

Course Guide

Administration of IBM Business Process Manager Advanced V8.5.7

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Course description

Administration of IBM Business Process Manager Advanced V8.5.7

Duration: 5 days

Purpose

In this introductory course, you learn the skills that are needed to install, configure, and administer IBM Business Process Manager Advanced V8.5.7.

IBM Business Process Manager Advanced V8.5.7 includes IBM Process Server, IBM Integration Designer, IBM Process Designer, IBM Process Center, and WebSphere Enterprise Service Bus. This course focuses on IBM Process Server, which is a high-performance business engine at the heart of business process management (BPM) and service-oriented architecture (SOA). The course covers how to configure both Process Center and Process Server in a network deployment environment. You learn about the various deployment topologies that are available for both environments. The course also teaches you about the selection criteria for choosing an appropriate deployment topology. You learn how Business Process Manager uses the service integration bus (WebSphere Platform Messaging) for all asynchronous communications.

To build a highly available Process Server architecture, you must understand how the service integration bus works, and know how to integrate it into the design of a topology. Hands-on exercises on the Ubuntu Linux operating system are provided throughout the course, giving you practical experience with designing, deploying, and troubleshooting a highly available Process Server environment. Through the labs, you configure both Process Center and Process Server in a network deployment environment and verify the configuration. You deploy a basic application and use it to test the capabilities of the Process Server environment. You examine applications in Process Center and deploy applications to both an online and an offline Process Server environment. Finally, you migrate process instances in the Process Server environment.

The exercises in this course run on IBM Business Process Manager Advanced V8.5.7. The lab environment uses the Ubuntu Linux platform.

Audience

This course is designed for systems administrators, solutions administrators, and operators who install, configure, manage, and troubleshoot Process Server applications.

Prerequisites

Before taking this course, you should successfully complete one of the IBM WebSphere Application Server V8.5 Administration courses (course code WA585G or ZA585G) or IBM WebSphere Application Server V8.5.5 Administration courses (course code WA855G or ZA855G). You should also have a general knowledge of:

- The Linux operating system

- Java Platform, Enterprise Edition (Java EE) and Extensible Markup Language (XML)
- Administering multitier business applications

Objectives

- Configure and administer a Process Center environment
- Configure and administer a Process Server environment
- Describe the purpose and business value of the tools included in IBM Business Process Manager Advanced V8.5.7: IBM Process Designer, IBM Integration Designer, IBM Process Server, IBM Process Center, and WebSphere Enterprise Service Bus
- Describe IBM Business Process Manager Advanced architecture, concepts, and terminology
- Describe the deployment considerations for IBM Business Process Manager Advanced components
- Describe the Process Server high availability topologies and their selection criteria
- Create a Process Center clustered environment by using the Deployment Environment wizard
- Create a customized properties file by using the IBM Business Process Manager Advanced Configuration Editor
- Create a Process Server clustered environment by using the BPMConfig utility
- Purge content in the Process Center environment
- Purge content in the Process Server environment
- Verify the functions of failover in a clustered environment
- Deploy and manage business applications
- Work with the administrative console and management tools
- Deploy applications to an offline and online Process Server environment
- Migrate process instances
- Implement SSL between the Process Center and Process Server environments
- Troubleshoot the environment

Agenda



Note

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

Day 1

- (00:15) Course introduction
- (01:00) Unit 1. Overview of IBM Business Process Manager Advanced
- (01:00) Unit 2. IBM Business Process Manager Advanced installation
- (00:30) Exercise 1. Installing IBM Business Process Manager Advanced
- (00:30) Unit 3. IBM Business Process Manager Advanced architecture overview
- (00:45) Unit 4. IBM Business Process Manager Advanced components
- (01:00) Unit 5. IBM Business Process Manager Advanced deployment topologies

Day 2

- (01:30) Exercise 2. Configuring the Process Center environment
- (01:15) Unit 6. Introduction to IBM Process Center
- (01:15) Exercise 3. Administering Process Center
- (00:30) Unit 7. Overview of Process Portal
- (00:45) Exercise 4. Administering Process Portal
- (01:30) Exercise 5. Purging content in Process Center

Day 3

- (01:00) Unit 8. Introduction to IBM Process Server
- (01:30) Exercise 6. Configuring the Process Server environment
- (01:00) Unit 9. Business process choreography
- (01:15) Unit 10. Application deployment concepts
- (01:15) Exercise 7. IBM Process Server administration

Day 4

- (01:30) Exercise 8. Purging content in Process Server
- (00:45) Unit 11. Overview of deployment scenarios
- (01:30) Exercise 9. Managing offline and online process servers
- (0:45) Exercise 10. Migrating process instances
- (01:15) Unit 12. Advanced administration concepts

Day 5

- (01:00) Exercise 11. Advanced Process Server administration
- (01:00) Unit 13. Security
- (01:00) Unit 14. Problem determination
- (00:15) Unit 15. Course summary

Unit 1. Overview of IBM Business Process Manager Advanced

Estimated time

01:00

Overview

This unit provides an introduction to the principles of business process management (BPM). You learn the capabilities of IBM Business Process Manager Advanced V8.5.7 for deploying BPM solutions.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

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Unit objectives

- Describe the concepts of business processes and business process management (BPM)
- Describe business integration roles in IBM Business Process Manager Advanced
- Describe the IBM product editions that support the development of business processes
- Describe the capabilities of IBM Business Process Manager Advanced
- Describe IBM Business Process Manager Advanced on Cloud

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Figure 1-2. Unit objectives

Topics

- Introduction to business processes and business process management
- IBM Business Process Manager editions
- IBM Business Process Manager Advanced features and capabilities
- IBM BPM on Cloud
- Integration with other IBM products

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Figure 1-3. Topics

1.1. Introduction to business processes and business process management

Introduction to business processes and business process management

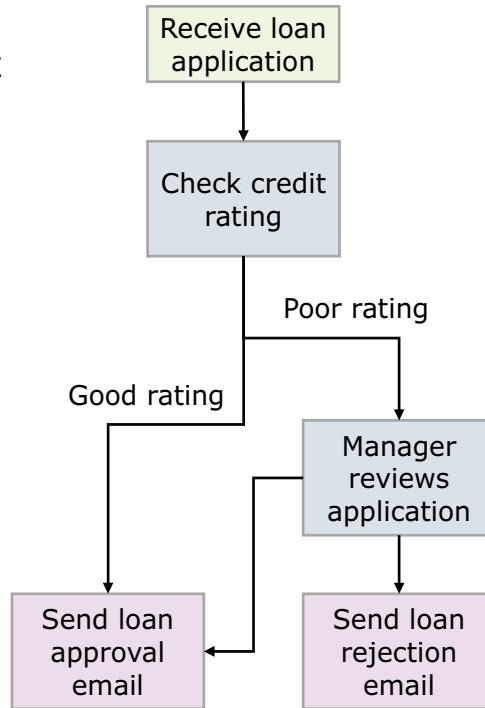
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Figure 1-4. Introduction to business processes and business process management

Business processes

- A *business process* is a collection of service interactions and activities that are run to fulfill a business need
- A business process defines the potential execution order of services:
 - Defines how to coordinate interactions between a process instance and its partners
 - Specifies how to handle errors (faults)
 - Specifies other required technology patterns like compensation



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Figure 1-5. Business processes

A *business process* is a collection of service interactions and activities that are run to fulfill a business need.

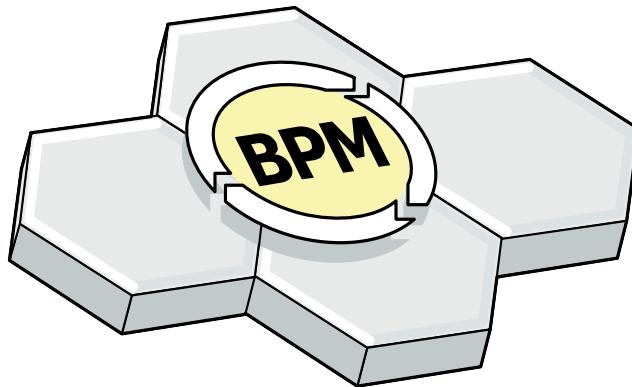
A business process defines the potential execution order of services.

The business process defines how to coordinate interactions between a process instance and its business partners, and specifies how errors are handled.

In the context of a business process, business partners define parties that interact with the process.

Business Process Management

- *Business process management (BPM)* is a systematic approach to improving business processes for an organization
 - BPM makes business processes more effective and efficient through a cycle of continuous improvement
- BPM often includes the steps:
 - Model, test, deploy, run, and monitor



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Figure 1-6. Business Process Management

Business process management (BPM) is a systematic approach to improving business processes for an organization. BPM makes business processes more effective and efficient through a cycle of continuous improvement.

BPM can include the steps of modeling, testing, deployment, running, and monitoring of the business processes.

IBM Business Process Manager

- IBM Business Process Manager gives you visibility into your business processes
 - Enables the development and management of business processes
 - Can be configured to support various levels of complexity and integration between IBM BPM components
 - An integrated runtime for all business processes, services, and enterprise applications
 - Tools for developers, administrators, and users
- Components of IBM Business Process Manager
 - IBM Process Server: The runtime platform
 - IBM Process Center: A unified IBM BPM asset repository
 - IBM Integration Designer: An authoring environment for developing services and self-contained enterprise applications
 - IBM Process Designer: An authoring environment for developing process models

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Figure 1-7. IBM Business Process Manager

IBM Business Process Manager gives you the capability to model and run your business processes.

With IBM Business Process Manager, you get to choose the types of models and services you want to create, and the type of development environment you want to use.

For example, you decide whether you want to model the business processes by using Business Process Model and Notation (BPMN) or Business Process Execution Language (BPEL).

The integrated runtime supports both BPMN and BPEL for business processes, services, and enterprise applications.

The components of IBM Business Process Manager include:

- IBM Process Server: This component is the runtime platform.
- IBM Process Center: This component is a unified IBM BPM asset repository.
- IBM Integration Designer: This component is an authoring environment for developing services and self-contained enterprise applications.
- IBM Process Designer: This component is an authoring environment for developing process models.

Business integration roles in BPM

User role	Role definition
Business leader (line-of-business manager)	<ul style="list-style-type: none"> • No programming experience • Focus is on business strategy and performance
Business analyst	<ul style="list-style-type: none"> • No programming experience • Focus is on business performance, process design, and optimization
Integration developer	<ul style="list-style-type: none"> • Some basic programming experience (loops, conditionals, and string manipulation) • Expects tools to simplify and abstract advanced IT implementation details
Application developer (IT developer)	<ul style="list-style-type: none"> • Focus is on the development of application-specific business logic (for example, EJBs, POJOs, and COBOL) for components and services that a business integration solution uses
IT architect	<ul style="list-style-type: none"> • Defines basic operational imperatives in the provision of IT services with a focus on resiliency, reuse, and adaptability
BPM administrator	<ul style="list-style-type: none"> • Focus is on administration, management, and maintenance of a deployed business solution

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Figure 1-8. Business integration roles in BPM

Several roles are associated with IBM Business Process Manager. The IBM BPM solution administrator is the focus for this course.

The IBM process management tools span the development cycle, allowing increased productivity and communication between different user roles. The definitions of the business integration user roles do not assume a one-to-one relationship. A single person can have multiple roles. For example, an application developer can take the role of integration developer. It is also common for several phases of the application development cycle to involve user roles.

1.2. IBM Business Process Manager editions

IBM Business Process Manager editions

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Figure 1-9. IBM Business Process Manager editions

Three editions of IBM Business Process Manager

- IBM BPM Express
 - Limited number of users
- IBM BPM Standard
 - A comprehensive IBM BPM platform
 - Can be used for typical business process management solutions
- IBM BPM Advanced
 - Includes all the features of the IBM BPM Standard version and more advanced integration and connectivity capabilities
- IBM Business Process Manager on Cloud is now available
 - Provides the same IBM BPM capabilities on the cloud

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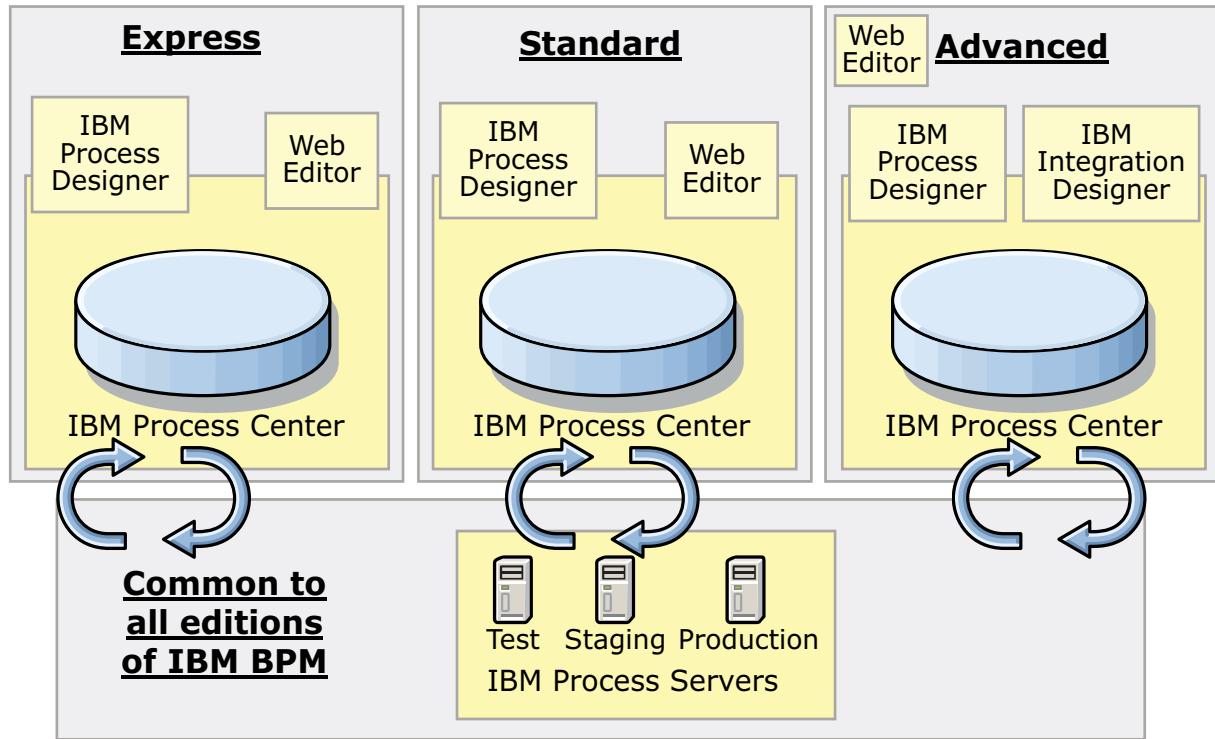
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Figure 1-10. Three editions of IBM Business Process Manager

IBM Business Process Manager Standard is used for typical business process management projects that require a deeper business user engagement and IT collaboration through the process improvement lifecycle. IBM Business Process Manager Standard is ideal for multi-project improvement programs that focus on workflow and productivity, scaling easily from initial project to enterprise-wide programs.

IBM BPM on Cloud is discussed in more detail later in this unit. IBM BPM on Cloud is covered in more detail in the appendix at the end of the student book.

IBM Business Process Manager editions



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Figure 1-11. IBM Business Process Manager editions

There are three different configurations of IBM Business Process Manager that correlate with typical entry points or stages in a business process management program for a company. Each configuration matches increasing levels of functional complexity.

IBM Business Process Manager Express is designed for a small business process management (BPM) project. It is configured to operate with a few users or a single server, with no clustering.

IBM Business Process Manager Standard is used for typical IBM BPM projects. It is designed for multi-project improvement programs that have a high business involvement. The standard configuration offers improved user productivity and basic system integration support.

IBM Business Process Manager Advanced offers the full set of advanced IBM BPM capabilities. It extends the support for high-volume process automation, with high quality of service. The advanced configuration offers built-in Service Component Architecture (SCA) components and all of the capabilities of IBM WebSphere Enterprise Service Bus.

You learn about Service Component Architecture and some of the capabilities of the IBM WebSphere Enterprise Service Bus in later units.

The Web Editor is the Web Process Designer.

IBM Business Process Manager Express

- IBM Process Designer limited to three authors
- IBM Process Center
 - Two development cores
 - No high availability
- Process Server
 - Run BPMN processes
 - Rules and monitoring support
 - No clustering support
 - No BPEL, SCA, or ESB support
- Small number of users
- Single server and no clustering
- Simple installation
- Low pricing

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Figure 1-12. IBM Business Process Manager Express

The entry level product is the IBM Business Process Manager Express and is good for a group just starting out with business process management. The IBM Business Process Manager Express contains functions that come from the WebSphere Lombardi Edition heritage. IBM Business Process Manager Express can be installed only in a stand-alone server with no clustering and has a simple installation process. The pricing is low so that you can get started with a business process management project without a major financial investment.

IBM Business Process Manager Standard (1 of 2)

- IBM Process Designer
- IBM Process Center
 - Able to version BPMN processes
 - Clustering supported
- Process Server
 - Run BPMN processes
 - Run monitoring support
 - No BPEL, SCA, or ESB support
- Includes basic system integration support
- Focus on improved workflow and productivity
- Larger number of users than Express configuration

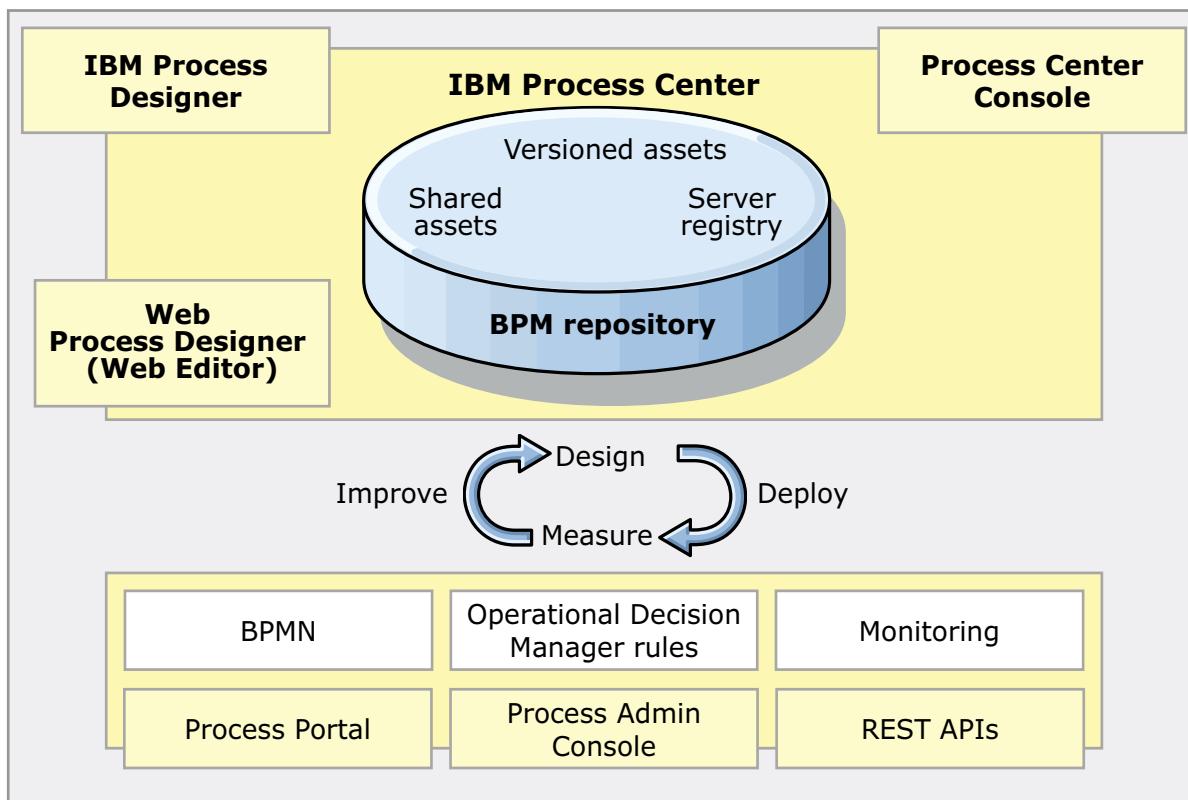
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Figure 1-13. IBM Business Process Manager Standard (1 of 2)

IBM Business Process Manager Standard is used for typical business process management projects that require a deeper business user engagement and IT collaboration through the process improvement lifecycle.

IBM Business Process Manager Standard (2 of 2)



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Figure 1-14. IBM Business Process Manager Standard (2 of 2)

IBM Business Process Manager Standard provides new levels of interoperability between IBM software.

IBM Business Process Manager Standard uses a shared model for development artifacts that are authored in the IBM Process Designer. It has one common repository and a single representation of the solution. The IBM BPM component that is called the IBM Process Center realizes this shared model. The IBM Process Center repository is implemented as tables within a database (commonly DB2).

IBM Business Process Manager Advanced (1 of 2)

- Includes all the tools, features, and capabilities of IBM BPM Standard

AND

- IBM Integration Designer
 - An authoring environment that is used for creating processes, including BPEL with human tasks, SCA components, and services
- More capabilities
 - Built in ESB, transaction support, integration adapters, and case management

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Figure 1-15. IBM Business Process Manager Advanced (1 of 2)

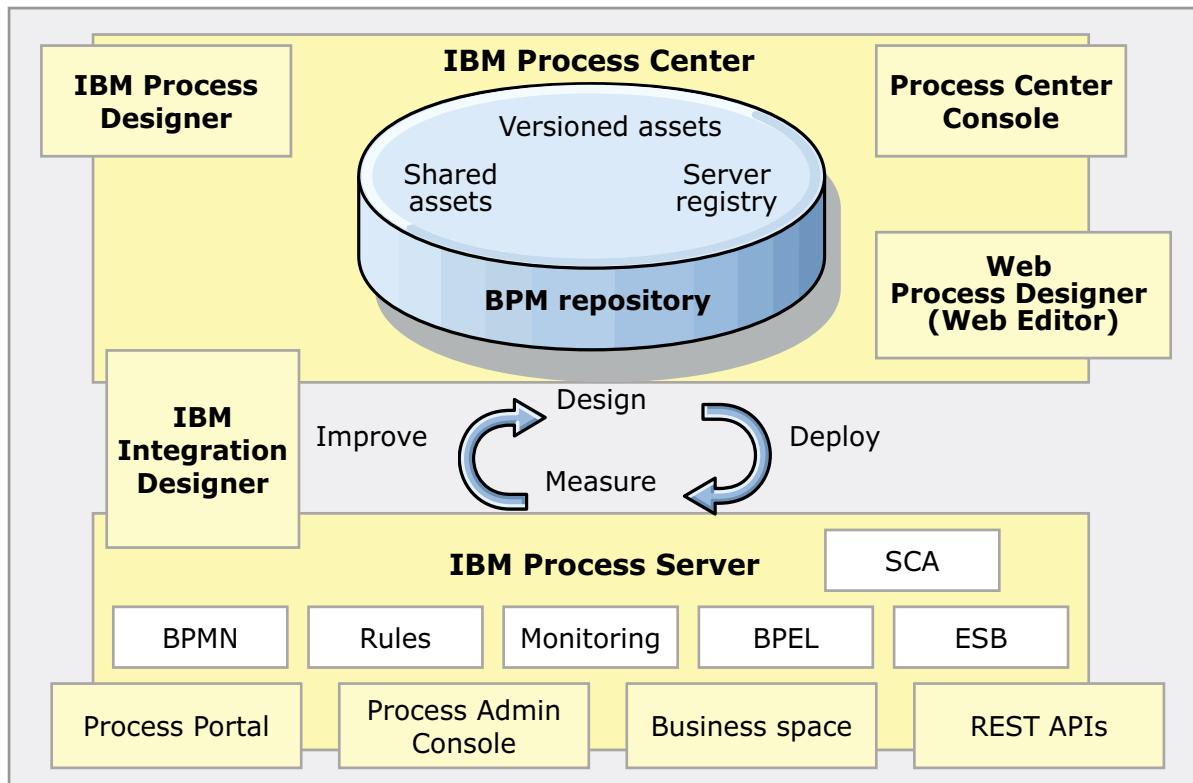
IBM Process Designer is an authoring environment that is used to create process models that contain automated and human tasks. These models are developed with the Business Process Model and Notation (BPMN) and Business Process Definition (BPD) formats.

