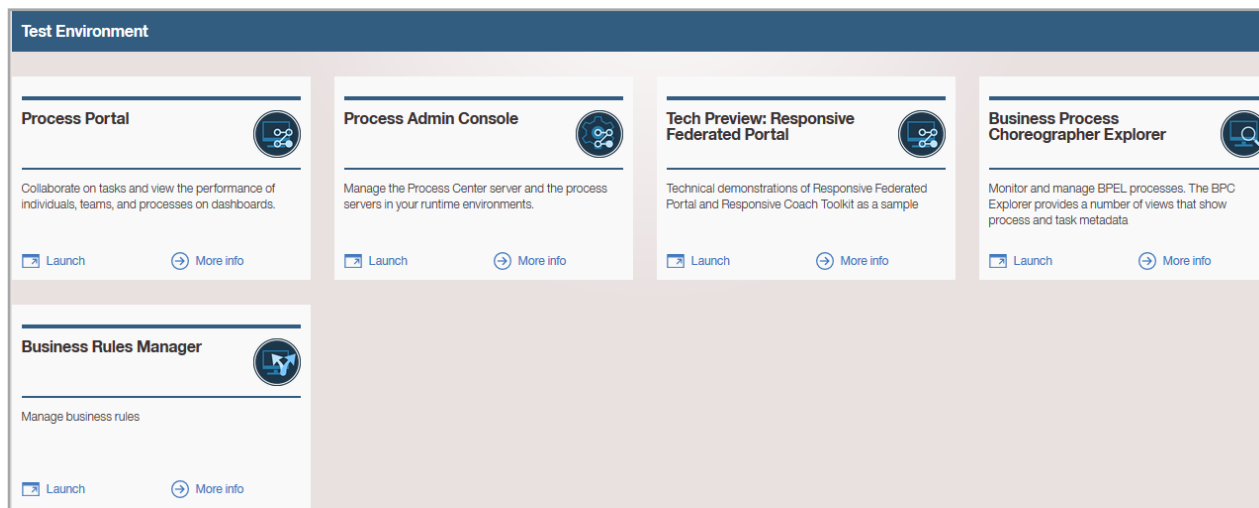
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Figure B-7. IBM Business Process Manager on Cloud user portal (1 of 3)



## IBM Business Process Manager on Cloud user portal (2 of 3)

- Access from home page to an array of tools in four environments:
  - Test



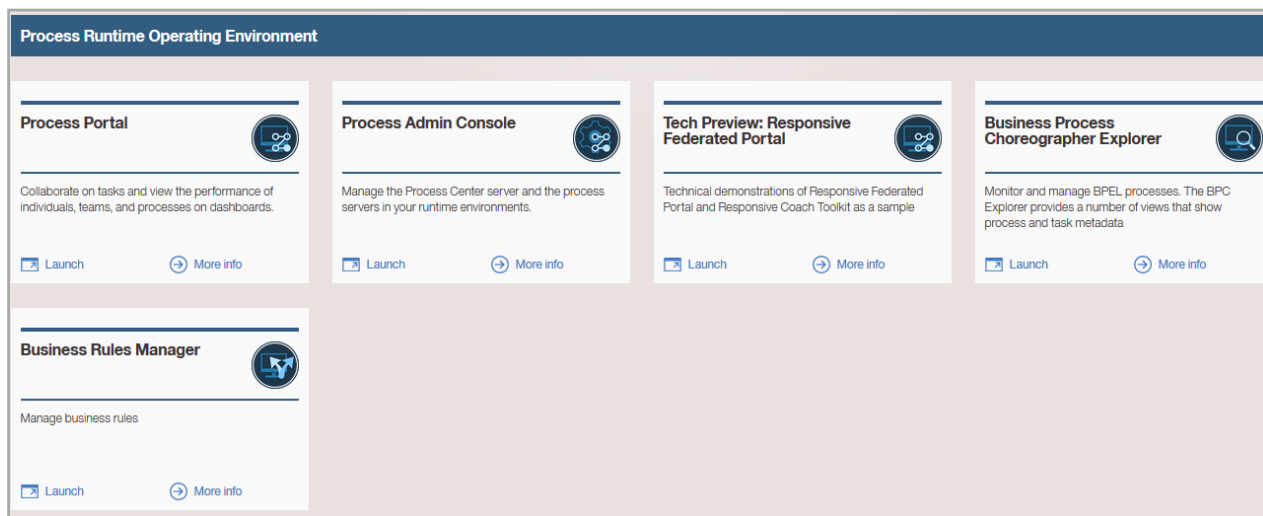
IBM Business Process Manager on Cloud

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Figure B-8. IBM Business Process Manager on Cloud user portal (2 of 3)

## IBM Business Process Manager on Cloud user portal (3 of 3)

- Access from home page to an array of tools in three environments:
  - Production Runtime Operating



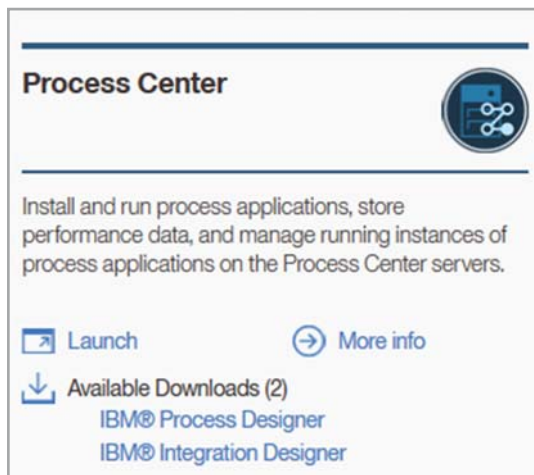
IBM Business Process Manager on Cloud

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Figure B-9. IBM Business Process Manager on Cloud user portal (3 of 3)

## Using the IBM Process Designer (1 of 3)

- Download a version of Process Designer that is configured for use with IBM Business Process Manager on Cloud
- Start Process Designer by double-clicking `eclipse.exe`