IBM Integration Designer is an authoring environment that is used to create process models and advanced service implementations, including mediations, Service Component Architecture (SCA) modules, business rules, and Business Process Execution Language (BPEL) with human tasks.

IBM Process Center includes a repository for all processes, services, and other assets that are created in the authoring environments. IBM Process Server provides a single runtime environment for supporting process models, service orchestration, and integration capabilities.



IBM Business Process Manager Advanced (2 of 2)



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Figure 1-16. IBM Business Process Manager Advanced (2 of 2)

IBM Business Process Manager Advanced provides new levels of interoperability between IBM software.

IBM Business Process Manager Advanced supports high-volume automation and extensive system integration.

IBM Business Process Manager Advanced uses a shared model for development artifacts that are authored in either IBM Process Designer or IBM Integration Designer. There is one common repository with a single representation of the solution.

The IBM BPM component that is called the IBM Process Center realizes this shared model.

The IBM Process Center repository is implemented as tables within a database (commonly DB2).

1.3. IBM Business Process Manager Advanced features and capabilities

IBM Business Process Manager Advanced features and capabilities

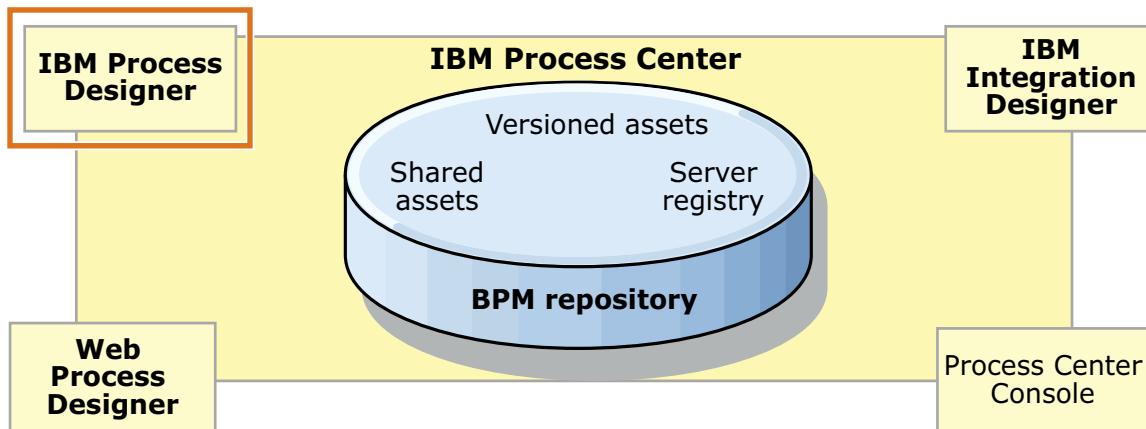
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Figure 1-17. IBM Business Process Manager Advanced features and capabilities

IBM Process Designer: Desktop Process Designer

- Tool to develop and manage business processes
- Model, simulate, and inspect business processes
- Artifacts: Business Process Model and Notation (BPMN) and business process definitions (BPD)



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Figure 1-18. IBM Process Designer: Desktop Process Designer

IBM Process Designer is an Eclipse-based tool that business process authors use. It offers capabilities to model and implement business processes as process applications. IBM Process Designer includes tools, the Process Inspector, and the Process Optimizer for interacting with processes on the Process Center Server (playback server) or a Process Server deployment target.

A process is the major unit of logic in IBM Business Process Manager. It is the container for all components of a process definition, including services, activities, and gateways; timer, message, and exception events; sequence lines, rules, and variables. When you model a process, you create a reusable business process definition (BPD).

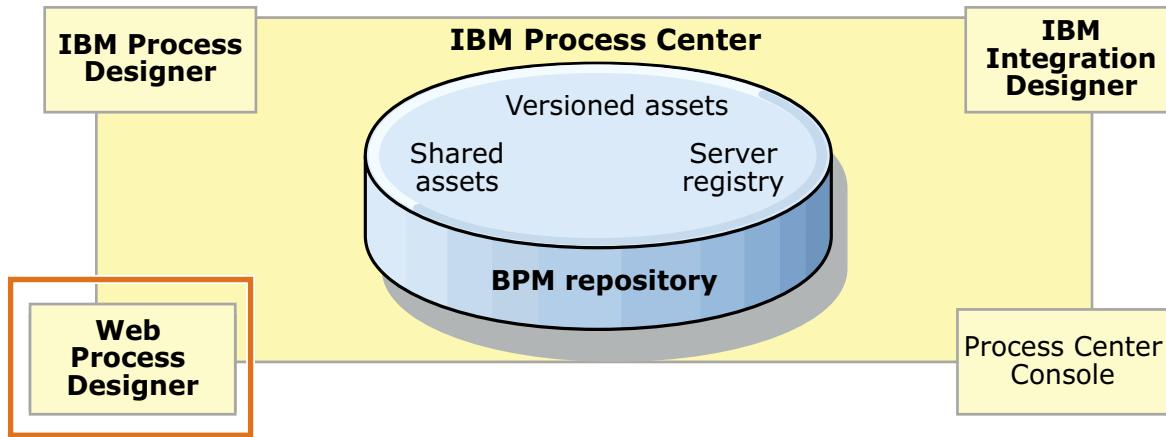
All Process Designer projects are contained in process applications. You store those process applications and associated artifacts in the Process Center repository.

Toolkits are containers that store library items (for example, BPDs) for reuse by process applications or other toolkits. Process applications can share library items from one or more toolkits, and toolkits can share library items from other toolkits.

Processes applications that are developed in Process Designer can run any time on the Process Center server or can be saved to a snapshot and deployed on the Process Server. The same is true of services that are developed in Integration Designer and associated with process applications.

IBM Process Designer: Web Process Designer

- Tool to develop and manage processes in a web-based editor
- Artifacts: Business objects, team, coach views, localization resources, server files, and web files
- Artifacts available only from web editor include case types, client-side human service, and document types



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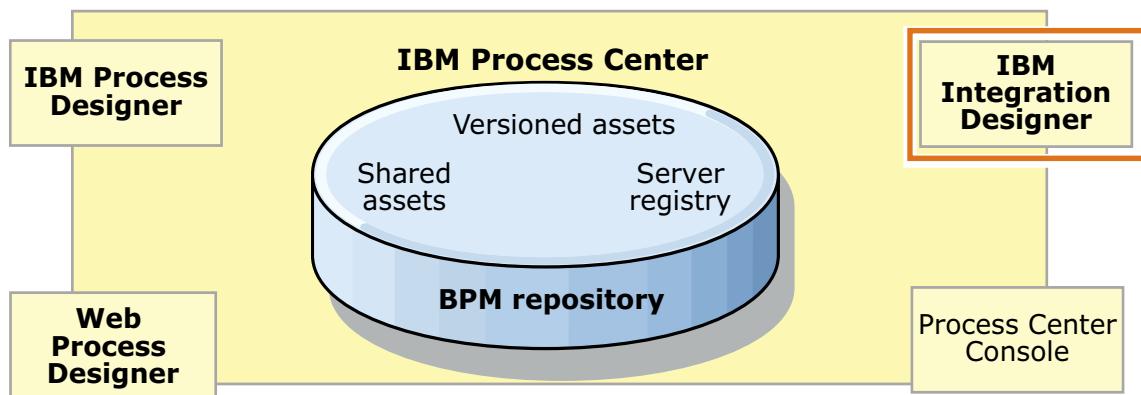
Figure 1-19. IBM Process Designer: Web Process Designer

Some features are not supported:

- Team: Simulation properties, team retrieval service
- Business objects: Shared business object flag can be set

IBM Integration Designer

- Development tool for building SCA-based, integration applications
- Provides a visual development environment for developing, assembling, testing, deploying, and managing integration modules and mediation modules
- Artifacts: Service Component Architecture (SCA) modules and libraries, and Advanced Integration services (AIS)
- Available with Advanced edition of the product only



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Figure 1-20. IBM Integration Designer

IBM Integration Designer is an Eclipse-based tool that IT developers use. *IBM Integration Designer* is used to author complex integrations and fully automated processes that support process applications that are designed in the Process Designer.

It incorporates a fully integrated testing environment with test cases and test suites. Using *IBM Integration Designer*, IT developers build reusable SOA services, orchestrate those services, and access traditional systems.

The artifacts that are produced in *IBM Integration Designer* include:

- SCA components that contain one or more modules and libraries and are deployable as EAR files
- Advanced Integration services that are traditional BPEL processes

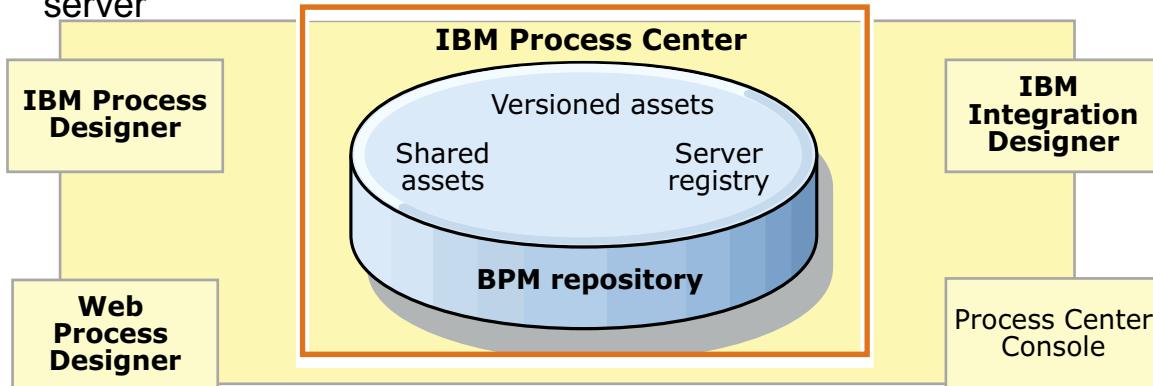
The SCA modules and libraries that are created with *IBM Integration Designer* can be associated with a process application by using the Process Center.

The artifacts that are produced in *Integration Designer* can be used as services by processes that are created in Process Designer.

In such cases, they are deployed with the process application.

IBM Process Center: Capabilities

- Repository for all Business Process Manager assets
- Lifecycle management and deployment of all applications
- Includes execution environment for development and testing
- Accessible from IBM Process Designer and from IBM Integration Designer
- Web interface by using IBM Process Center Console
- Includes Process Center server and the Performance Data Warehouse server



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Figure 1-21. IBM Process Center: Capabilities

You can use the IBM Process Center repository to share business process management assets with other users who are developing process applications and toolkits. These assets include process applications, reusable toolkits, monitor models, and more. It also can manage dependencies, versions, and deployment to servers.

The repository also maintains a registry of the process servers in the environment. The Process Center is involved in the modeling and development of process applications, running the applications during initial testing, and deploying the applications to test and production servers.

The IBM Process Center includes two servers, the Process Center server and the Performance Data Warehouse server. These servers allow developers that are working in Process Designer to run their process applications and store performance data for testing and playback during development efforts. Performance Data Warehouse retrieves tracked data from Process Server or Process Center server at regular intervals.

IBM Process Server: Capabilities

- Runtime engine for deployed applications
- Supports SCA-based services
- Supports:
 - Business processes
 - Service orchestration
 - Integration
- Provides simple and flexible execution of standards-based business process management solutions
- Implements WS-BPEL compliant process engine that runs complex business process automation
- Facilitates building of composite integration applications
- Provides high performance and qualities of service with fault tolerance and error-detection capability
- Includes a prebuilt Web 2.0 business user client (Business Space)

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Figure 1-22. IBM Process Server: Capabilities

IBM Process Server is the runtime environment for business process applications.

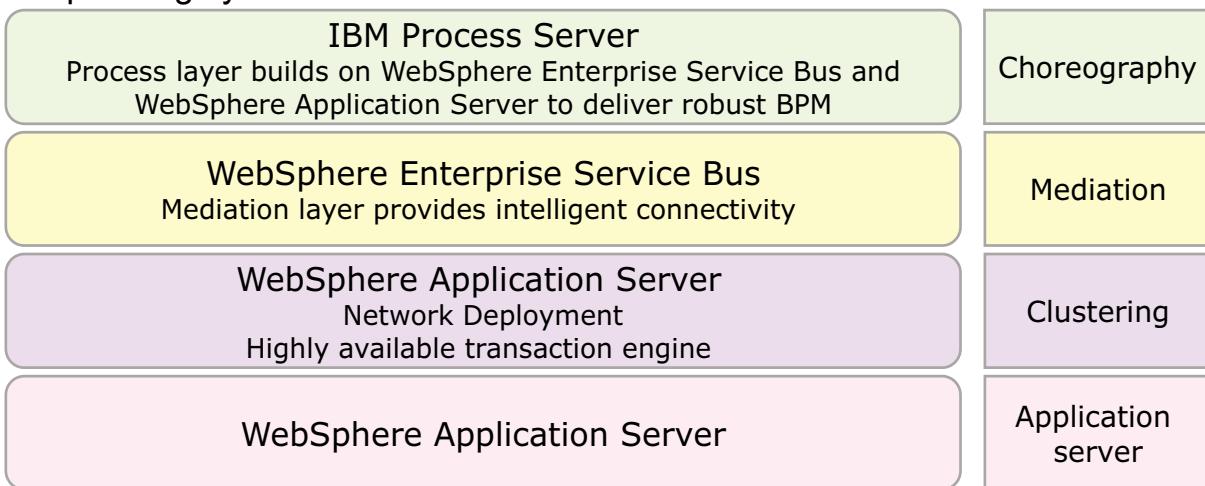
IBM Process Server provides rich and diverse functions for business processes. Some key capabilities include Service Component Architecture (SCA), which provides the capability to implement SCA-based services that can have various implementation types and support various communication protocols. Business Process Execution Language (BPEL) provides a high-level way to define your business processes that are provided as SCA components.

Enterprise service bus (ESB) capabilities provide a way to loosely couple service requesters and service providers, allowing for protocol conversion, message transformation, and routing. Business Process Model and Notation (BPMN) is another way to define the flow of a business process. Rules are a way to abstract decision points from code so that they can be more easily adjusted.

Monitoring is a way to track in real time how a business process is working to help identify bottlenecks and potential places for improvement. The Process Portal is one of several tools that are used for management of human tasks. Business Space provides a configurable user interface that can be used for various purposes.

IBM Process Server: Foundation

- WebSphere Application Server Network Deployment provides high availability, workload management, and qualities of service
- WebSphere Enterprise Service Bus integration provides a communication infrastructure for integrating services, applications, and data
- IBM Process Server adds business process management functions to the operating system



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Figure 1-23. IBM Process Server: Foundation

At the lowest level, IBM Process Server is based on the WebSphere Application Server product. WebSphere Application Server implements the Java EE standard and allows applications that are written on top of it to be portable and efficient. To IBM, Java EE is a platform-neutral operating system that provides all the richness of functions that are needed to build and run applications. Users of Java EE can divest themselves from concerns of security, transaction support, resource management, and much more, and leave those functions to the Java EE environment. In this way, programmers can focus on the important business functions.

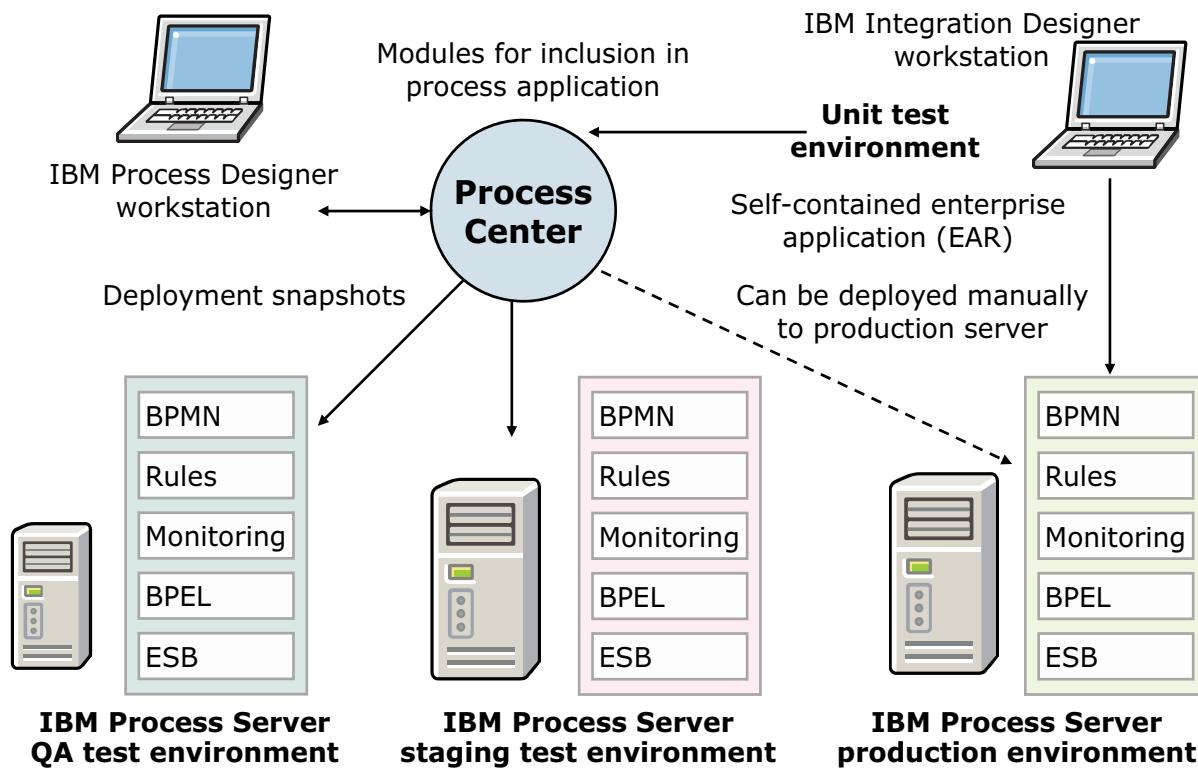
Although IBM Process Server is implemented on top of WebSphere Application Server, Java EE skills are not required to design and implement IBM BPM solutions in IBM Process Server. IBM Process Server provides a higher level of abstraction, hiding its own implementation details.

Each layer encapsulates and builds on the lower layer. Everything begins with the application server. The higher abstraction layers indirectly use the application server or WebSphere Application Server Network Deployment for security, user registry, transactions, scalability, clustering, high availability, failover, platform messaging, and automated deployment.

WebSphere Enterprise Service Bus adds support for ESB service integration points, message mediation flows, and central management of integration logic and integration resources. IBM Process Server adds the capabilities of business process development and choreography.



Typical development and deployment scenario



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Figure 1-24. Typical development and deployment scenario

The diagram shows a typical development and deployment topology.

A unit test environment (UTE) is installed during the installation of IBM Integration Designer. In this mode, the unit tester can test SCA modules locally in the IBM Process Server running inside the UTE, or test them through the Process Center.

The IBM Process Designer workstation communicates directly with Process Center by using the Process Center Console.

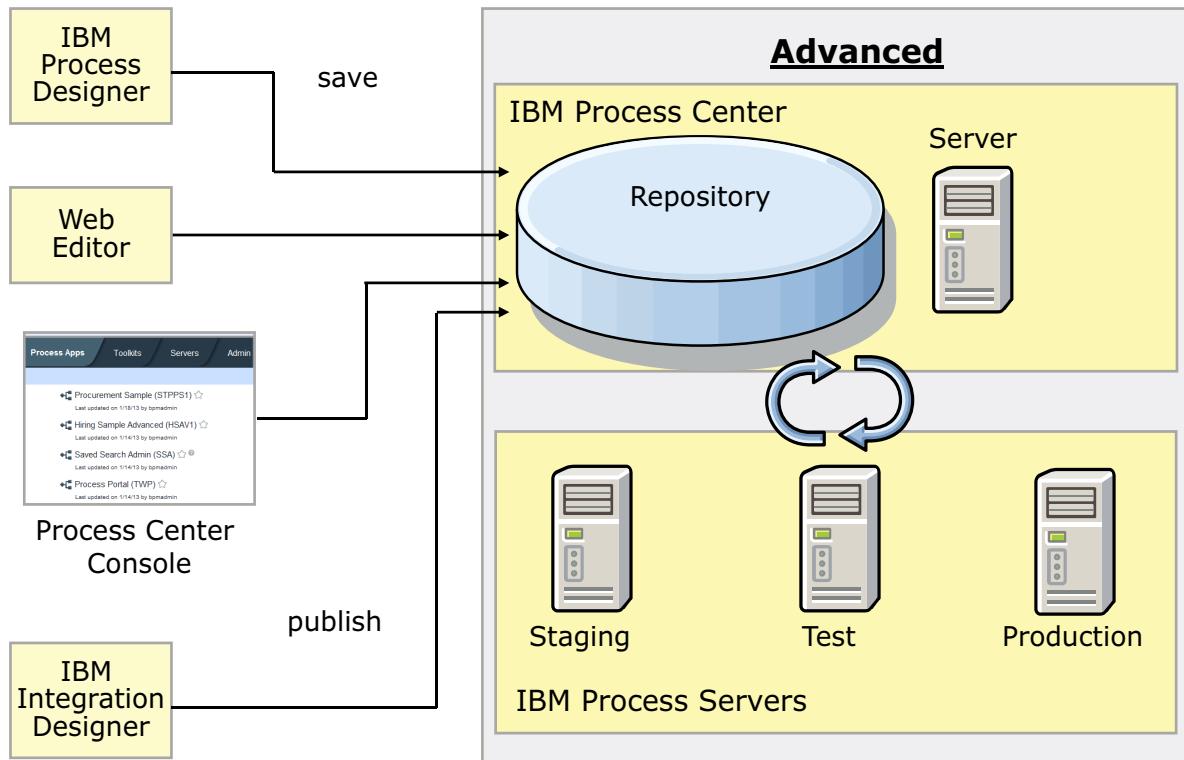
In the example, there are independent QA, staging, and production environments, each with their own full stand-alone IBM Process Server that can be connected to the central IBM Process Center. Artifacts are being published and synchronized back and forth between all the environments while the IBM Process Center is managing the central repository.

This scenario is just a sample, and the topology can be modified to suit the organization requirements.

If you want to install a snapshot on an IBM Process Server that is not currently connected to the Process Center server (an offline server), create an installation package. Then, extract the package and transfer it to the offline server. Next, use administrative commands on the server to install the package.



Administering Process Center artifacts



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Figure 1-25. Administering Process Center artifacts

The Process Center Console is a tool that is intended for administrators and developers who must manage the lifecycle of application components.

Administrators and developers can create, export, clone, activate, or archive snapshots of process applications or toolkits and grant access to these applications.

There are a number of ways to access the Process Center Console.

If you are primarily an administrator and do not actively work on the application development, you can view the Process Center Console by using the web-based Process Center Console.

The Process Center Console is started with the web address:

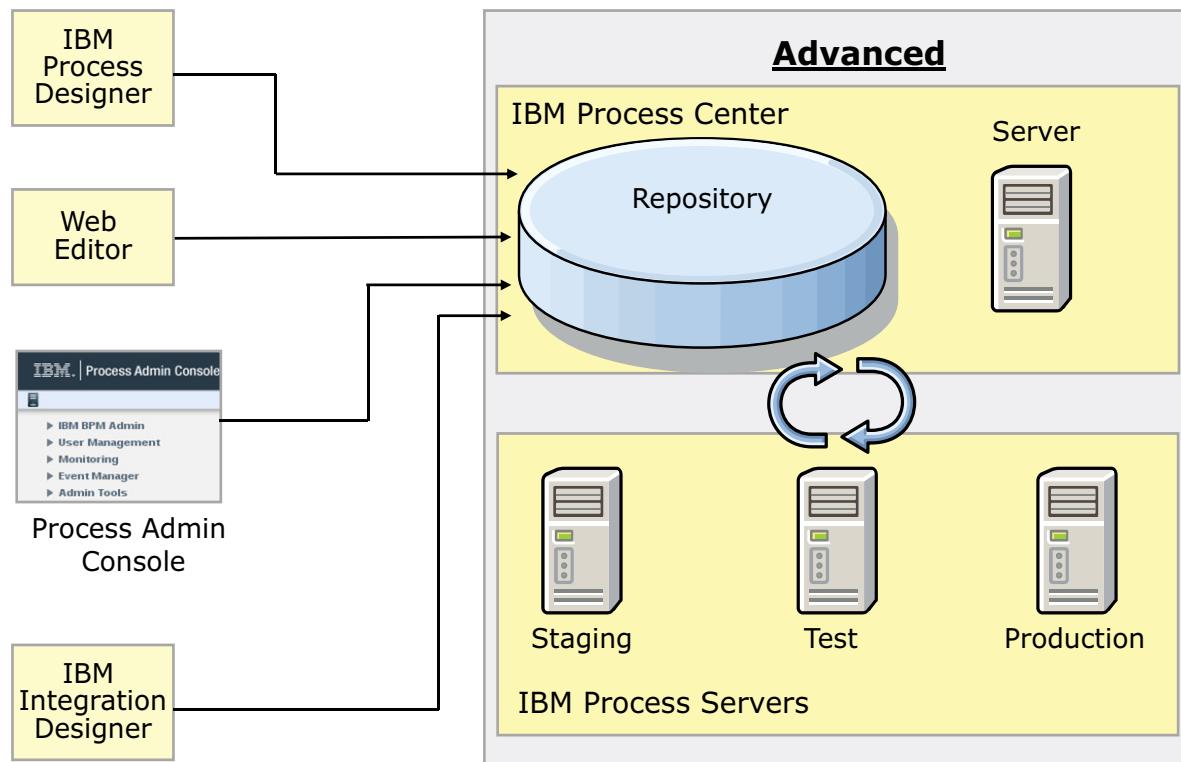
`http://hostname:port/ProcessCenter`

If you are a business analyst and work on the creation of business process definitions and associated assets, you can view the Process Center Console from inside IBM Process Designer.

If you work as a developer on the Advanced Integration service assets of the process application, you can also view the Process Center Console in a separate perspective in IBM Integration Designer.



Managing process servers



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Figure 1-26. Managing process servers

You use the Process Admin Console to manage the process servers in your runtime environments and the Process Center server that is part of the Process Center.

To access the Process Admin Console, enter the following URL:

`http://hostname:port/ProcessAdmin`

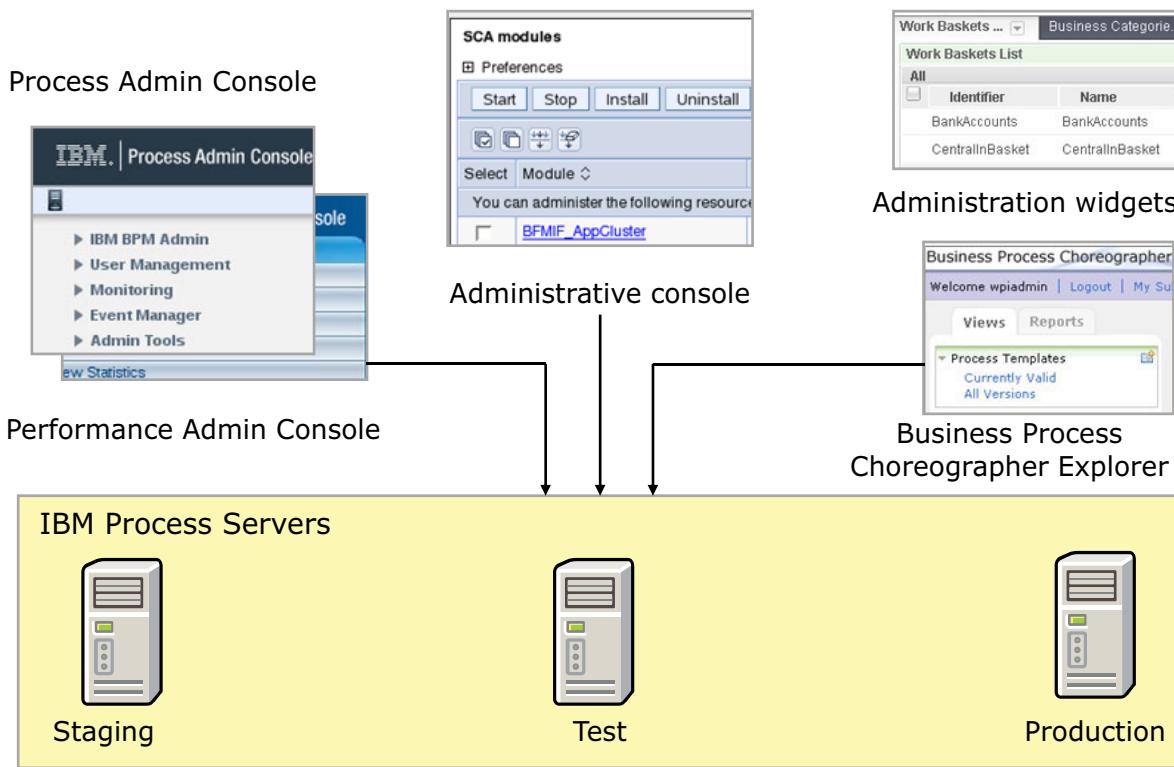
An IBM Process Server on IBM Process Center is used to run process applications on a Process Server that is connected to a Process Center. The server that is created can be a staging server, test server, or production server.

The capability of the Process Center server and any associated process (production) servers must match, both for server registration purposes and for process application snapshot testing and deployment purposes.

To import or test a snapshot on the Process Center server or deploy it on a production process server, the target server must support all of the functions in the process application. For example, you cannot import a process application with Service Component Architecture (SCA) modules unless the Process Center server supports IBM Business Process Manager Advanced.



Graphical administration of IBM Process Servers



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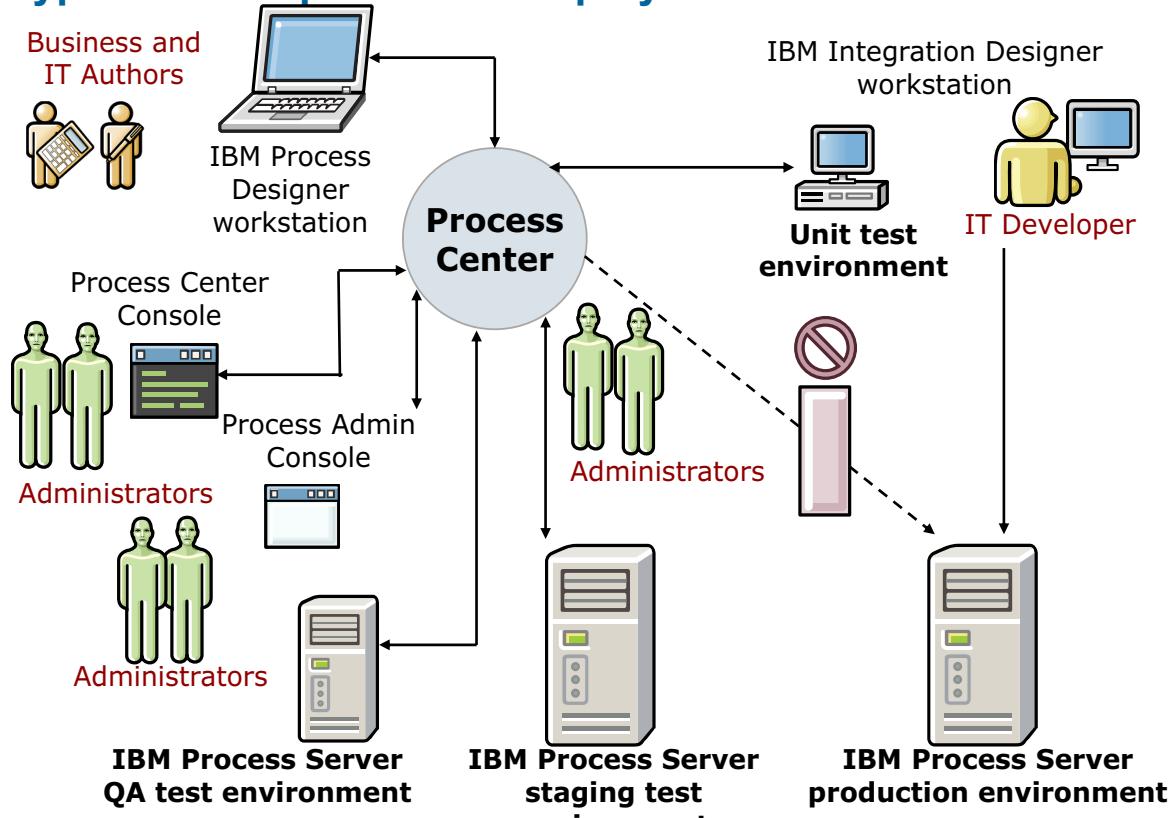
Figure 1-27. Graphical administration of IBM Process Servers

This page shows some of the graphical tools that are used to administer IBM Process Servers. These graphical administration tools are covered in greater detail in later units.

IBM Training



Typical development and deployment environment



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Figure 1-28. Typical development and deployment environment

The diagram shows a typical development and deployment topology.

There is a unit test environment (UTE) that is installed during the installation of IBM Integration Designer. In this mode, the unit tester can test SCA modules locally in the IBM Process Server running inside the UTE, or test them through the Process Center.

The IBM Process Designer workstation communicates directly with Process Center by using the Process Center Console.

In the example, there are independent QA, staging, and production environments, each with their own full stand-alone IBM Process Server that can be connected to the central IBM Process Center. Artifacts are being published and synchronized back and forth between all the environments while the IBM Process Center is managing the central repository.

This scenario is just a sample, and the topology can be modified to suit the organization requirements.

1.4. IBM BPM on Cloud

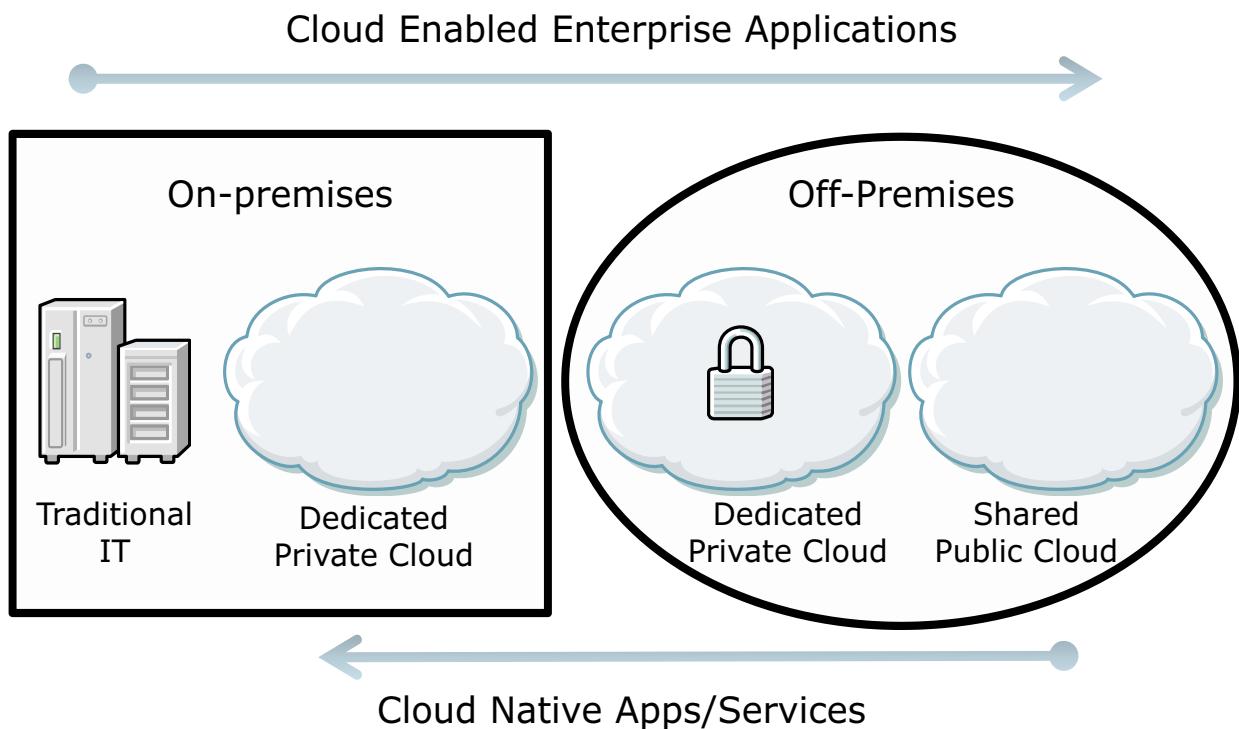
IBM BPM on Cloud

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Figure 1-29. IBM BPM on Cloud

On-premises, cloud, and hybrid



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Figure 1-30. 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
 - Dev/Test/Prod
 - High Availability
 - Disaster Recovery
 - Scalability and Resilience
 - Multi-Tenancy
 - Federation
- System Monitoring
- User Management
 - User Repository
 - Roles and Participants

Popular use cases for IBM BPM on Cloud

- Pilot project
 - Providing the business value
 - Try out a newer version of IBM BPM
- Development
 - An organization can manage a production solution on-premises
 - Need to get started fast to meet corporate go live dates
- Instead of an on-premises solution
 - Organizations with small or no IT department
 - Urgency for implementation
 - Prefer cloud solutions to on-premises

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 A)

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Figure 1-32. 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 runtime 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 A: IBM BPM on Cloud.

IBM BPM on Cloud customer focus: Manage and automate decisions

IBM manages:

- Uptime
- Monitoring
- Backup
- High availability
- Disaster recovery
- Updates
- Maintenance
- 24 x 7 support
- Tuned configuration



Customers manage:

- Application development
- Application integration
- Application support



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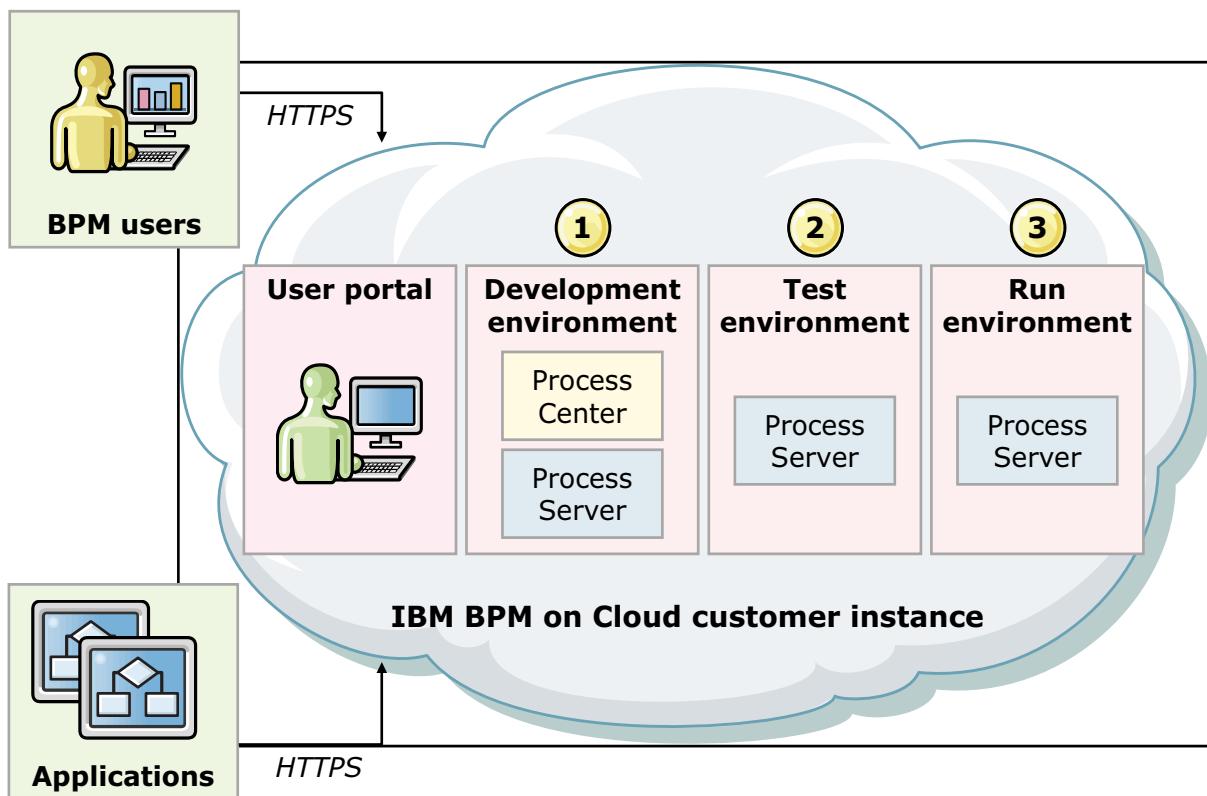
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Figure 1-33. IBM BPM on Cloud customer focus: Manage and automate decisions

Access to the infrastructure

- The IBM operational team monitors and manages the IBM BPM infrastructure
 - Including virtual machines, operating systems, and IBM BPM and database configuration
- Client users do not have access to the infrastructure
 - Including the file system, administrative console, direct access to the IBM BPM databases by using database tools
- IBM BPM on Cloud provides alternatives by using self-service administration capabilities
 - Such as access to log files for diagnostics (UI and REST API), management of data sources and certificates, restarting the Process Center server, and more
- What IBM does not yet have administration for, the IBM operational team can assist you with the tasks
 - Such as customizing the Process Portal

IBM BPM on Cloud: Three runtime environments



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Figure 1-35. IBM BPM on Cloud: Three runtime environments

IBM BPM on Cloud provides three runtime environments for decision management:

1. Development
2. Test
3. Run

In this diagram:

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



IBM BPM on Cloud user portal

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

The screenshot shows the 'Development Environment' section of the IBM BPM on Cloud user portal. It displays a grid of tools categorized by environment:

Development Environment	
Process Center	REST UI
Install and run process applications, store performance data, and manage running instances of process applications on the Process Center servers.	Prototype IBM BPM REST resources and their associated parameters.
Launch More info Available Downloads (2) IBM® Process Designer IBM® Integration Designer	Launch More info
Tech Preview: Responsive Federated Portal	Business Process Choreographer Explorer
Technical demonstrations of Responsive Federated Portal and Responsive Coach Toolkit as a sample	Monitor and manage BPEL processes. The BPC Explorer provides a number of views that show process and task metadata.
Launch More info	Launch More info
Process Portal	Business Rules Manager
Collaborate on tasks and view the performance of individuals, teams, and processes on dashboards.	Manage business rules
Launch More info	Launch More info
Process Admin Console	
Manage the Process Center server and the process servers in your runtime environments.	
Launch More info	

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Figure 1-36. IBM BPM on Cloud user portal

1.5. Integration with other IBM products

Integration with other IBM products

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Figure 1-37. Integration with other IBM products

Mobile application support (1 of 2)

- IBM Business Process Manager includes a non-production license entitlement for IBM Worklight Enterprise Edition
 - Cannot deploy the applications to a production environment
- Use business decisions from mobile devices
- Develop custom hybrid mobile applications that extend IBM BPM experiences to smartphones and tablets
- Lite Coach views to help deliver a true mobile experience
- More information can be found in the *Extending IBM Business Process Manager to the Mobile Enterprise with IBM Worklight* Redbooks document
 - <http://www.redbooks.ibm.com/redpieces/abstracts/sq248240.html?Open>

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Figure 1-38. Mobile application support (1 of 2)

IBM Business Process Manager Advanced and IBM Business Process Manager Standard V8.5.7 include a nonproduction license entitlement for IBM Worklight Enterprise Edition as a supporting program. Worklight Enterprise Edition offers organizations a wide set of services to help manage, develop, and deploy functionally rich, cross-platform mobile applications.