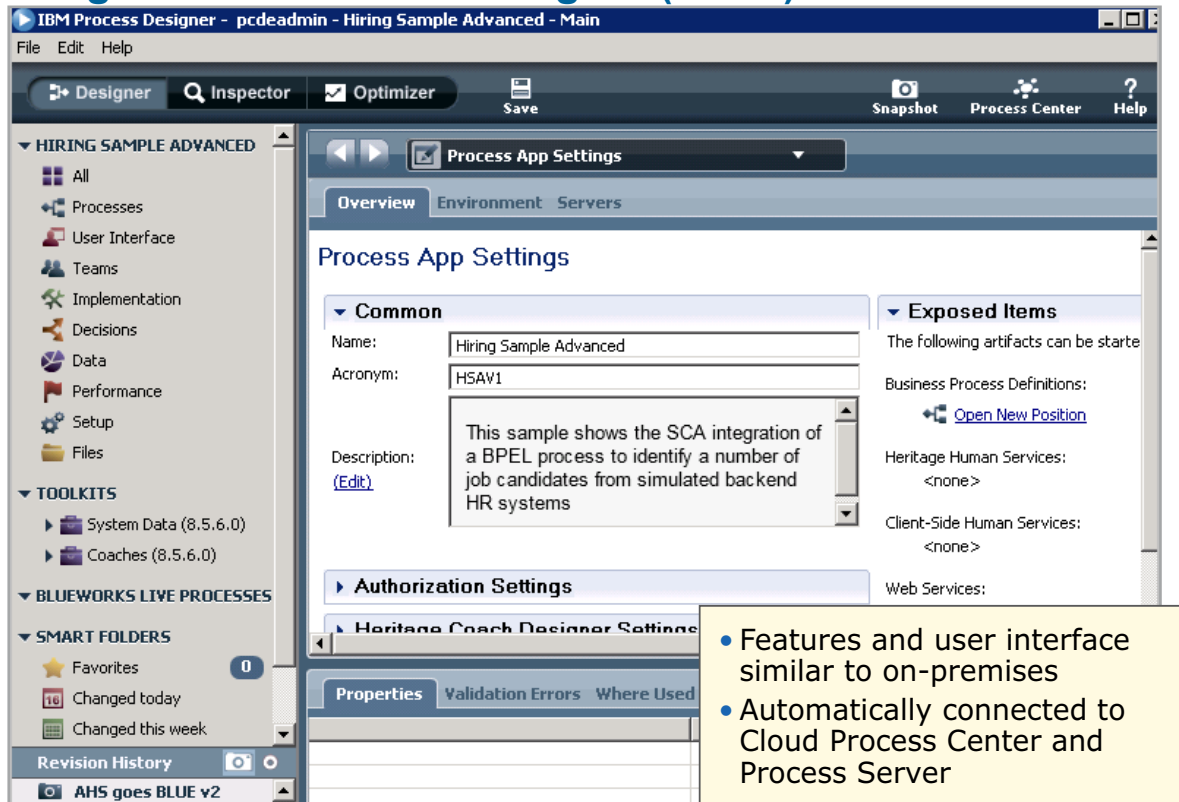


IBM Business Process Manager on Cloud

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Figure B-10. Using the IBM Process Designer (1 of 3)

## Using the IBM Process Designer (2 of 3)

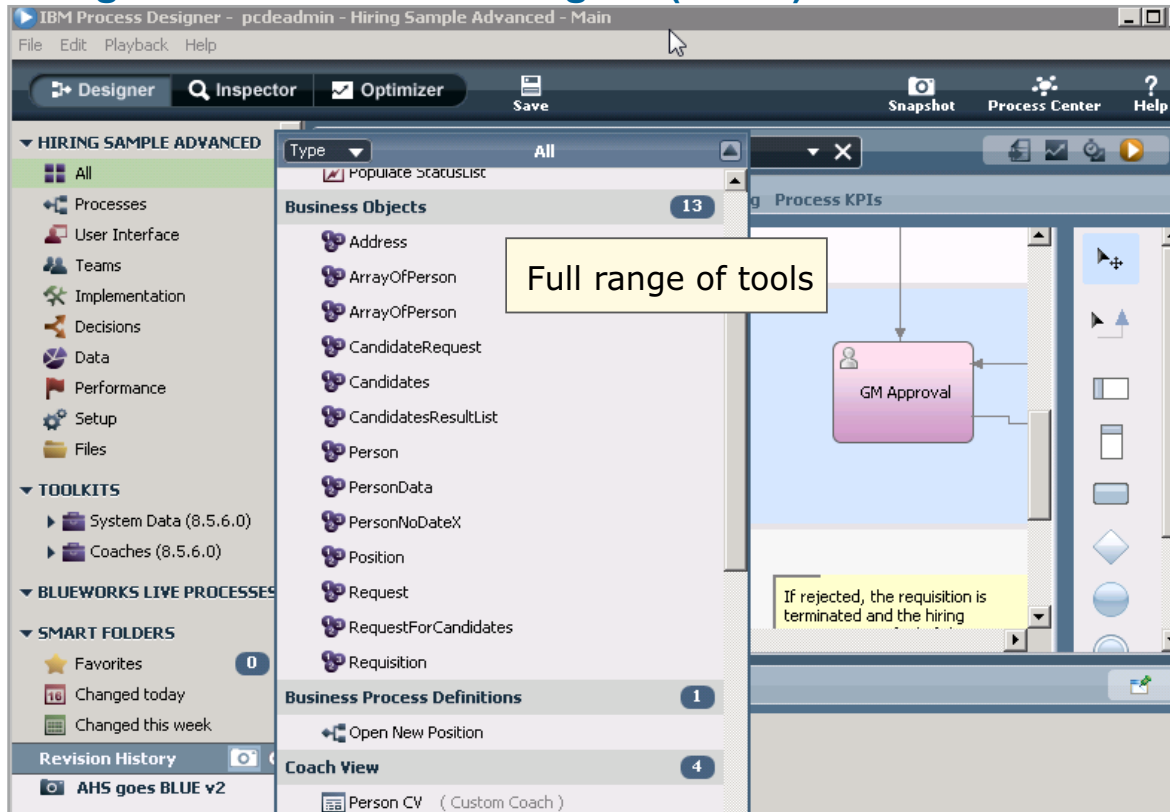


IBM Business Process Manager on Cloud

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Figure B-11. Using the IBM Process Designer (2 of 3)