When you combine Worklight Enterprise Edition (nonproduction license entitlement) with IBM Business Process Manager, you can do the following tasks:

- Develop custom hybrid mobile applications that extend IBM Business Process Manager experiences to smartphones and tablets
- Use IBM Business Process Manager APIs and coaches in custom mobile applications
- Use authentication, notification, and analytics capabilities from Worklight Enterprise Edition
- Use the Worklight App Center private application store to test the distribution of your application inside your enterprise

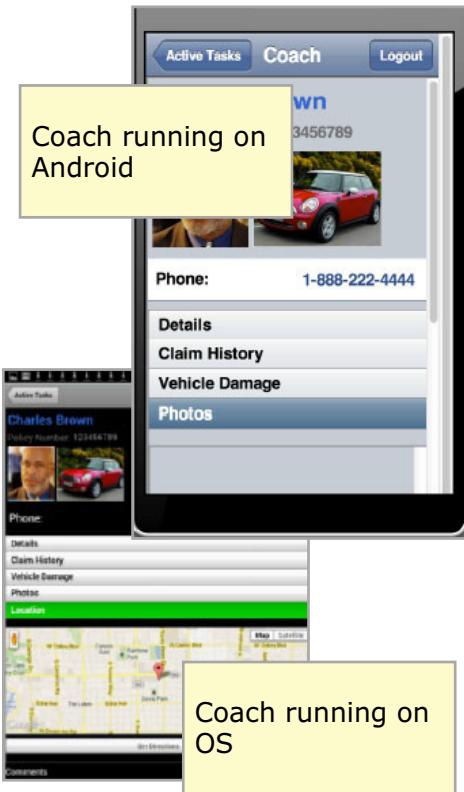
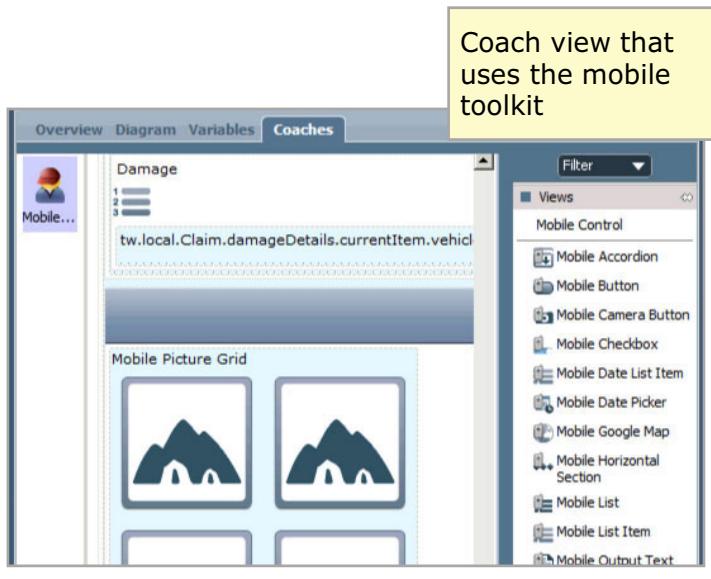
Sample mobile coaches toolkit includes over 15 coach views for mobile device access, theming, page navigation, and visual controls.

When you are ready to move your application to a production environment, you can do so by purchasing either a Worklight Enterprise Edition license or a Worklight Consumer Edition license, depending on your needs.



Mobile application support (2 of 2)

- At run time, the appropriate theme is dynamically applied for both appearance and size



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Figure 1-39. Mobile application support (2 of 2)

Sample mobile coaches toolkit coach views help create coach views for developing coaches that are optimized for devices for common patterns.

Working with IBM BPM documents

- Use Enterprise Content Management tools to work with IBM Business Process Manager documents
- IBM Business Process Manager document store
 - CMIS-enabled, embedded document repository that is used to store IBM Business Process Manager documents in IBM Business Process Manager
 - Supports CMIS operations, inbound events, and you can use either coaches or Heritage Coaches to work with IBM Business Process Manager documents in the document store
- Create IBM Business Process Manager documents with a coach view and content integration in a service
- Limitations in working with IBM Business Process Manager documents
 - Must use federated repositories as the user registry
 - Restricts document size to 1 gigabyte or less
 - Not available for IBM Business Process Manager for z/OS or IBM DB2 for z/OS as its database

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Figure 1-40. Working with IBM BPM documents

In IBM Business Process Manager, you can use Enterprise Content Manager tools to work with IBM Business Process Manager documents in the embedded IBM Business Process Manager document store. For example, you can create, edit, and work with documents in the document store with either a client-side human service or a heritage human service.

Integrating IBM BPM and Enterprise Content Management

- Interact with an Enterprise Content Management server to store or view documents
 - Enterprise Content Management systems manage documents of different types such as records, images, and web pages throughout their lifecycle
 - Enterprise Content Management systems are used to increase efficiency and to monitor the security of information, and to comply with industry and government regulations
- Access and update these documents from a business process by using Enterprise Content Management operations in services such as an integration service or a human service
- For Enterprise Content Management integration, predefined types, services, and events are available
 - These types and services are contained in the Content Management (SYSCM) toolkit
- Content start and intermediate events are triggered from Enterprise Content Management events

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Figure 1-41. Integrating IBM BPM and Enterprise Content Management

For more information, see *Integrating IBM Business Process Manager with an Enterprise Content Management system*:

http://www.ibm.com/developerworks/bpm/bpmjournal/1212_ramos/1212_ramos.html

Monitoring process applications with IBM Business Monitor

- IBM Business Monitor is comprehensive business activity monitoring software
 - Up-to-date view of your business performance
 - Provides predictions for you to act on before problems occur
 - Personalized business dashboards process business events and data
 - Calculate key performance indicators (KPIs) and metrics
 - IBM Business Monitor can collect events and data from a wide variety of sources
- Integrate IBM Business Monitor with IBM Business Process Manager to provide business monitoring capability for your process applications
 - Monitor process applications that were built by using IBM Process Designer and deployed to IBM Business Process Manager Standard
 - Business author who uses IBM Process Designer to define a BPMN process application can specify IBM Business Monitor tracking definitions for the process application without having to use a separate tool

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Figure 1-42. Monitoring process applications with IBM Business Monitor

For more information about IBM Business Monitor, see:

http://www.ibm.com/support/knowledgecenter/en/SSFPJS_8.5.7/com.ibm.wbpm.mon.doc/scen/intro.html

Integrating with IBM Operational Decision Manager

- IBM Operational Decision Manager complements IBM Business Process Manager products to empower businesses to automate, manage, and improve the decision cycle in the face of growing complexity and change
- IBM Process Designer supports rich rule authoring and execution features that are based on paradigms that are familiar to Operational Decision Manager users
- Authoring features include the Business Action Language (BAL) for authoring if-then rules in the Intellirule Editor
- IBM Process Designer users can export a rule project that contains the rules that implement a process task
- The exported rules thus move from a process-centric lifecycle and governance model to the Operational Decision Manager methodology and lifecycle
- IBM Process Designer and Integration Designer also include wizards to easily integrate existing business rule applications into business processes

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Figure 1-43. Integrating with IBM Operational Decision Manager

IBM Operational Decision Manager (ODM) complements with the IBM Business Process Manager products to empower businesses to automate, manage, and improve the decision cycle in the face of growing complexity and change.

For more information, see “Best practices for designing and implementing decision services, Part 2: Integrating IBM Business Process Manager and IBM Operational Decision Management”:

http://www.ibm.com/developerworks/bpm/bpmjournal/1212_boyer2/1212_boyer2.html

Unit summary

- Describe the concepts of business processes and business process management (BPM)
- Describe business integration roles in IBM Business Process Manager Advanced
- Describe the IBM product editions that support the development of business processes
- Describe the capabilities of IBM Business Process Manager Advanced
- Describe IBM Business Process Manager Advanced on Cloud

Review questions

1. A business process is deployed and runs on which of the following products?
 - A. IBM Integration Designer
 - B. IBM Process Server
 - C. IBM Process Center
 - D. IBM Process Designer
2. True or False: IBM Process Center provides a central development environment and repository for multiple process authors who are working in IBM Process Designer.
3. Which of the following roles indicate an individual who needs no programming experience and whose focus is on business performance, process design, and optimization?
 - A. IT architect
 - B. Business leader
 - C. Business analyst
 - D. Integration developer



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Figure 1-45. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers (1 of 2)

1. A business process is deployed and runs on which of the following products?
 - A. IBM Integration Designer
 - B. IBM Process Server
 - C. IBM Process Center
 - D. IBM Process Designer

The answer is B.
2. True or False: IBM Process Center provides a central development environment and repository for multiple process authors who are working in IBM Process Designer.
The answer is True.



Review answers (2 of 2)

3. Which of the following roles indicate an individual who needs no programming experience and whose focus is on business performance, process design, and optimization?
- A. IT architect
 - B. Business leader
 - C. Business analyst
 - D. Integration developer
- The answer is C.



Unit 2. IBM Business Process Manager Advanced installation

Estimated time

01:00

Overview

This unit provides an overview of IBM Business Process Manager Advanced installation. You learn various methods to install the product, create profiles, and verify and troubleshoot the installation.

How you will check your progress

- Checkpoint
- Lab exercises

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Install IBM Business Process Manager Advanced silently
- Create profiles by using the Profile Management Tool and the manageprofiles command
- Verify product installation and profile creation
- Troubleshoot a failed installation and a failed profile creation
- Uninstall IBM Business Process Manager Advanced

Topics

- IBM Business Process Manager Advanced installation
- IBM Installation Manager
- Installing the software
- Profiles
- Installation troubleshooting

IBM Business Process Manager Advanced installation

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Figure 2-2. Topics

2.1. IBM Business Process Manager Advanced installation

IBM Business Process Manager Advanced installation

IBM Business Process Manager Advanced installation

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Figure 2-3. IBM Business Process Manager Advanced installation

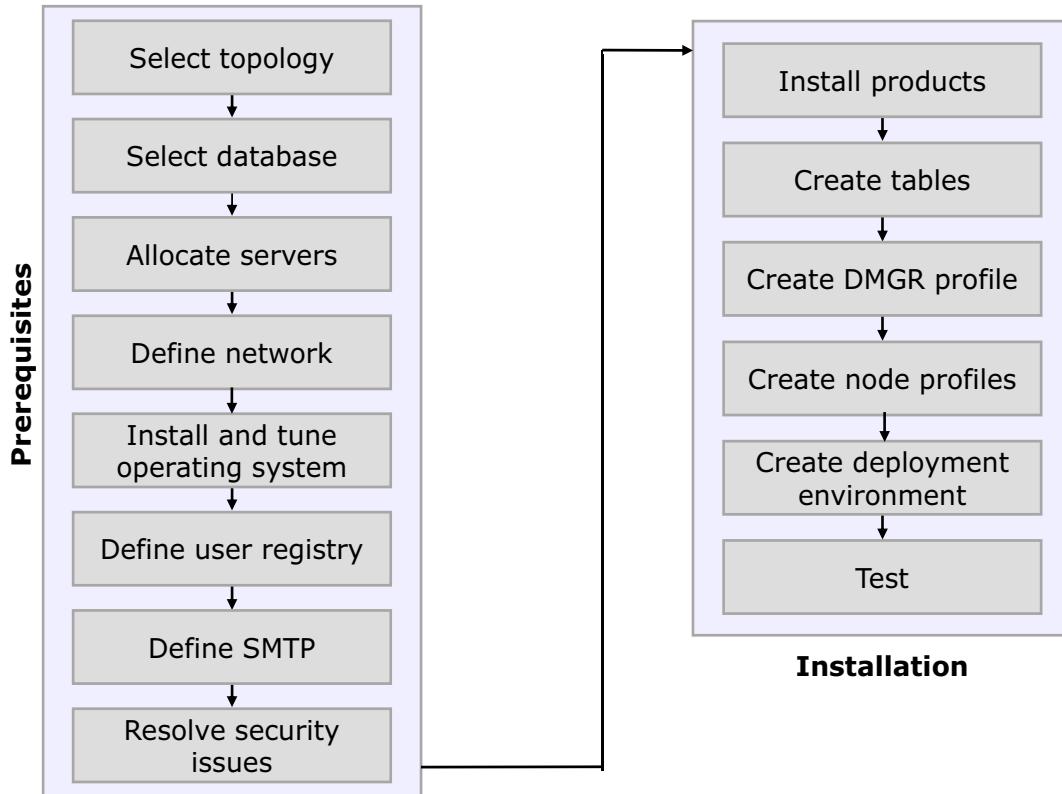
Planning is essential

- Preliminary design of high availability environments is required
 - High availability solutions are complicated and resource-intensive
 - Good design prevents deployment bottlenecks (consider your naming topology, security, and more)
- Setup takes multiple days
 - Depends on infrastructure complexity (number of systems, LDAP, and more)
 - For novices, plan two weeks for successful deployment
 - Extra time might be needed for complicated or incomplete designs

Figure 2-4. Planning is essential

To have a straightforward deployment and a setup that meets requirements, adequate planning is necessary. The setup (installation of binary files, fix packs, profile creation, Business Process Choreographer configuration, messaging engine configuration, and similar tasks) takes multiple days. The time that it takes depends on the number of systems that are used in the environment. It also depends on the complexity of other functions that are needed (like LDAP Directory Services, multiple HTTP servers, firewalls, and similar functions).

Planning: Prerequisites and installation planning



IBM Business Process Manager Advanced installation

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Figure 2-5. Planning: Prerequisites and installation planning

When the prerequisite steps are thoroughly run, the installation process is likely to be fast and smooth. Ensure that you finish each of the steps and check that all the components are configured and available.

Installation overview

- WebSphere product installation separates the core product binary data from the configuration data
 - Can have multiple sets of customized runtime environments
 - Each environment is known as a profile
 - Profiles share product binary files
- Must create profiles after installation of product binary files
 - Use the Profile Management Tool, `manageprofiles` command, or `BPMConfig` command
- Easier than multiple installations
 - Less disk space
 - Product update is simplified; updates are applied before or after profile creation

Figure 2-6. Installation overview

You can obtain the product code to install on distributed systems in either of the following ways:

- From the product media
- From the Passport Advantage site, where licensed customers can download installation images

The installation launchpad is available on the product disk and on downloaded installation images. The launchpad is the suggested method for installing components from the product media.

In addition to installing an IBM Business Process Manager environment from scratch, it is possible to install IBM Business Process Manager in an existing WebSphere Application Server or Network Deployment environment. When IBM Business Process Manager is installed in an existing environment, IBM Business Process Manager features are added to the existing product installation.

Hardware and software prerequisites

- Examine the Business Process Manager Advanced supported hardware and software page for current requirements:
 - <http://www.ibm.com/software/integration/business-process-manager/advanced/sysreqs/>
- Select the link to view the list of supported hardware and software for IBM Business Process Manager Advanced
- Supported operating systems include:
 - AIX
 - Linux (Red Hat, SUSE, and Ubuntu)
 - Solaris
 - Windows (8, 8.1, 10, and 2012)
 - z/OS

IBM Business Process Manager Advanced installation

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Figure 2-7. Hardware and software prerequisites

For more information about the current requirements, see the WebSphere Application Server supported hardware and software page:

<http://www.ibm.com/support/docview.wss?uid=swg27023005>



Note

Support for Windows 7, Windows Server 2008, and Windows 2008 R2 is deprecated.

2.2. IBM Installation Manager

IBM Installation Manager

IBM Business Process Manager Advanced installation

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Figure 2-8. IBM Installation Manager

IBM Installation Manager

- Eclipse-based tool to manage the installation, update, modification, rollback, and uninstallation of product packages
 - Installation Manager installs automatically before the IBM Business Process Manager installation package
- Includes a number of wizards that make it easy to maintain packages throughout their lifecycles
- Includes a GUI interface and a command line mode
- Can be installed automatically, interactively, or silently
 - In `<bpm_extract_root>/IM`

Figure 2-9. IBM Installation Manager

The Installation Manager is a program that helps you install, import, update, modify, and uninstall packages on your computer. The Installation Manager also provides tools for managing licenses for the packages that it installs, and for updating and modifying packages. If the Installation Manager is installed on your computer, it is updated to ensure that the computer has the newest version installed.

You must run Installation Manager on those systems on which you install or update product code. You normally need only one Installation Manager on a system to track product installations.

IBM Installation Manager basics

- The IBM Installation Manager can be used to interactively install or update packages
 - Set repository preferences to indicate where to get the data for installing or updating packages
 - Default repository preference is a service repository, which requires internet connectivity
 - Can modify repository preference to use local repository
- Starting the IBM Installation Manager GUI:
 - Use the Start menu
 - Use the `IBMMIM` command
 - In `<install_root>/IBM/InstallationManager/eclipse`
- More information about the IBM Installation Manager can be found by using the IBM Knowledge Center
 - http://www.ibm.com/support/knowledgecenter/SSDV2W_1.8.0/com.ibm.cic.agent.ui.doc/helpindex_imic.html

Figure 2-10. IBM Installation Manager basics

Working with IBM Installation Manager simplifies the installation process for many IBM products. The Installation Manager installation kit is delivered as part of the product download. Installation Manager might be installed on each computer since one installation can handle the installation of multiple products. After it is installed, Installation Manager must be configured to the appropriate repositories that contain product installation packages.

A repository is a place where the installation packages can be found. The repository includes metadata that describes the software version and how it can be installed. It has a list of files that are organized in a tree structure and can exist on a local directory or on a remotely reachable server.

Installation Manager: GUI mode (1 of 2)

- Started by using the IBMIM command in <IM_root>/eclipse

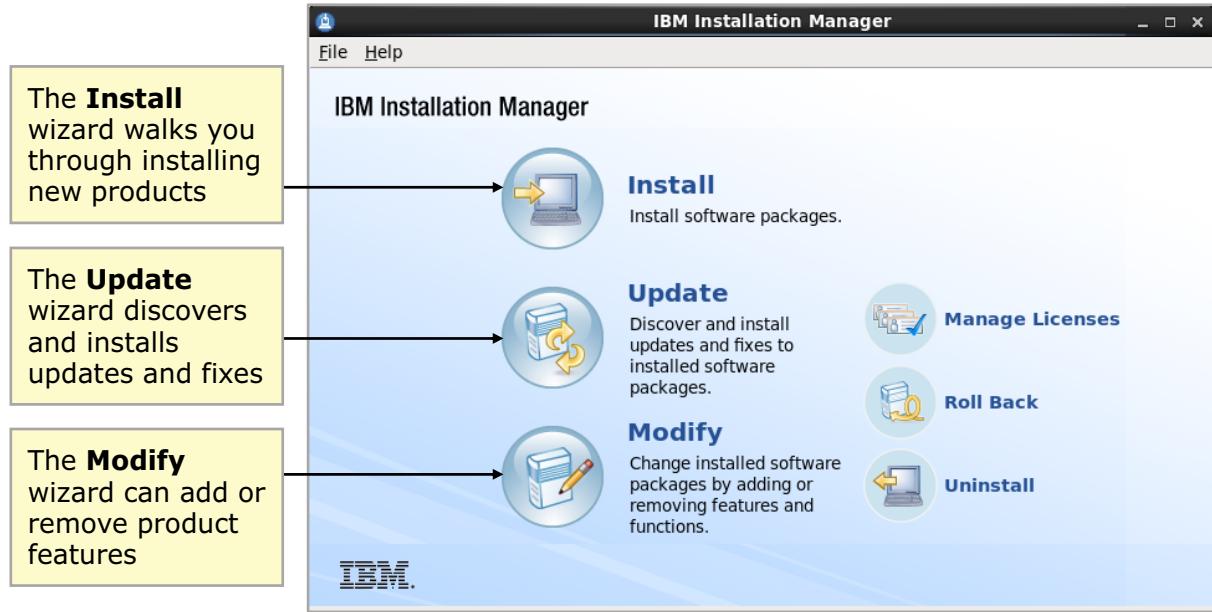
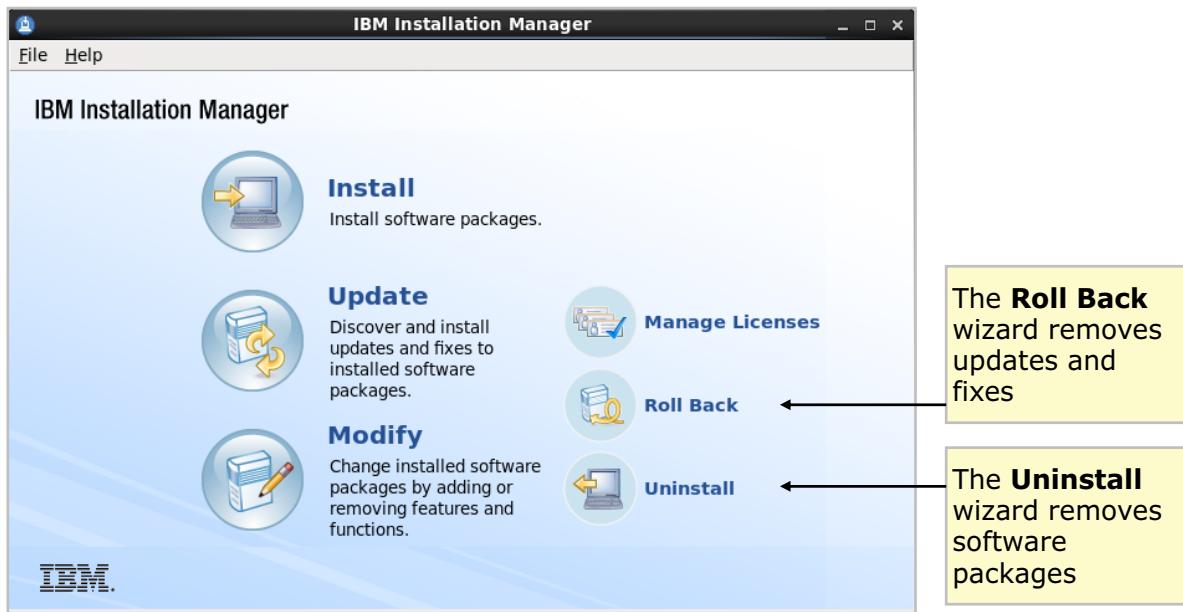


Figure 2-11. Installation Manager: GUI mode (1 of 2)

Wizards guide you through the steps that you must take to install, modify, update, roll back, or uninstall your IBM products. Use Installation Manager to install individual software packages on your local computer, or with the IBM Packaging Utility to install software for an enterprise.



Installation Manager: GUI mode (2 of 2)



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Figure 2-12. Installation Manager: GUI mode (2 of 2)

Installation Manager: Command line (1 of 2)

- When you cannot use the IBM Installation Manager user interface, you can use IBM Installation Manager command line to manage installations
 - In `<IM_root>/tools/imcl`
- Use `imcl` commands with either the installed version of Installation Manager or the Installation Manager installer
- From the command line, you can:
 - Manage installations
 - View repository contents, available packages, and fixes, and others
 - Run installation scripts that include commands and options for specifying the details of your installation
- Run the help command to view the available commands for Installation Manager
 - For example, `<IM_root>/tools/imcl -help`

Figure 2-13. Installation Manager: Command line (1 of 2)

You must run `imcl` commands from the tools directory. You cannot use `imcl` from the Installation Manager installer if an earlier version of Installation Manager is installed. Include quotation marks around file paths that have spaces.

Installation Manager: Command line (2 of 2)

- The common `imcl` command options that are used are:

Command options	Function
<code>install</code>	To install offerings
<code>uninstall</code>	To uninstall offerings or interim fixes
<code>listAvailablePackages</code>	Find the offerings available in repositories
<code>listAvailableFixes</code>	List interim fixes available for installation in repository for offering
<code>listInstalledPackages</code>	List packages that the Installation Manager installs
<code>version</code>	Version information of Installation Manager
<code>rollback</code>	To roll back to previous installed fix pack
<code>listInstallationDirectories</code>	Directory locations of installed product

- All commands are in `<IM_root>/eclipse/tools`

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Figure 2-14. Installation Manager: Command line (2 of 2)

There are many other `imcl` command options. You can go to the IBM Knowledge Center to get a complete listing. Details can be found at the following URL:

https://www.ibm.com/support/knowledgecenter/SSDV2W_1.8.0/com.ibm.cic.commandline.doc/topics/c_imcl_container.html

IBM Installation Manager repository (1 of 2)

- An IBM Installation Manager repository contains the full content that is required to install on various operating systems
 - Contains one or multiple product offerings that have both metadata and actual payload for the offerings
- Metadata describes such aspects of the offering as
 - Name, version, supported operating system, and other items
 - Components of the offering (optional or required feature)
 - Relationships between offerings and features of the offerings
- Repositories are collections of files in a directory structure that contain product installation metadata and files
 - Different IBM Installation Managers on different workstations can reference the same repository

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Figure 2-15. IBM Installation Manager repository (1 of 2)

A repository is a location that stores data for installing, modifying, rolling back, updating, or uninstalling packages. You can add, edit, or remove repositories and modify the repository order in the repository table. The IBM Installation Manager repository contains one or multiple product offerings that have both metadata and actual payload for the offerings. The offering metadata describes such aspects of the offering as name, version, supported operating systems, required and optional features and relationships, and dependencies between offerings and features of offerings.

Normally, an IBM Installation Manager repository contains the full content that is required to install on various platforms and operating systems. Remote repositories are available for installation by using the web or product images, and fixes can be stored in local repositories and customized.

IBM Installation Manager repository (2 of 2)

- Repository topologies can be generalized in the following three categories:
 - **Public repository (web repository)**: Publicly accessible using a URL, typically on ibm.com
 - **Local repository**: Used by a single system and not shared with others
 - **Enterprise repository**: Created in-house, typically exists behind the firewall, and systems within the enterprise intranet can access it
- Tools are provided to copy offerings from one repository to another
 - IBM Package Utility or file transfer tools

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Figure 2-16. IBM Installation Manager repository (2 of 2)

Repositories can be referenced from different IBM Installation Managers on different computers, and the repository topologies can be generalized in three categories:

- Public repository that the public can access by using a URL with an internal connect or local share file system
- Enterprise repository that is usually behind the firewall and accessed only by multiple computers within the enterprise intranet
- Local repository that is used by a single user and not shared with others

There are tools available to copy offerings from one repository to another; for example, the IBM Package Utility. If you are using a third-party tool to transfer the repository between computers, you must use binary transfer mode.

2.3. Installing the software

Installing the software

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Figure 2-17. Installing the software

Installing IBM Business Process Manager

- Installation options:
 - Use Launchpad
 - Use the Installation Manager GUI (without Launchpad)
 - Install silently by using a response file that is tailored for your environment
- The installation software provides sample response files for each supported operating system and bit version for a silent installation
 - The sample response files provide detailed instructions and information about setting the values
- Sample response files are in the software binaries directory in `responsefiles/BPM`
 - Files are included for a root and non-root installation and 64-bit

Figure 2-18. Installing IBM Business Process Manager



Windows

Installation paths must be kept as short as possible to avoid path limits. Avoid installing to `\Program Files`. Use installation paths that do not contain spaces, and install as close to the root directory as possible.

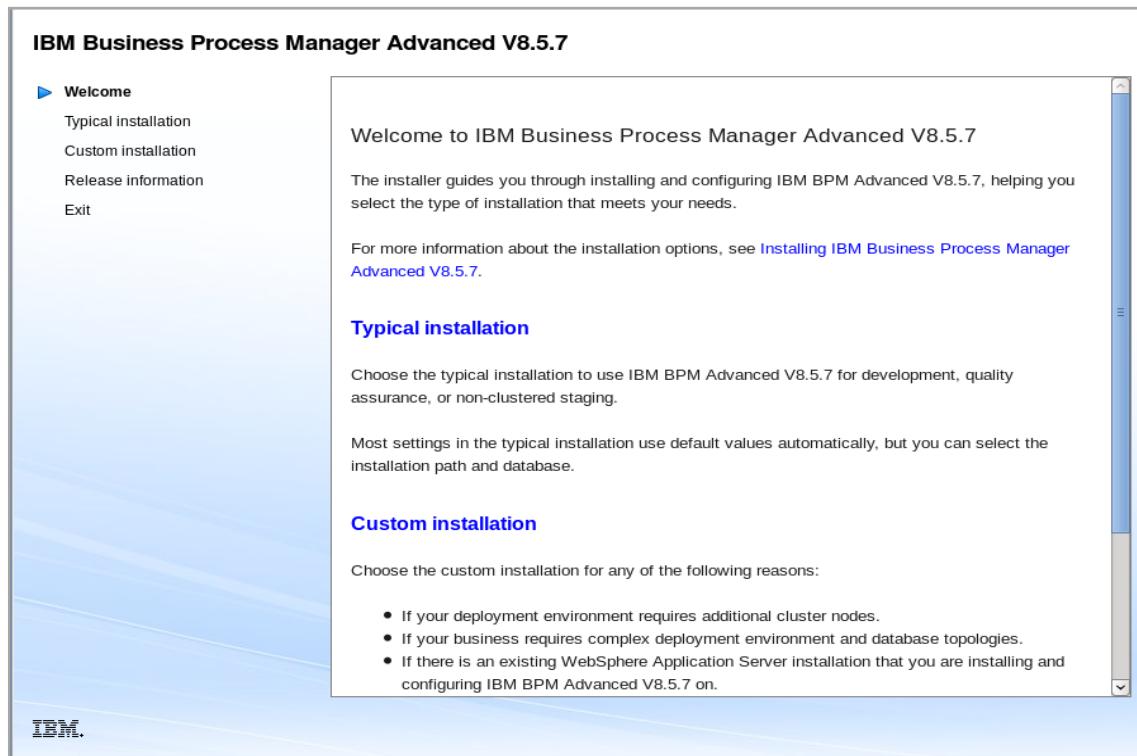
Installation launchpad (1 of 2)

- Single point of reference for installing the entire application server environment by installing product binary files
- Two installation choices:
 - Typical installation
 - Custom installation
- Typical installation
 - Fast and simple installation
 - Optional installation of DB2 Express binary files
 - Creates an environment
- Custom installation
 - Install binary files only
 - Provides more installation options for configuring an environment

Figure 2-19. Installation launchpad (1 of 2)

Using the product launchpad, the typical installation installs the software, configures the deployment manager and managed node profiles, and configures a single cluster deployment environment that consists of a single node and single server.

Installation launchpad (2 of 2)



IBM Business Process Manager Advanced installation

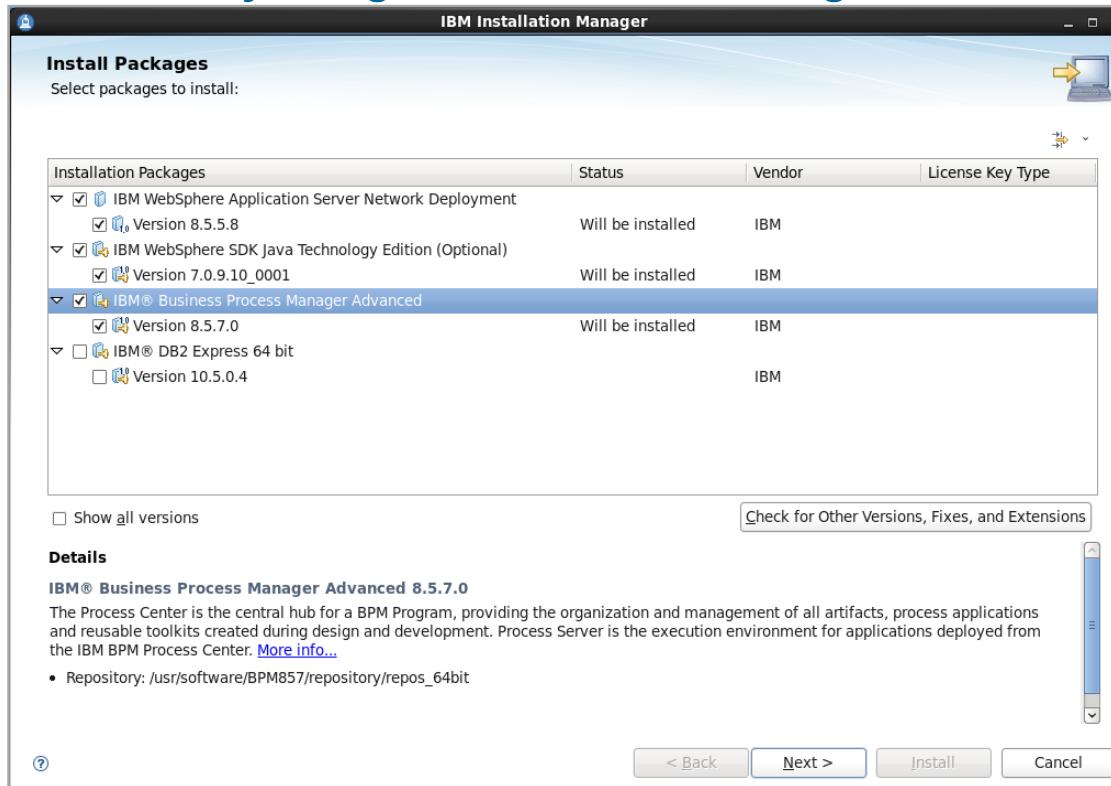
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Figure 2-20. Installation launchpad (2 of 2)

The Welcome pane is the first pane that is displayed when the launchpad is started. Its right pane contains fast path links that start graphical user interface (GUI) installer programs. The left pane includes links to install Business Process Manager and get release information.

IBM Training

Installation by using the Installation Manager GUI



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Figure 2-21. Installation by using the Installation Manager GUI

Silent installation

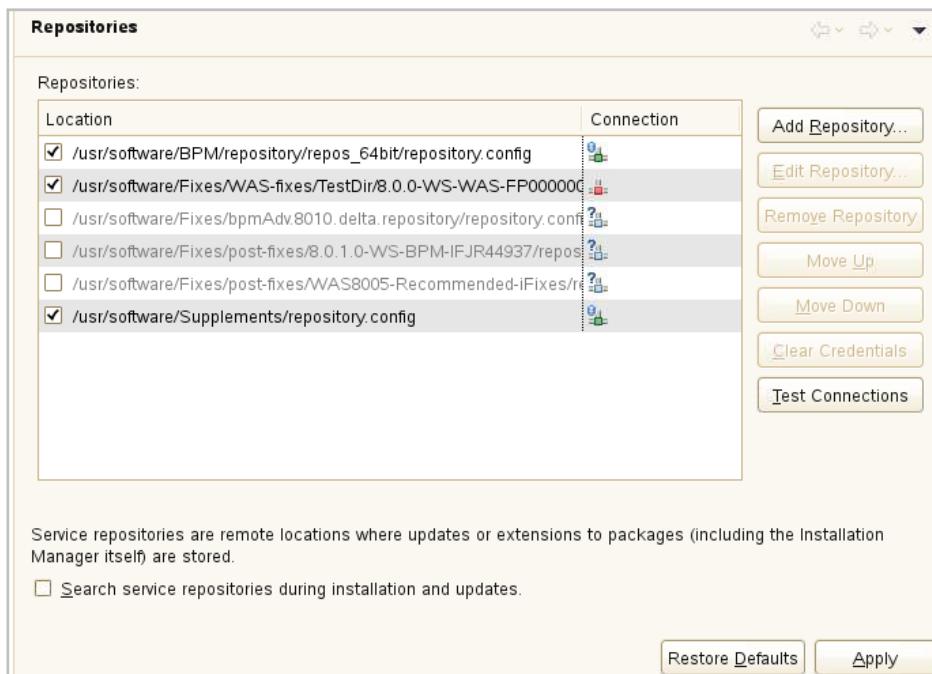
- You can perform a silent installation by using the command line or by using a response file
 - Sample response files are included with the installation files
 - Modify the response file for your environment and configuration requirements
- During the silent installation, the following tasks are performed:
 - Installation Manager is installed or updated to the appropriate level
 - The required base products and IBM Business Process Manager are installed
- After installation, use the BPMConfig command to:
 - Generate database scripts
 - Configure a deployment manager and one or more managed node profiles
 - Create a pattern-based network deployment environment

Figure 2-22. Silent installation

You can install IBM Business Process Manager silently by creating a response file and then running a command to use that response file to install the product.

Install fixes

- Use **Update** option in Installation Manager to install interim fixes or fix packs



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Figure 2-23. *Install fixes*

Be sure to add the fixes to the list of repositories in Installation Manager. Before you can update a package, Installation Manager must have access to the repository that contains the package updates. Internet access might be required. If you have an IBM Passport Advantage account, you can update packages from the Passport Advantage site. If you are installing updates from a repository that is not on the Passport Advantage site, you must specify the repository in the preferences before trying to update.

Uninstalling IBM Business Process Manager

- Use the IBM Installation Manager uninstall wizard to uninstall
 - Launch Installation Manager
 - Click **Uninstall**
 - A pane with the list of all the installed packages is shown
 - If there is a dependency, you must uninstall all the products with dependencies before removing the dependency product
- Stop all server instances before uninstalling
- Select the package that you want to uninstall
- Always use the IBM Installation Manager to uninstall

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Figure 2-24. Uninstalling IBM Business Process Manager

You can uninstall packages from a single installation location by using the uninstall option in the Installation Manager. You can also uninstall all the installed packages from every installation location. You can use the command line mode of the Installation Manager to uninstall IBM Business Process Manager.

To uninstall the packages, you must log in to the system by using the same user account that you used to install the product packages. A package cannot be uninstalled when another package has a dependency on it, unless the dependent package is also selected to be uninstalled.

2.4. Profiles

Profiles

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Figure 2-25. Profiles

What is a profile?

- A set of configurable files that use WebSphere product binary files to provide a WebSphere runtime environment
- Process Server and Process Center files are split into two categories:
 - Product files
 - Configuration files (profiles)
- Each profile uses the same set of product binary files
- There are two types of Business Process Manager profiles:
 - Deployment manager profile
 - Managed node profile
- Each profile type has a template that is used when creating that type of profile

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Figure 2-26. What is a profile?

For a network deployment or IBM Process Server environment, a default runtime is not created during installation. After installation, profiles, nodes, and servers are created.

You can create a deployment manager profile, a stand-alone application server profile, or a custom profile by using the profile creation wizard. A profile consists of files that define the runtime environment for the deployment manager or the application server. Each environment has its own administrative interface except for a custom profile. A custom profile is an empty node that you can federate into a deployment manager cell and customize. No default server processes or applications are created for a custom profile.

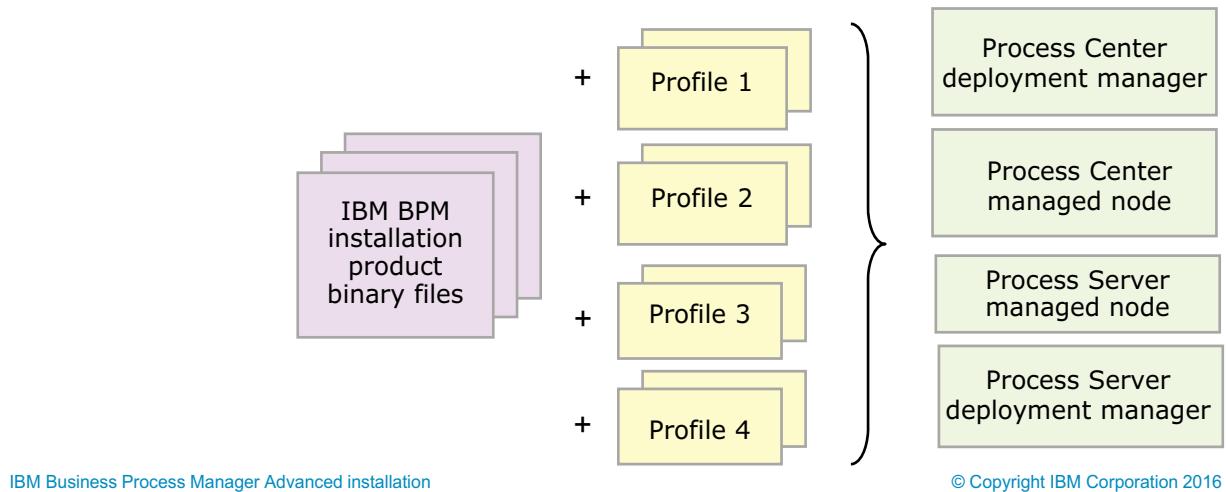
Each deployment manager or application server profile has its own first steps console. The command to start the first steps console is part of the profile. A prompt to start the first steps console that is associated with a profile is displayed on the last pane of the profile creation wizard.

The Process Server product installation is WebSphere Application Server Network Deployment with more features. Therefore, you can create all three profile types as well in a Process Server product installation. You can create Process Server runtimes in addition to WebSphere Application Server runtimes with the IBM Process Server product installation.

As Process Server also includes the WebSphere Enterprise Service Bus product, it is possible to create a WebSphere Enterprise Service Bus runtime with this product package. You do not create a WebSphere Enterprise Service Bus runtime in this course.

Profiles in network deployment

- Profiles represent the nodes
 - Multiple nodes can be installed on a single computer
 - Nodes can contain a single stand-alone application server
 - Nodes can be federated into a cell
- Each profile uses the same product files regardless of type:
 - IBM BPM managed node
 - IBM BPM deployment manager



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Figure 2-27. Profiles in network deployment

When a profile is created, the configuration details for the server are stored in a folder that is unique to the profile. You can think of the product files as the runtime component, and the profiles as the input for the runtime.

Creating profiles

- Use the Profile Management Tool (PMT):
 - From the Start menu (Windows only)
 - At the end of the installation wizard by using the IBM Installation Manager
 - The command line tool `pmt.sh`
 - From the First steps console
 - Available on 64-bit systems except on Solaris
- Manually using the `manageprofiles` command line tool
 - Create profiles in silent mode by using `-silent` option
 - Location: `<bpm_root>/bin/manageProfiles.bat`
- Creation as part of a deployment environment configuration by using the BPMConfig utility

Figure 2-28. Creating profiles

Profiles are created based on templates that are supplied with the product. Each template consists of a set of files that provide the initial settings for the profile and a list of actions to do after the profile is created. Currently, there is no support for modifying these templates or for creating templates that are based on existing application servers.

When creating a profile by using the command line tool, you must specify one of the following templates:

- DMgr (for deployment manager profiles)
- Managed (for custom nodes)

Profile creation by using the command line tool

- The `manageprofiles` script can:
 - Create a profile by using the command:
`manageprofiles -create -profileName -profilePath -templatePath -cellName -hostname -nodeName`
 - List all profiles by using the command:
`manageprofiles -listProfiles`
 - Delete a profile by using the command:
`manageprofiles -delete -profileName`
- The `manageprofiles` script contains many more command parameters such as database host, database delay config, database user name, password, and more

Figure 2-29. Profile creation by using the command line tool

The `manageprofiles` command line tool can be used as an alternative to the graphical profile creation wizard to create all runtime environments. The command creates profiles, which are the set of files that define the runtime environment for a deployment manager, a custom profile, or a stand-alone server profile. The command line tool can be used to create, delete, augment, unaugment, list, or validate profiles. It is in `<install_root>\bin`.

Deleting a profile leaves a number of files behind, including the contents of the logs directory. If required, these files can be deleted manually.

The list of profiles and their properties can be found in the `<bpm_root>\properties\profileregistry.xml` file. More properties, such as log levels, can be found in `wasprofile.properties` file in the `<bpm_root>\properties\` folder.

When you use the profile creation wizard, be sure to check the host name. The wizard might provide you with a fully qualified host name by default by adding the DNS suffix to the short name. This short name can cause problems if other profiles used only the short name. The form of the host name (short name or fully qualified name) is not important when the same form is used consistently.

For IBM Process Server profile creation, the profile template is:

`<bpm_root>\profileTemplates\managed.wbiserver`

For IBM Process Server Deployment Manager profile creation, the profile template is:

`<bpm_root>\profileTemplates\dmgr.wbiserver`

Profile deletion

- To properly delete a profile:
 - Use the `manageprofiles` command to delete a profile
 - The command automatically unaugments the profile before deleting it
 - Manually delete the profile directory:
`<bpm_root>/profiles/<profile_name>`

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Figure 2-30. Profile deletion

You can delete a profile by using the `manageprofiles` command. If the command fails, you can delete the profile by using operating system commands.

If a node within a profile is federated to a deployment manager, before you delete the profile, stop the node and remove the node from the deployment manager. Otherwise, an orphan node is left in the deployment manager.

If you delete a profile that has augmenting templates that are registered to it in the profile registry, unaugment actions are attempted before the deletion.

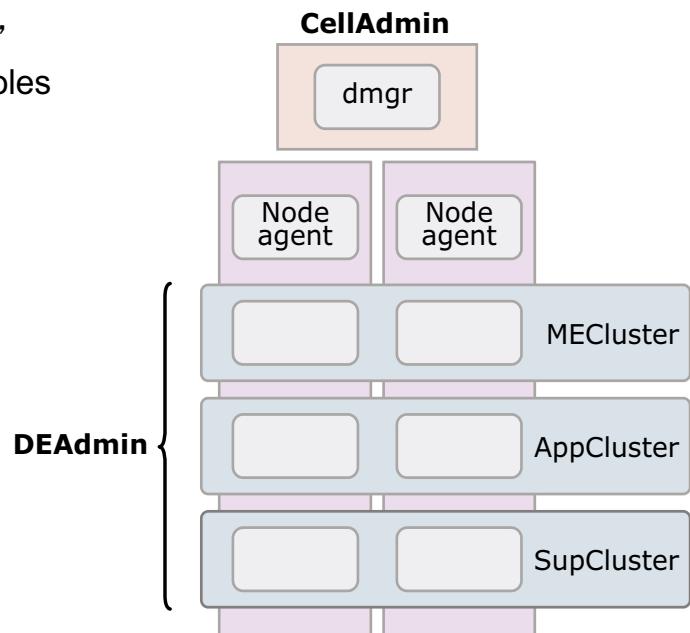
You cannot delete a profile by using the Profile Management Tool.