## Using the IBM Process Designer (3 of 3)



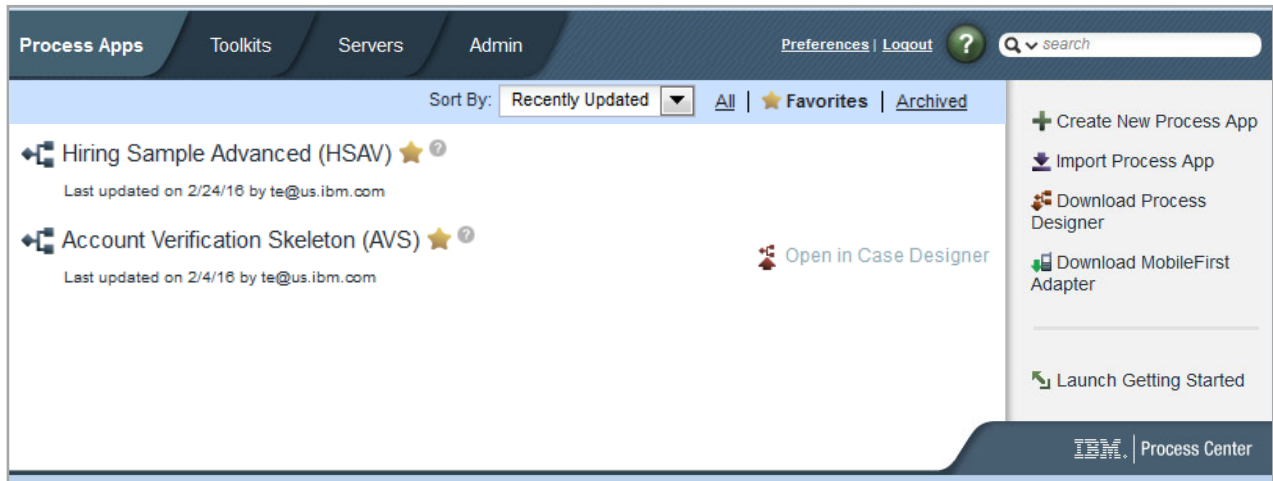
IBM Business Process Manager on Cloud

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Figure B-12. Using the IBM Process Designer (3 of 3)

## Using the IBM Process Center (1 of 3)

- Familiar interface



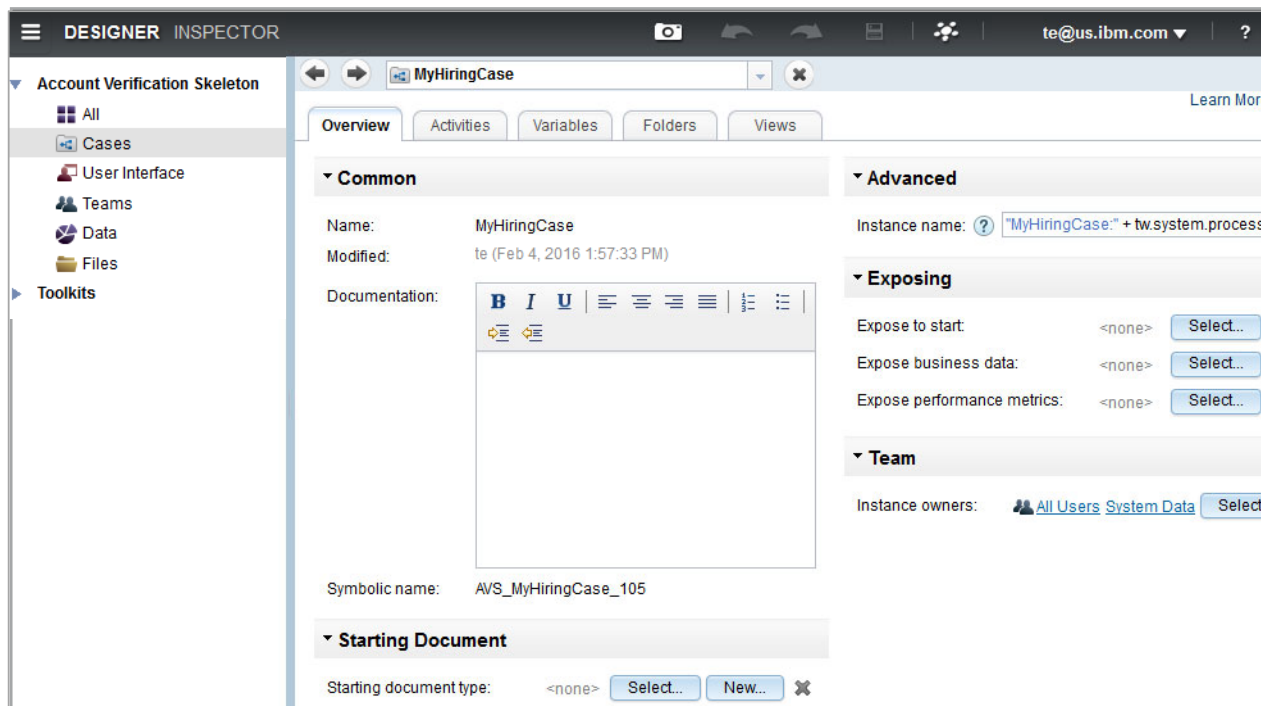
IBM Business Process Manager on Cloud

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Figure B-13. Using the IBM Process Center (1 of 3)

## Using the IBM Process Center (2 of 3)

- Cloud-based Case Designer



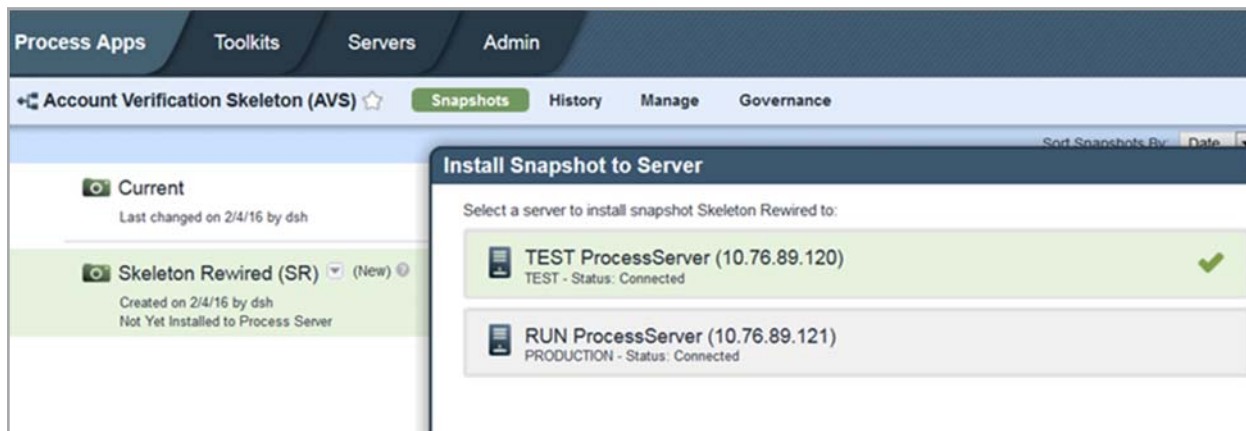
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Figure B-14. Using the IBM Process Center (2 of 3)

## Using the IBM Process Center (3 of 3)

- Snapshots, export, install familiar



IBM Business Process Manager on Cloud

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Figure B-15. Using the IBM Process Center (3 of 3)



## Using the IBM Process Portal

- Users shown familiar Work, Tasks, Coaches interface

The screenshot displays the IBM Process Portal interface for submitting a job requisition. The top navigation bar includes links for 'WO...', 'PROCESS...', 'TEAM PERFORMANCE', and 'PROCESS PERFORMAN...'. The left sidebar shows 'My Work' and 'My Tasks' sections, with a notification for 'Overdue (9)' and a task titled 'Step: Enter Applicant Info' with a sub-note 'Acquire Customer For LOB Life Policy Vi...'. The main content area is titled 'Step: Submit job requisition' and contains the following sections:

- Job requisition data**
  - Requester**
    - \* Request number: 1140
    - \* Hiring Manager: Roland Peisl
  - Requested job position**
    - \* Employment status: [dropdown]
    - \* Department: [dropdown]
    - Number of employees required: 1
  - Requested job start date and location**
    - \* Planned date of job start: 2/4/2016
    - \* Location: [dropdown]
- Position data**
  - \* Position type: [dropdown]
  - \* Job title: Head of Product Development
- Make your decision**
  - Next

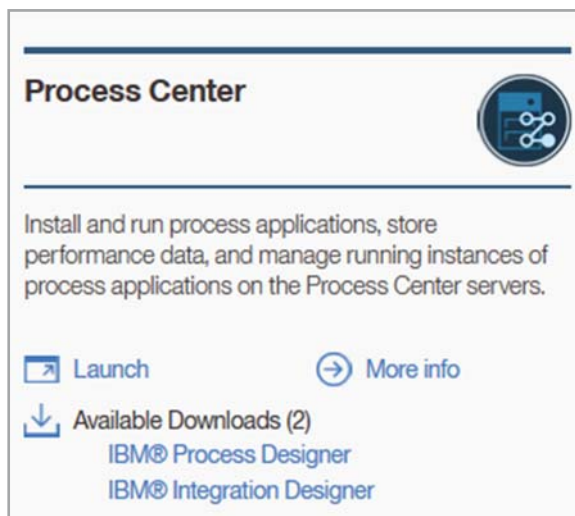
IBM Business Process Manager on Cloud

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Figure B-16. Using the IBM Process Portal

## Using the IBM Integration Designer

- Download a version of the IBM Integration Designer from the IBM Business Process Manager cloud:
  - URL for connecting to IBM Business Process Manager on Cloud provided
- Start IBM Integration Designer on local workstation as usual



IBM Business Process Manager on Cloud

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Figure B-17. Using the IBM Integration Designer

## Finding help for IBM Business Process Manager on Cloud

- IBM Knowledge Center for IBM Business Process Manager on Cloud  
[http://www.ibm.com/support/knowledgecenter/SS964W/ditamaps/product\\_welcome\\_oncloud.html](http://www.ibm.com/support/knowledgecenter/SS964W/ditamaps/product_welcome_oncloud.html)
  - Complete product documentation for IBM Business Process Manager on Cloud, including a “Getting Started” tutorial
  - IBM Business Process Manager on Cloud user portal also has direct links to the documentation
- IBM Business Process Manager Support Portal  
<https://www.ibm.com/support/entry/portal/product/websphere>
  - Support Portal provides tools and resources for help with IBM Business Process Manager
  - Open service requests, view fix lists, access community resources, and more

## Appendix C. Resource guide

Completing this IBM Training course is a great first step in building your IBM Middleware skills. Beyond this course, IBM offers several resources to keep your Middleware skills on the cutting edge. Resources available to you range from product documentation to support websites and social media websites.

### Training

- **IBM Training website**
  - Bookmark the IBM Training website for easy access to the full listing of IBM training curricula. The website also features training paths to help you select your next course and available certifications.
  - For more information, see: <http://www.ibm.com/training>
- **IBM Training News**
  - Review or subscribe to updates from IBM and its training partners.
  - For more information, see: <http://bit.ly/IBMTrainEN>
- **IBM Certification**
  - Demonstrate your mastery of IBM Middleware to your employer or clients through IBM Professional Certification. Middleware certifications are available for developers, administrators, and business analysts.
  - For more information, see: <http://www.ibm.com/certify>
- **Training paths**
  - Find your next course easily with IBM training paths. Training paths provide a visual flow-chart style representation of training for many IBM products and roles, including developers and administrators.
  - For more information, see:  
<http://www-304.ibm.com/jct03001c/services/learning/ites.wss/us/en?pageType=page&c=a0003096>

### Social media links

Connect with IBM Middleware Education and IBM Training, and learn about the latest courses, certifications, and special offers by seeing any of the following social media websites.