Enabling administrative security

- Administrative security is automatically configured during profile creation
- To enable global security, you must specify an ID for authenticating to the administrative tools:
 - User name
 - Password
- The administrative user is created in a repository within the process server or enterprise service bus
 - By default, a federated file-based repository is configured
- After installation finishes, you can add more:
 - Users
 - Groups
 - External user repositories (LDAP, database, custom)

Administrative users

- **CellAdmin** is the classic WebSphere administrator
 - WebSphere “primary admin”
 - Can assign admin security roles
 - Cell administrative account
- **DEAdmin** is the main Business Process Manager administrator
 - WebSphere “secondary admin”
 - Cannot assign admin security roles
 - Deployment environment administrative account



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Figure 2-32. Administrative users

CellAdmin: Make this user the primary user in WebSphere Application Server and to the groups defined as the admin and author groups in IBM Business Process Manager. The groups are either the tw_admins and tw_authors defaults, or the groups that are defined by the bpmAdminGroup properties and bpmAuthorGroup if the groups are modified.

DEAdmin: Add this user to the administrator, deployer, and operator roles in WebSphere Application Server and to the groups defined as the admin and author groups in IBM Business Process Manager. The groups are either the tw_admins and tw_authors defaults, or the groups that are defined by the bpmAdminGroup properties and bpmAuthorGroup if the groups are modified.



First steps

The screenshot shows the 'First steps' pane of the WebSphere Application Server - First steps - PServerDmgr interface. The pane contains several options:

- Installation verification**: Confirm that your server is installed and that it can start properly.
- Stop the deployment manager**: Stop the deployment manager and its applications.
- Administrative console**: Install and administer applications.
- WebSphere Customization Toolbox**: Launch this toolbox to access the Profile Management Tool and work with profiles, or to access the Migration Management Tool and migrate WebSphere Application Server 6.0, 6.1, 7.0 or 8.0 profiles to version 8.5.
- Information center for WebSphere Application Server**: Learn more about WebSphere Application Server and explore sample applications.
- IBM Education Assistant for WebSphere software**: Access multimedia content for WebSphere Application Server version 8.5 and other IBM software products.
- Exit**

To the right of the screenshot is a yellow callout box containing the following bullet points:

- Postinstallation ease-of-use tool
- Windows: Run from Start menu or command line
- Can be used to verify the installation
- One per profile

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Figure 2-33. First steps

First steps is a postinstallation ease-of-use tool for doing various tasks. Options are displayed dynamically on the first steps pane, depending on the features you install.

To start first steps from the command line, use the command:

```
<bpm_root>/firststeps/firststeps.bat
```

After profile creation, the first steps tool can be started by using the command:

```
<profile_root>/firststeps/firststeps.bat
```



Installation verification

WebSphere Application Server - First steps - PServerDmgr

WebSphere Application Server

First steps

Installation verification

Confirm that your server is installed and that it can start properly.

First steps output - Installation verification

```

Profile type is:dmgr
Cell name is:machineaCell01
Node name is:machineaCellManager01
Current encoding is:Cp1252
Server port number is:9060
[IVTL0020I]: Could not connect to Application Server, waiting for server to start
[IVTL0010I]: Connecting to the WebSphere Application Server machinea on port: 9060
[IVTL0020I]: Could not connect to Application Server, waiting for server to start
Start running the following command:cmd.exe /c "C:\DP\bin\startManager.bat" -profileName Dmgr01
>ADMU0116I: Tool information is being logged in file
>      C:\DP\logs\dmgr\startServer.log
>ADMU0128I: Starting tool with the Dmgr01 profile
>ADMU3100I: Reading configuration for server: dmgr
>ADMU3200I: Server launched. Waiting for initialization status.
>ADMU3000I: Server dmgr open for e-business; process id is 380
[IVTL0015I]: WebSphere Application Server machinea is running on port 9060 for profile Dmgr01
[IVTL0035I]: Scanning the file C:\DP\logs\dmgr\SystemOut.log for errors and warnings
[4/4/07 3:10:58:266 EDT] 0000000a ConnectionFac W J2CA0294W: Deprecated usage of direct JNDI
[4/4/07 3:10:58:656 EDT] 0000000a ConnectionFac W J2CA0294W: Deprecated usage of direct JNDI
[IVTL0040I]: 2 errors/warnings were detected in the file C:\DP\logs\dmgr\SystemOut.log
[IVTL0070I]: IVT Verification Succeeded
[IVTL0080I]: Installation Verification is complete

```

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Figure 2-34. Installation verification

Use the installation verification tools to gain assurance that the product is successfully installed. IBM Process Server includes an installation verification tool.

The installation verification test (IVT) tool is used to test deployment manager profiles and stand-alone server profiles to make sure that the server processes can start. The IVT program scans product log files for errors and verifies core functions of the product installation. Additionally, the IVT does a Health Monitor check and generates a report for stand-alone server profiles.

Administration options

- **Integrated Solutions Console:** Browser-based administration
 - Administrative security is enabled by default
 - Provides task filter mechanism for WebSphere Application Server, IBM Process Server, or user-defined tasks
 - Standard Java EE web application available at:
 http://<hostname>:9060/ibm/console
 https://<hostname>:9043/ibm/console
- **wsadmin:** Command line scripting environment
 - Administrative security is enabled by default
 - Jython or Jacl type scripts
 - Supports interactive or script execution modes
 - Available connection types: SOAP (default), RMI, NONE
 - Default scripting environment configuration that is in
`<profile_root>/properties/wsadmin.properties`

Figure 2-35. Administration options

Process Server uses the same administrative model as WebSphere Application Server, and you can apply WebSphere administration skills directly to managing IBM Process Server.

The Integrated Solutions Console is a web application that provides a GUI for administering Process Server and Process Center. Before WebSphere Application Server V6.1, it was called the administrative console.

For wsadmin, Jacl is deprecated, even though it is the default scripting language (script extension `*.jac1`). Jython is the suggested scripting language (script extension `*.py`). To use the Jython scripting language, change the `defaultLang` parameter in the `wsadmin.properties` file, or use the `wsadmin start` parameter `-lang jython`.

In the interactive mode, scripting commands are entered one at a time at the `wsadmin` command prompt. Script execution mode allows the administrator to run one or multiple scripts, such as scripts for configuring runtime resources and installing new applications simultaneously. As with changes in the Integrated Solutions Console, every configuration change must be saved in `wsadmin`. The save persists the changes to the master configuration.

A `wsadmin.properties` file in `<profile_root>\properties\` specifies the default environment configuration for `wsadmin`. These settings might be explicitly overridden by applying optional start parameters. The available start parameters can be displayed by entering: `wsadmin -help`

Ant scripts and JMX-based applications provide further administrative options for IBM Process Server runtime configurations.

2.5. Installation troubleshooting

Installation troubleshooting

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Figure 2-36. Installation troubleshooting

Verifying the product installation

- Determine current maintenance level
 - Run the `versionInfo` command
 - Examine the following file:
`<bpm_root>/properties/version/BPM.product`

```
<?xml version="1.0" encoding="UTF-8"?>
<product name="IBM Business Process Manager Advanced">
    <id>BPMPC</id>
    <version>8.5.7.0</version>
    <build-info
        date="3/1/16"
        level="20160301-140232"/>
</product>
```

- After interim fixes, fix packs, and refresh packs installed:
 - Determine maintenance packages use the command
`versionInfo -maintenancePackages`
 - Generate various reports
`historyInfo`, `genHistoryReport`, `genVersionReport`

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Figure 2-37. Verifying the product installation

The `historyInfo` command generates a report from data that is extracted from XML files in the `properties/version` folder and the `properties/version/history` folder. The report includes a list of changed components and a history of installed or uninstalled maintenance packages. The `historyInfo` tool displays important data about the product and its installed components, such as the build version and build date. History information for installation and removal of maintenance packages is also displayed in the report. This tool is useful when working with support personnel to determine the cause of any problem.

The `genHistoryReport` command generates the `historyReport.html` report file in the current working directory, which is usually the `bin` directory. The report includes a list of changed components and installed or uninstalled maintenance packages. The `genHistoryReport` script starts the `historyInfo` script, which specifies the correct parameters that are used to place the information that is generated into an HTML file in the current directory.

The `genVersionReport` command uses the `versionInfo` command to generate the `versionReport.html` report file in the current working directory, which is usually the `bin` directory. The report includes a list of changed components and installed or uninstalled maintenance packages. The `genVersionReport` script starts the `versionInfo` script, which specifies the correct parameters that are used to place the information that is generated into an HTML file in the current working directory.

Verifying the installation

- Run the Installation Verification Tool (IVT):
 - Run from the First steps screen
 - Run from the command line by using `<profile_root>/bin/ivt` which requires server and profile names
 - Can be run against a *deployment manager profile* only
- After running IVT
 - Examine the IVT log file for error messages:
`<bpm_root>/profiles/<profile_name>/logs/ivtclient.log`
- Examine the output from the IVT and check the verification status for the following details:
 - Server starts successfully
 - Servlet engine
 - JavaServer Pages
 - Enterprise bean

Figure 2-38. Verifying the installation

Run the installation verification test (IVT) tool to verify that the profile was created successfully.



Installation Manager logs and history

- In graphical mode, logs can be viewed by using Installation Manager

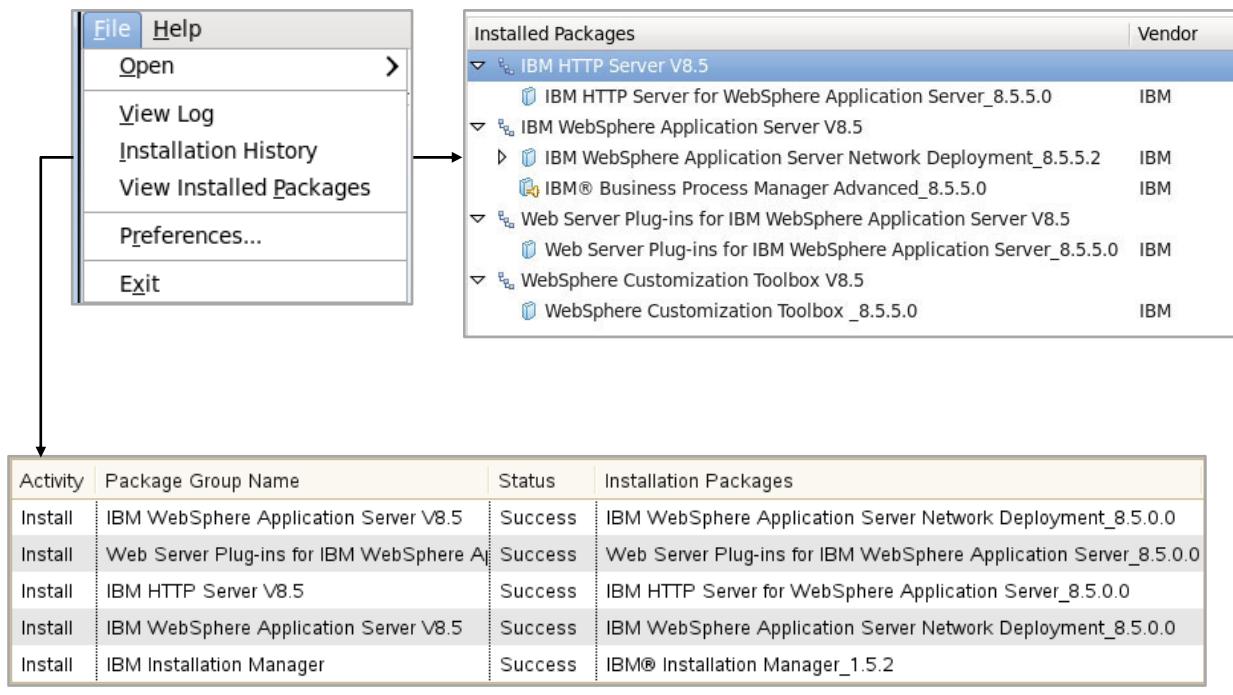


Figure 2-39. Installation Manager logs and history

Logs: View history by using a web browser

- From `<agent_data>/histories`, open `index.xml` in a web browser

All History Files	
Install Location Name	History File
WebSphere Customization Toolbox V8.5	WebSphere Customization Toolbox V8.5/history.xml
IBM Installation Manager	IBM Installation Manager/history.xml
Web Server Plug-ins for IBM WebSphere Application Server V8.5	Web Server Plug-ins for IBM WebSphere Application Server V8.5/history.xml
IBM HTTP Server V8.5	IBM HTTP Server V8.5/history.xml
IBM WebSphere Application Server V8.5	IBM WebSphere Application Server V8.5/history.xml

- Each `history` file can be opened for more details about the installation
 - Start and end times, status (success, failure), package, summary of features

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Figure 2-40. Logs: View history by using a web browser

The agent data location is in the following locations for Windows:

- **Administrator installation:** C:\ProgramData\IBM\InstallationManager
 - **Non-administrator installation:**
C:\Users\user\ApplicationData\Roaming\IBM\InstallationManager
 - **Group installation:** Not available

The agent data location is in the following locations for Linux and UNIX:

- **Administrator installation:** /var/ibm/InstallationManager
 - **Non-administrator installation:** /user_home/var/ibm/InstallationManager
 - **Group installation:** /user_home/var/ibm/InstallationManager_Group



View all installed products (1 of 2)

- Open `installed.xml` under the `<agent_data>` directory in a web browser

A screenshot of a Mozilla Firefox browser window. The title bar says "IBM Installation Manager - Installed Offerings - Mozilla Firefox". The address bar shows "file:///home/localuser/var.ibm/InstallationManager/installed.xml". The main content area has a heading "IBM Installation Manager - Installed Offerings" and a sub-heading "IBM® Installation Manager Version 1.8.4 (1.8.4000.20151125_0201)". It displays two pieces of configuration information:

Installation Directory:	/opt/IBM/InstallationManager/eclipse
Architecture:	64-bit

Shared Resource Directory:	/opt/IBM/IMShared
-----------------------------------	-------------------

Figure 2-41. View all installed products (1 of 2)

View all installed products (2 of 2)

IBM WebSphere Application Server Network Deployment V8.5	
Package Group Name: Package Group Installation Directory: Package Group Translations: Package Group Architecture:	/opt/IBM/BPM en 32-bit
Packages	Features
IBM® Business Process Manager Advanced Version 8.5.7.0 (8.5.7000.20160301_1551) Repository /opt/software/BPM/repository/repos_64bit	<ul style="list-style-type: none"> ◦ Business Process Manager Advanced Process Center License
IBM WebSphere SDK Java Technology Edition (Optional) Version 7.0.9.10_0001 (7.0.9010.20151112_0100) Repository /opt/software/BPM/repository/repos_64bit	<ul style="list-style-type: none"> ◦ 7.0.1.0-WS-WASJavaSDK7-LinuxX64-IFPI55776 Version 7.0.1000.20160126_1544 (7.0.1000.20160126_1544)
IBM WebSphere Application Server Network Deployment Version 8.5.5.8 (8.5.5008.20151112_0939) Repository /opt/software/BPM/repository/repos_64bit	<ul style="list-style-type: none"> ◦ IBM 64-bit WebSphere SDK for Java ◦ EJBDeploy tool for pre-EJB 3.0 modules ◦ Embeddable EJB container ◦ Sample applications ◦ Stand-alone thin clients and resource adapters

IBM Business Process Manager Advanced installation

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Figure 2-42. View all installed products (2 of 2)

Troubleshooting installations

- Check the response file option values that are provided for silent installation
 - Verify the parameters in the script
 - Always use correct case with property names
 - Enclose values in double quotation marks
- Compare your response file to one included with the product:
 - In `<install_image>/responsefiles/BPM/`
- Review error messages and examine log files
 - The `<install_root>/logs/install/log.txt` file records install details
- If the silent installation fails and there is no information in the installation logs, record entries for the events
 - `<IM_install_root>/IBMIMc.sh -launcher.ini silent-install.ini -updateAll -log <log_path_and_name>`

Figure 2-43. Troubleshooting installations

If you are installing either the Advanced or Advanced Process Server configurations of IBM Business Process Manager with Installation Manager, and you selected to install only the client, you might get the following warning message: The packages are installed with warnings. View Log file.

If you see this warning message after installing the client feature of Business Process Manager on a Windows system with just the client feature that is selected, examine the logs.

Troubleshooting profiles

- Problems during profile creation
 - Examine the logs directory: `<bpm_root>/logs/manageprofiles/*`
- Problems during augmenting of a profile
 - Examine
`<bpm_root>/logs/manageprofiles/<profile_name>_augment_error.log`
- A number of log files are created for each profile
 - First-failure data capture (FFDC) log and exception files that are common to all profile types
 - In `<profile_root>/logs/ffdc`
 - Profile-specific logs:
`SystemOut.log`
`SystemErr.log`
`startServer.log`
`stopServer.log`

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Figure 2-44. Troubleshooting profiles

Various log files are created during installation and uninstallation of IBM Business Process Manager and during profile creation, augmentation, and deletion. Consult the applicable logs if problems occur during these procedures.

Unit summary

- Install IBM Business Process Manager Advanced silently
- Create profiles by using the Profile Management Tool and the manageprofiles command
- Verify product installation and profile creation
- Troubleshoot a failed installation and a failed profile creation
- Uninstall IBM Business Process Manager Advanced

Review questions

1. True or False: The IBM Installation Manager is used to install updates to the underlying WebSphere Application Server Network Deployment installation.
2. Which log file is used to verify that the installation was successful?
 - A. SystemOut.log
 - B. log.txt
 - C. responsefile.log
 - D. startServer.log
3. True or False: To uninstall the IBM Installation Manager, you must uninstall all packages that the Installation Manager installed.



Figure 2-46. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. True or False: The IBM Installation Manager is used to install updates to the underlying WebSphere Application Server Network Deployment installation.
The answer is True.

2. Which log file is used to verify that the installation was successful?
 - A. SystemOut.log
 - B. log.txt
 - C. responsefile.log
 - D. startserver.logThe answer is B.

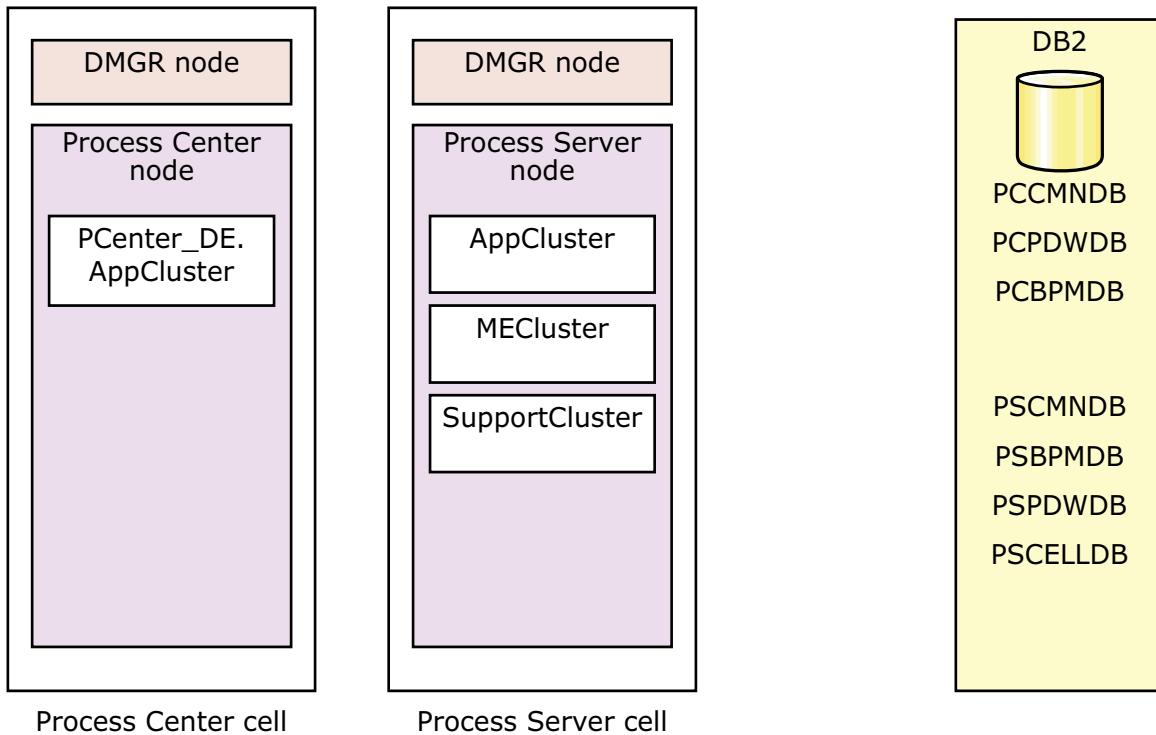
3. True or False: To uninstall the IBM Installation Manager, you must uninstall all packages that the Installation Manager installed.
The answer is True.



Exercise environment: VMware

- The products that are covered in this course are installed on a VMware image
 - The operating system that is used for the VMware image in this class is Ubuntu
- VMware is a virtual machine, a working operating system that interacts with the operating system of the host system
 - Similar to running another personal computer on your personal computer
- VMware is not an IBM product and does not come with the products that are used in this class
 - The use of VMware in this course is intended for educational purposes only, and is not appropriate in a production environment
- Because of the processor usage of running a virtual machine on your system, IBM products that are installed in VMware run more slowly than when installed on the host computer

Exercise environment: Two cell topology configuration



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Figure 2-49. Exercise environment: Two cell topology configuration

This figure shows your lab environment for the course exercises.

Exercise: Installing IBM Business Process Manager Advanced

IBM Business Process Manager Advanced installation

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Figure 2-50. Exercise: Installing IBM Business Process Manager Advanced

Exercise objectives

- Create a response file for a silent installation
- Install IBM Business Process Manager Advanced
- View the installation log file
- Confirm the installation



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Figure 2-51. Exercise objectives

Unit 3. IBM Business Process Manager Advanced architecture overview

Estimated time

00:30

Overview

This unit provides a technical overview of IBM Business Process Manager Advanced architecture.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Define network deployment concepts and terminology
- Define clusters and cluster members
- Describe administrative interfaces and tools
- Define administrative flow

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Figure 3-1. Unit objectives

This unit provides an overview of WebSphere Network Deployment architecture, runtime, and administrative tools.