- **Twitter**
  - Receive concise updates from Middleware Education a few times each week.
  - Follow Middleware Education at: [twitter.com/websphere\\_edu](https://twitter.com/websphere_edu)
- **Facebook:**
  - Follow IBM Training on Facebook to keep in sync with the latest news and career trends, and to post questions or comments.

- Find IBM Training at: [facebook.com/ibmtraining](https://facebook.com/ibmtraining)
- **YouTube:**
  - See the IBM Training YouTube channel to learn about IBM training programs and courses.
  - Find IBM Training at: [youtube.com/IBMTraining](https://youtube.com/IBMTraining)

## Support

- **Middleware Support portal**
  - The Middleware Support website provides access to a portfolio of downloadable support tools, including troubleshooting utilities, product updates, drivers, and Authorized Program Analysis Reports (APARS). The Middleware Support website also provides links to online Middleware communities and forums for collaboratively solving issues. You can now customize the IBM Support website by adding or deleting portlets to show the most important information for the IBM products that you work with.
  - For more information, see: <http://www.ibm.com/software/websphere/support>
- **IBM Support Assistant**
  - The IBM Support Assistant is a local serviceability workbench that makes it easier and faster for you to resolve software product issues. It includes a desktop search component that searches multiple IBM and non-IBM locations concurrently and returns the results in a single window, all within IBM Support Assistant.
  - IBM Support Assistant includes a built-in capability to submit service requests; it automatically collects key problem information and transmits it directly to your IBM support representative.
  - For more information, see: <http://www.ibm.com/software/support/isa>
- **IBM Education Assistant**
  - IBM Education Assistant is a collection of multimedia modules that are designed to help you gain a basic understanding of IBM software products and use them more effectively. The presentations, demonstrations, and tutorials that are part of the IBM Education Assistant are an ideal refresher for what you learned in your IBM Training course.
  - For more information, see:  
<http://www.ibm.com/software/info/education/assistant/>

## Middleware documentation and tips

- **IBM Redbooks**
  - The IBM International Technical Support Organization develops and publishes IBM Redbooks publications. IBM Redbooks are downloadable PDF files that describe installation and implementation experiences, typical solution scenarios, and step-by-step “how-to” guidelines for many Middleware products. Often, Redbooks

include sample code and other support materials available as downloads from the site.

- For more information, see: <http://www.ibm.com/redbooks>

- **IBM documentation and libraries**

- IBM Knowledge Centers and product libraries provide an online interface for finding technical information on a particular product, offering, or product solution. The IBM Knowledge Centers and libraries include various types of documentation, including white papers, podcasts, webcasts, release notes, evaluation guides, and other resources to help you plan, install, configure, use, tune, monitor, troubleshoot, and maintain Middleware products. The Knowledge Center and library are located conveniently in the left navigation on product web pages.

- **developerWorks**

- IBM developerWorks is the web-based professional network and technical resource for millions of developers, IT professionals, and students worldwide. IBM developerWorks provides an extensive, easy-to-search technical library to help you get up to speed on the most critical technologies that affect your profession. Among its many resources, developerWorks includes how-to articles, tutorials, skill kits, trial code, demonstrations, and podcasts. In addition to the Middleware zone, developerWorks also includes content areas for Java, SOA, web services, and XML.
- For more information, see: <http://www.ibm.com/developerworks>

## Services

- IBM Software Services for Middleware are a team of highly skilled consultants with broad architectural knowledge, deep technical skills, expertise on suggested practices, and close ties with IBM research and development labs. The Middleware Services team offers skills transfer, implementation, migration, architecture, and design services, plus customized workshops. Through a worldwide network of services specialists, IBM Software Service for Middleware makes it easy for you to design, build, test, and deploy solutions, helping you to become an on-demand business.
- For more information, see:  
<http://www.ibm.com/services/us/en/it-services/systems/middleware-services>





IBM Training