Topics

- Network deployment concepts and terminology
- Clusters
- Network deployment administration

3.1. Network deployment concepts and terminology

Network deployment concepts and terminology

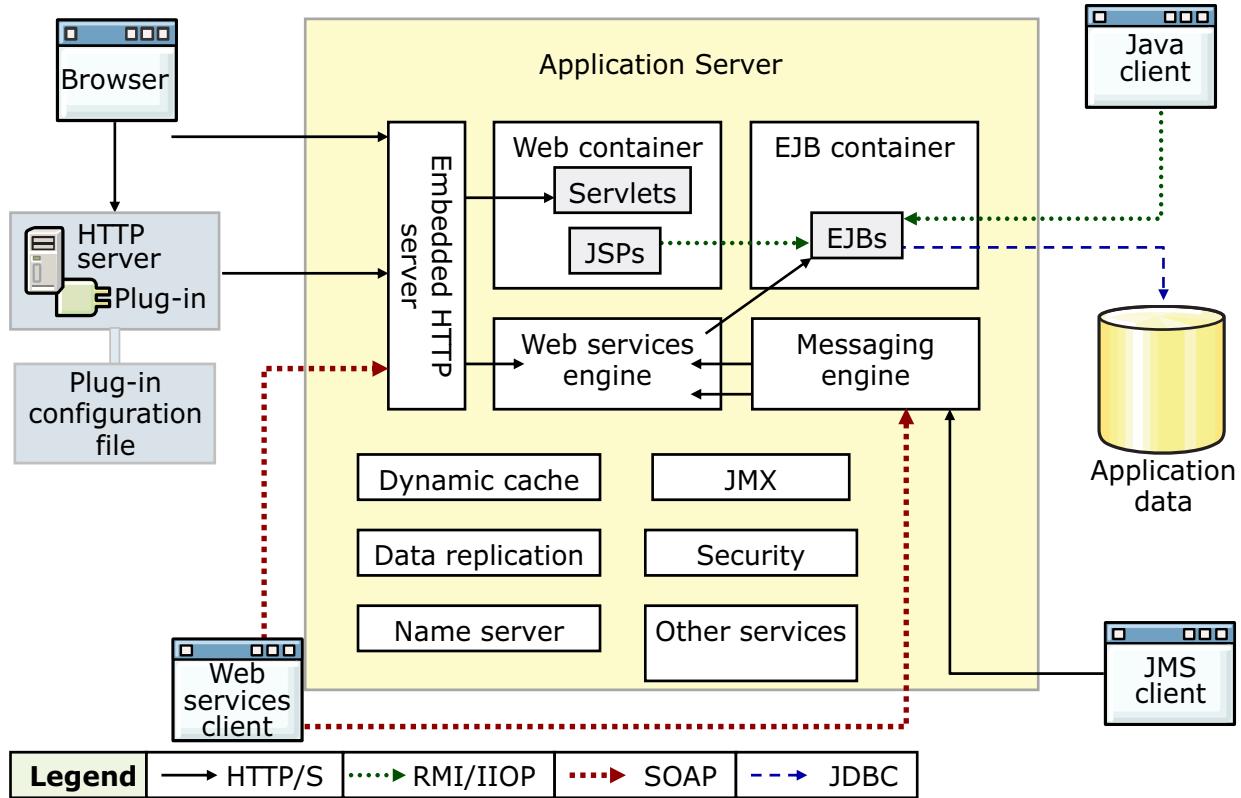
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Figure 3-3. Network deployment concepts and terminology



WebSphere architecture runtime



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Figure 3-4. WebSphere architecture runtime

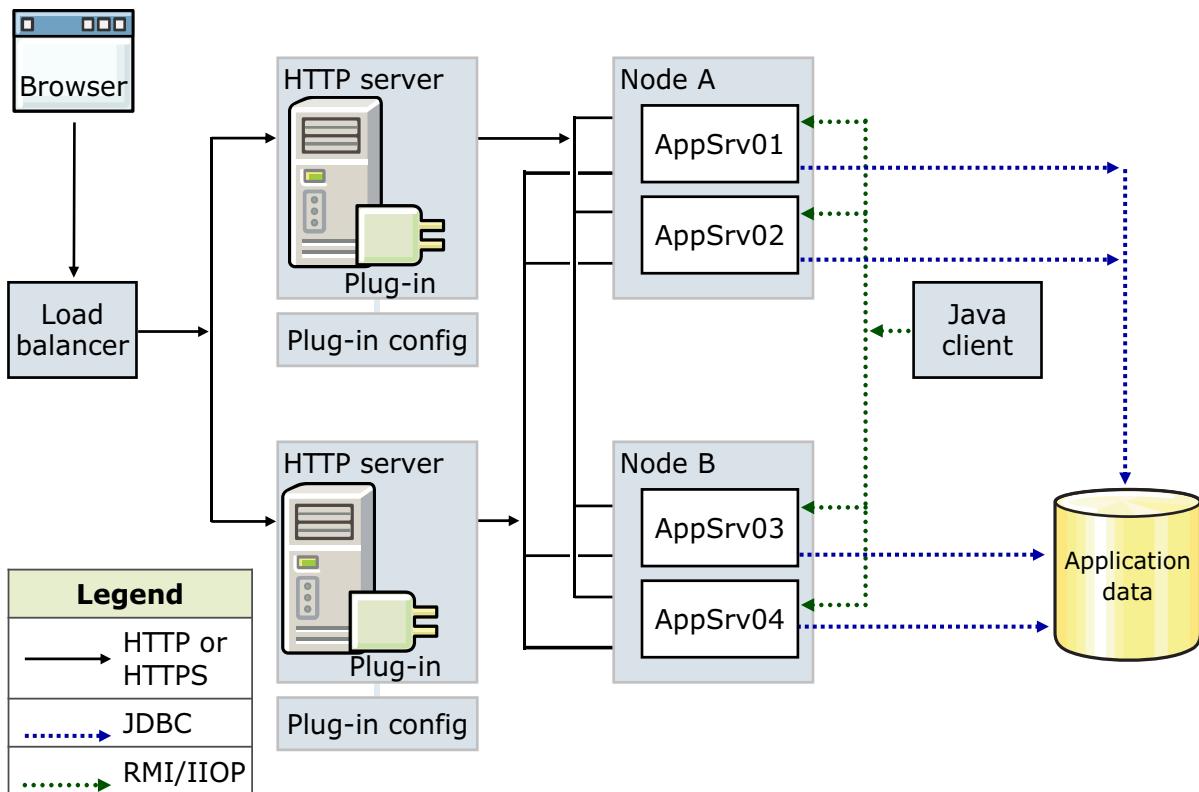
This diagram illustrates the basic architecture of WebSphere Application Server, including several of the larger components.

The browser is the main interaction mechanism for users. A browser communicates with a web server (HTTP server). Requests are forwarded from the HTTP server plug-in that is loaded with the HTTP server to the embedded HTTP server within the application server. The embedded server forwards the request to the web container to either a servlet or a JSP. If the servlets or JSPs must access distributed business logic or a database, the Java EE mechanism is through EJBs within the EJB container. EJBs (entity in this case) can communicate with the database to store, retrieve, query, and delete data. JDBC is one way that this communication can occur.

The browser can communicate directly with the embedded HTTP server (bypassing the external web server); this configuration is only for testing and development purposes. Browsers are not the only clients; a pure Java client can access EJBs directly through RMI/IOP. Web services clients can also access the application server, either through SOAP over HTTP and passing through the embedded HTTP server, or through direct communication with the messaging engine within the application server. JMS clients can directly communicate with the messaging engine.



Network deployment runtime flow



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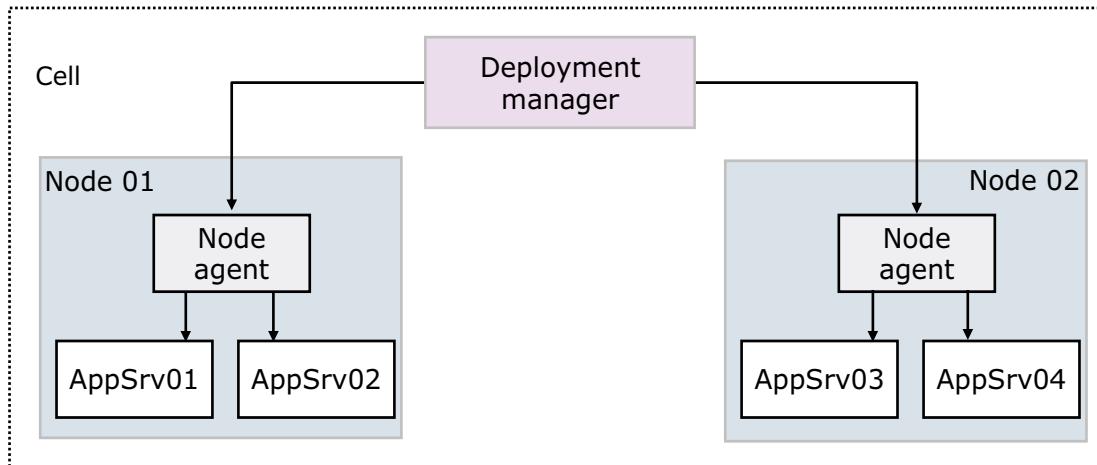
Figure 3-5. Network deployment runtime flow

The main theme with Network Deployment is distributed applications. While the flow of an application remains the same, there are significant additions to the runtime of an application. Note the load balancer: this configuration allows for multiple HTTP servers. Users point their browsers to the load balancer, and their requests are workload managed to an HTTP server. When a request reaches one of the HTTP servers, the HTTP server plug-in load balances the request between the application servers that it is configured to serve. After the request enters the application server, the flow is identical to how it was in Express and Base.

The Java client requests to EJBs can also be workload-managed so that the requests do not all go to one application server.

WebSphere cells

- A WebSphere cell defines an administrative domain
 - Available in WebSphere Application Server Network Deployment
 - A deployment manager provides centralized administration for entire cell
 - Nodes run application components in application servers



IBM Business Process Manager Advanced architecture overview

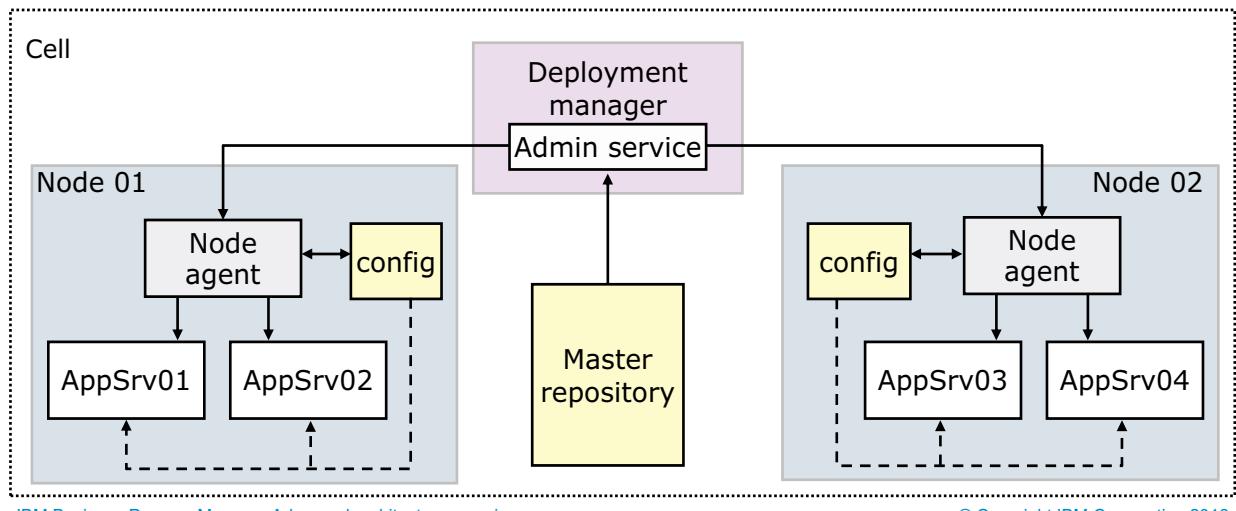
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Figure 3-6. WebSphere cells

A cell is a grouping of nodes into a single administrative domain. A cell encompasses the entire management domain. In a network deployment environment, a cell can consist of multiple nodes (and node groups), which are administered from a single point that is called the deployment manager.

Network deployment concepts (1 of 2)

- Deployment manager (dmgr)
 - Manages the node agents
 - Holds the configuration repository for the entire management domain, called a *cell*
 - Administrative service runs inside the dmgr
 - The deployment manager is defined within a profile
- Node
 - Logical grouping of servers
 - A single *node agent* process manages the node
 - Each node is defined within a profile



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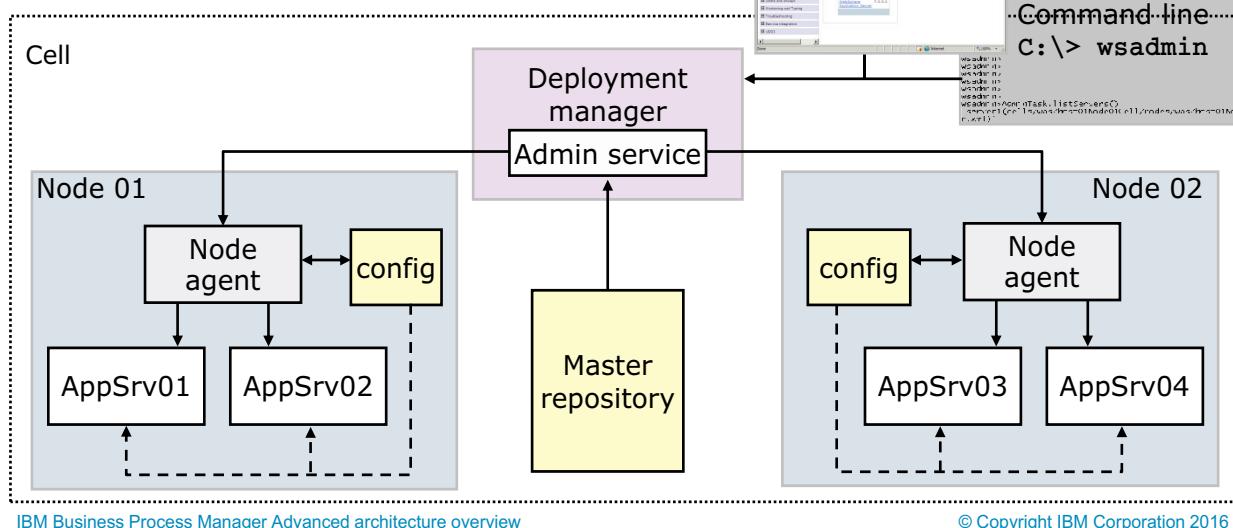
Figure 3-7. Network deployment concepts (1 of 2)

WebSphere Network Deployment-based products use several logical components that slot together to form highly configurable and scalable application server environments.

- **Deployment manager:** The deployment manager is the central administration point of a cell that consists of multiple nodes in a distributed server configuration. The deployment manager communicates with the node agent to manage the application servers within one node.
- **Nodes:** A WebSphere node is a managed container for one or more application servers. Typically, a single node corresponds to a single server. A node comprises a node agent, by which the node is controlled, and the application servers that are hosted on that node.

Network deployment concepts (2 of 2)

- **Node agent**
 - Created and installed when a node is federated into a cell
 - Works with the deployment manager to do administrative activities on the node
- **Administrative tools**
 - Browser-based administrative console
 - Command line, scripting, automation



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Figure 3-8. Network deployment concepts (2 of 2)

WebSphere Network Deployment-based products use several logical components that slot together to form highly configurable and scalable application server environments.

- **Node agents:** The WebSphere node agent is an architectural component by which the deployment manager for the cell can remotely manage the node, its application servers, and their applications.
- **Administrative tools:** The deployment manager runs a single application, web-based configuration front end, which is known as the administrative console, through which you can do nearly all management tasks. The wsadmin command line tool allows scripting and automation of management tasks.

3.2. Clusters

Clusters

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Figure 3-9. Clusters

Clusters and cluster members

- Creating more throughput within a cell cannot be done by installing one application on multiple application servers
 - Creates conflicts with the namespace
 - Cluster members are created from templates
- Clusters allow for the same application server template to have multiple copies in a cell
 - Single point of management
 - Automatic workload management and failover
- Clusters are a set of application servers that have the same applications that are installed, and grouped logically for workload management
- Applications that are installed to the cluster are automatically propagated to the cluster members

Figure 3-10. Clusters and cluster members

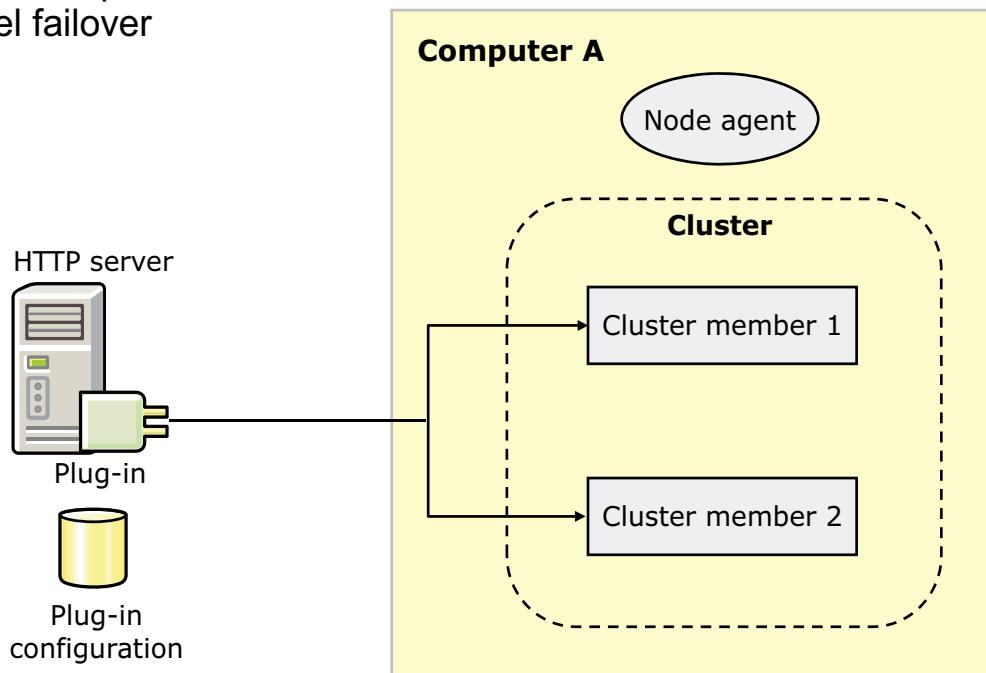
Clustering is a key technique that you can use to improve the availability and the scalability of an IBM Process Server environment. With clustering, you can:

- Increase system availability by providing redundant JVM processes or hardware components that can ensure some level of continuity of service in case of failures.
- Provide a mechanism to accommodate more workload scalability by making available more processes and systems to run transactions. You can think of a cluster as a group of servers that work together, but are displayed as one server to the outside world.

The concepts of failover and scalability are largely independent. You might find that a topology that ensures scalability might not be good at ensuring availability, and vice versa. With WebSphere, you can use clustering techniques in many different ways to address availability and scalability. There are two types of clustering that you can do: vertical clustering and horizontal clustering.

Configurations: Vertical scaling

- Can provide better performance with multiple processors
- Provides process level failover



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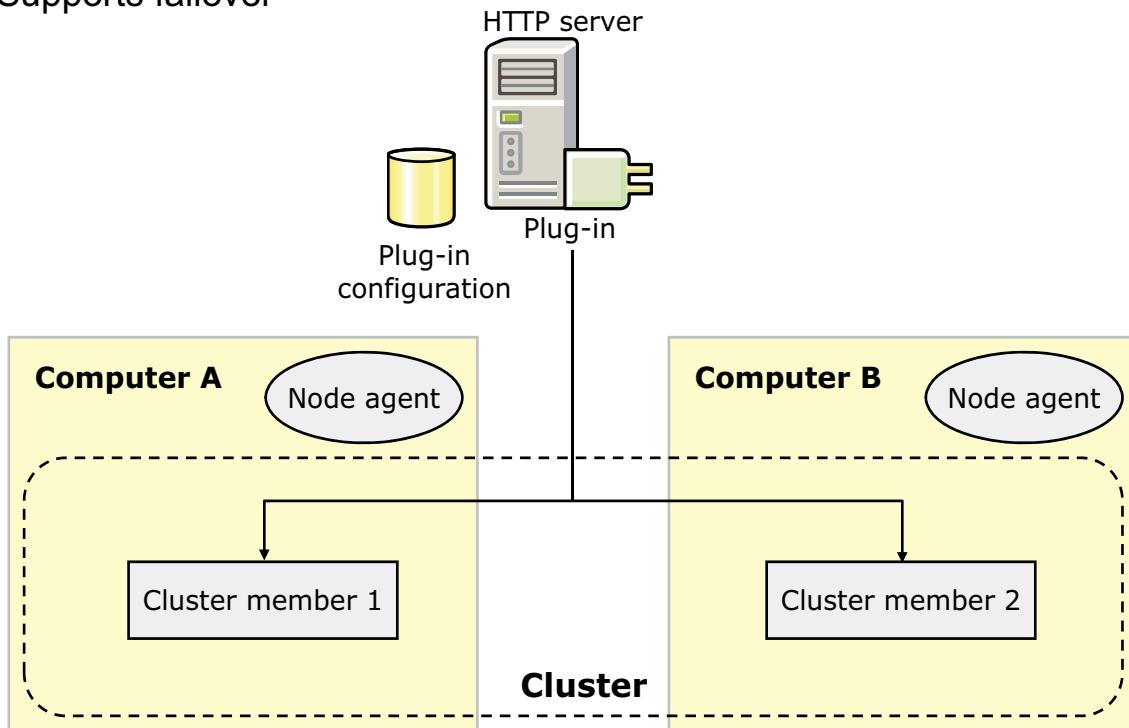
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Figure 3-11. Configurations: Vertical scaling

Clustering with vertical cluster members is the practice of defining cluster members of an application server on the same physical server. Experience shows that when a single JVM process implements a single memory server, then the application server cannot always fully use the processor power and RAM of a large multiprocessor server. Clustering with vertical cluster members provides a straightforward mechanism to create multiple JVM processes that together can fully use all the processing power and memory available. However, vertical clusters do not provide resiliency if the hardware that is hosting the cluster fails.

Configurations: Horizontal scaling

- Supports failover



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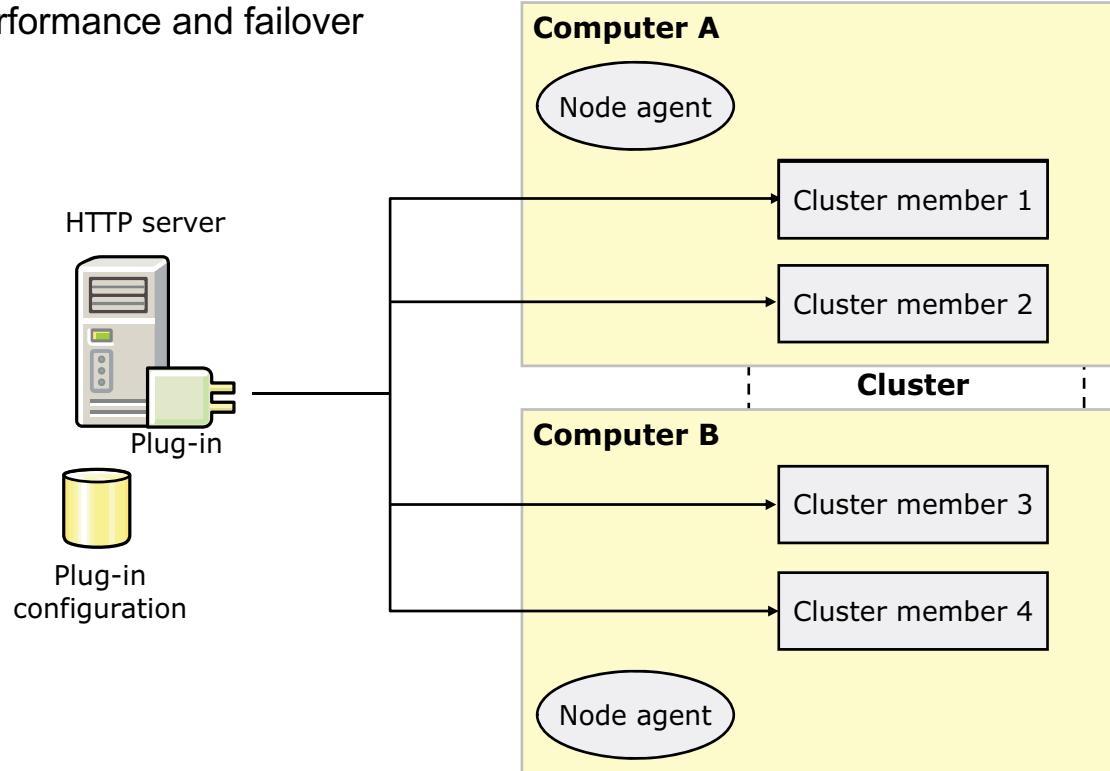
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Figure 3-12. Configurations: Horizontal scaling

Clustering with horizontal cluster members is the traditional practice of defining cluster members of an application server on multiple physical computers, allowing a single application to span several computers while presenting a single system image. Clustering with horizontal cluster members can provide increased throughput and high availability. If one piece of hardware fails, there are other pieces of hardware with active servers in the cluster that can pick up the load, so there is no outage.

Configurations: Vertical and horizontal scaling

- Performance and failover



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Figure 3-13. Configurations: Vertical and horizontal scaling

Scaling both vertically and horizontally combines both system and process level failover.

3.3. Network deployment administration

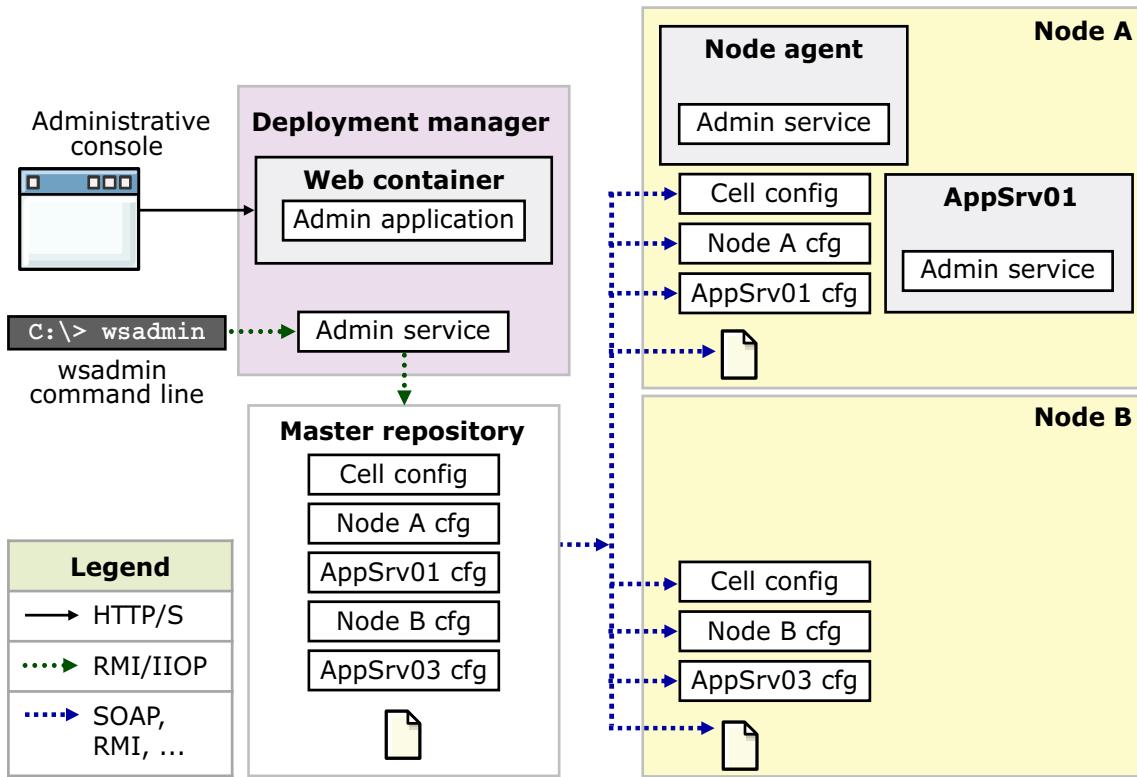
Network deployment administration

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Figure 3-14. Network deployment administration

Network deployment administration flow



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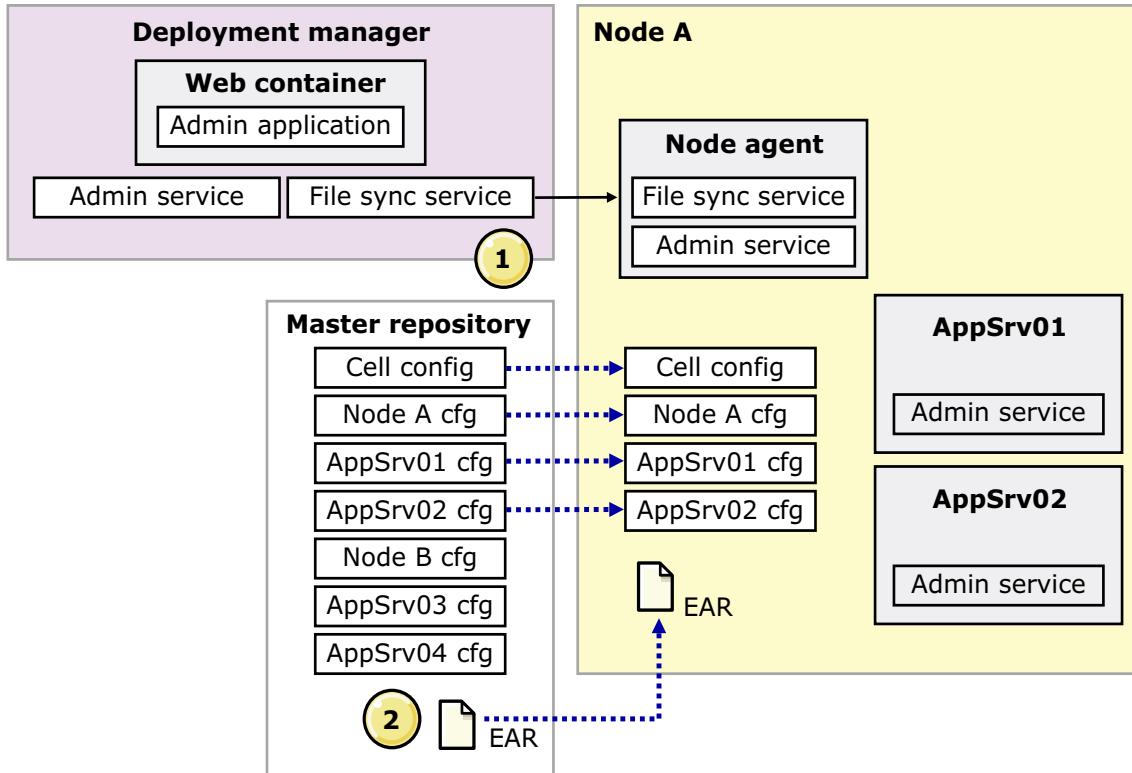
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Figure 3-15. Network deployment administration flow

The administrative console and wsadmin are the two ways with which the environment is administered. However, these tools communicate with the deployment manager and not with the application servers directly. Finally, the communication of these commands flows from the tools to the deployment manager, and then to the node agents and to the application servers. This flow allows for the administration of multiple nodes from a single focal point (the deployment manager). Each node can contain multiple application servers.

There is one main (master) repository for the configuration files within a cell, and those files are associated with the deployment manager. All updates to the configuration files go through the deployment manager. You must be careful about directly connecting to an application server with wsadmin or the administrative console. Any changes that are made to the configuration files are only temporary and are overwritten with the configuration files from the master files (repository).

File synchronization



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Figure 3-16. File synchronization

Each managed process, node agent, and deployment manager starts with its own set of configuration files. The deployment manager contains the master configuration. Any changes that are made at the node agent or server level are local and overridden by the master configuration at the next synchronization (update).

1. Node agents synchronize their files with the master copy either automatically or manually. Automatic synchronization can be done at start or scheduled periodically. Manual synchronization is done with the administrative console or from the command line.
2. During synchronization, the node agent asks for changes to the master configuration. Any new or updated files are copied to the node.

Unit summary

- Define network deployment concepts and terminology
- Define clusters and cluster members
- Describe administrative interfaces and tools
- Define administrative flow

Review questions

1. Which managed processes can be part of a cell?
 - A. Deployment manager
 - B. Node agent
 - C. Load balancer
 - D. Application server
2. Of the following options, which one provides an environment for running servlets?
 - A. Client module
 - B. Web container
 - C. EJB module
3. What is the default protocol type for wsadmin?
 - A. SOAP
 - B. RMI
 - C. None



Figure 3-18. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. Which managed processes can be part of a cell?
 - A. [Deployment manager](#)
 - B. [Node agent](#)
 - C. Load balancer
 - D. [Application server](#)

The answer is A, B, and D.
2. Of the following options, which one provides an environment for running servlets?
 - A. Client module
 - B. [Web container](#)
 - C. EJB module

The answer is B.
3. What is the default protocol type for wsadmin?
 - A. [SOAP](#)
 - B. RMI
 - C. None

The answer is A.

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Figure 3-19. Review answers



Unit 4. IBM Business Process Manager Advanced components

Estimated time

00:45

Overview

This unit provides an overview of the IBM Business Process Manager Advanced components.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe the main components of IBM Business Process Manager Advanced
- Describe the deployment considerations for the databases
- Describe the service integration bus and messaging engine
- Describe the applications that are used to manage a clustered environment
- Describe the Performance Data Warehouse

Topics

- Components
- Applications
- Performance Data Warehouse overview

IBM Business Process Manager Advanced components

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Figure 4-2. Topics

4.1. Components

Components

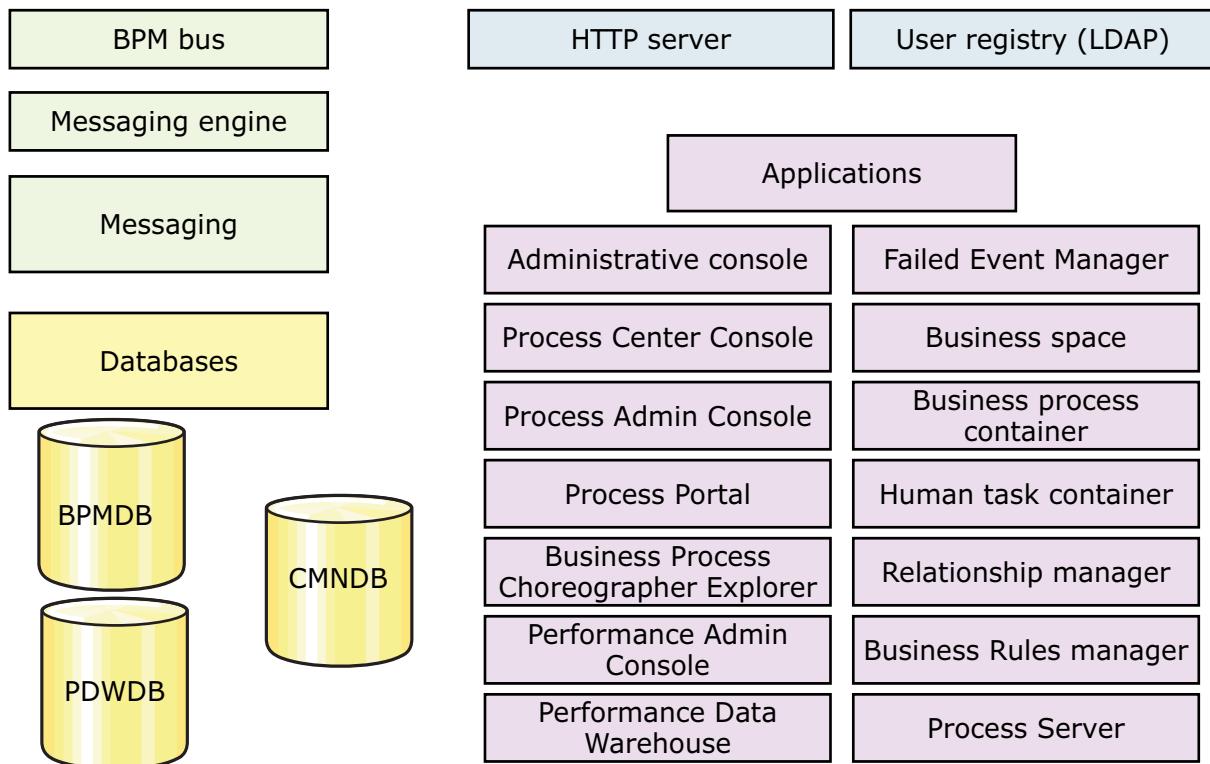
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Figure 4-3. Components



Overview of topology components



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Figure 4-4. Overview of topology components

Before examining the key cluster topologies, a review of the components is useful. Every IBM Business Process Manager environment has three fundamental layers.

- Application layer:**

The application layer comprises the business process, the Process Server components to support them, and the administration functions (administrative console, Business Process Choreographer Explorer, and applications such as the Failed Event Manager).

- Database layer:**

A production-ready, relational database system is required (Derby does not support production environments). Process Server requires access to certain application configuration and runtime information that is stored in relational database tables. IBM Process Server requires the database layer, but it is managed outside IBM Process Server. In general, you might configure five or more databases, depending on how you intend to provide adequate performance and scalability.

- Messaging layer:**

IBM Process Server also requires a messaging infrastructure that consists of a messaging engine, buses, and queues. Clustering the messaging infrastructure is the most complex aspect of the high availability environment. In general, since you use WebSphere Platform Messaging (service integration bus), the messaging infrastructure is also clustered by using WebSphere

clustering techniques. However, you must understand a number of considerations when you select a topology.

Depicted in the upper-right corner of the graphic are more components that run outside Process Server but might be needed in most Process Server environments. Load balancers and HTTP servers are used to process web requests and direct them to cluster members, which are able to do the work (workload balancing). For a clustered environment, the user registry must be LDAP or a custom registry because distributed environments cannot use a local operating system as a user registry.

Databases support in a topology

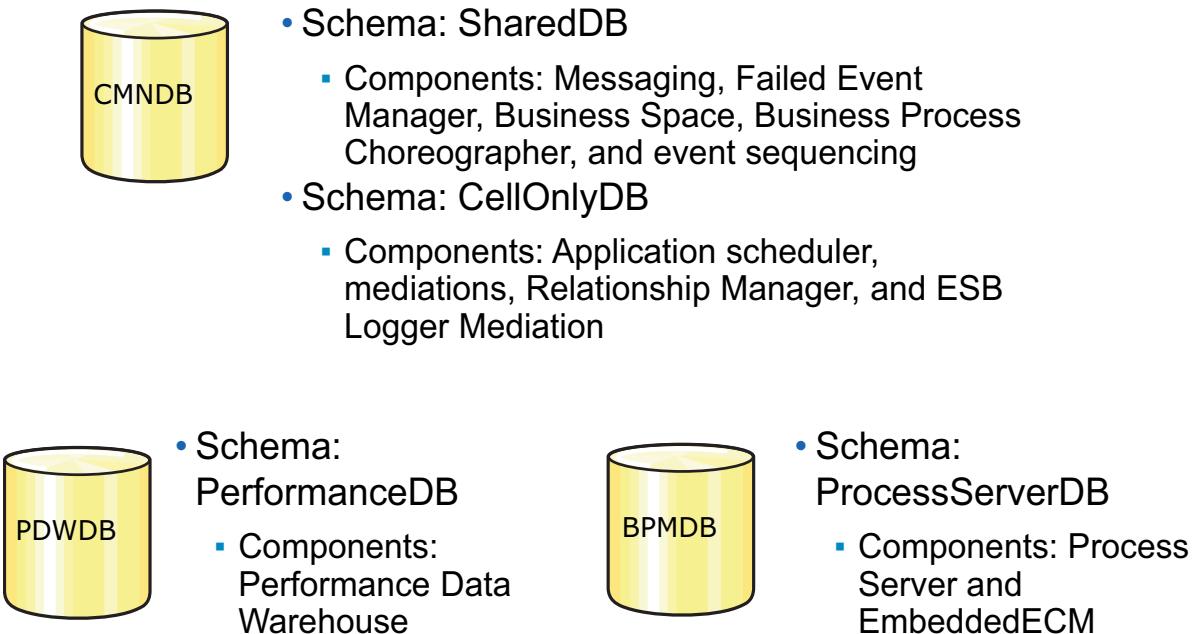
- Databases and schemas are different
- Database schemas share the same database
 - Messaging, Business Space, and Business Process Choreographer are assigned to database schemas
 - Process Server and Performance Data Warehouse do not have schema support; therefore, they cannot share the same database
- The three databases that are required to support your topology:
 - Common database: **CMNDB**
 - Process Server database: **BPMDB**
 - Performance Data Warehouse: **PDWDB**
- The Common database is split into two pieces:
 - Cell scoped tables per the entire cell
 - Deployment environment scoped tables per the deployment environment

Figure 4-5. Databases support in a topology

To plan your database configuration, you must know which databases must be in place and configured to use the software. You must also know which components of IBM Business Process Manager you use and their associated databases. Also, you must know about the tasks that are required to administer the databases, and the security privileges of the database system that you are using.

This slide lists the databases and their purpose within an IBM BPM infrastructure.

Required databases



IBM Business Process Manager Advanced components

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Figure 4-6. Required databases

The Process Server and Performance Data Warehouse components do not support case-sensitive databases. These databases must *not* be case-sensitive.

For Microsoft SQL Server and Oracle databases, the following restrictions apply:

- For Microsoft SQL Server databases, components other than Process Server or Performance Data Warehouse require that their databases be case-sensitive.
- For Oracle databases, the Process Server, Performance Data Warehouse, and Common database components must use a separate schema or user. They can use the same instance.

Optional databases

Configure Databases

Edit the database parameters for the data sources that are used by this deployment environment.

* Select provider: DB2

Shared parameters:

* User name: db2admin	* Password: *****	* Confirm password: *****
* Server: server1.ibm.com	* Port: 50000	<input checked="" type="checkbox"/> Create Tables?

Databases:

common database	
+ Name: CMNDB	
Process database	
+ Name: BPMDB	
Performance Data Warehouse database	
+ Name: PDWDB	

Check Separate messaging if you want to separate the messaging engine database.

<input checked="" type="checkbox"/> Separate messaging	Name: MEDB
--	------------

Check Separate BPC if you want to separate the Business Process Choreographer (BPC) database.

<input checked="" type="checkbox"/> Separate BPC	Name: BPEDB
--	-------------

Test connection

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Figure 4-7. Optional databases

IBM BPM bus

- A service integration bus is a managed communication mechanism that supports service integration through synchronous and asynchronous messaging
- A single service integration bus and single messaging engine that use the same database schema as the product database by default
- Each deployment environment has its own bus
- The single bus is called `BPM.deployment_environment_name.Bus`

Figure 4-8. IBM BPM bus

The service integration bus (SIBus) provides the following capabilities:

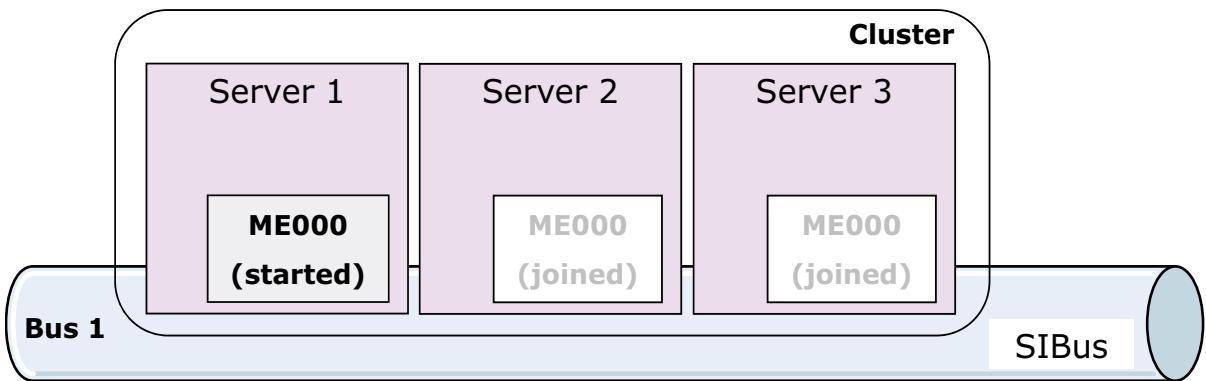
- Any application can exchange messages with any other application by using a destination to which one application sends, and from which the other application receives.
- A message-producing application, that is, a producer, can produce messages for a destination regardless of which messaging engine the producer uses to connect to the bus.
- A message-consuming application, that is, a consumer, can consume messages from a destination (whenever that destination is available) regardless of which messaging engine the consumer uses to connect to the bus.

The bus supports the following types of messaging:

- Sending messages synchronously requires the consuming application to be running and reachable.
- Sending messages asynchronously (possible whether the consuming application is running or not and if the destination is reachable). Both point-to-point and publish/subscribe messaging are supported.
- Publishing events or other notifications. The bus can also generate notification messages.

Bus features

- When you add a cluster as a bus member
 - An ME is automatically created
- Only one active ME at any time
 - High availability manager decides which server runs the ME
 - The MEs on the other cluster members are in a joined state (“hot standby”)
- If the active ME is down, the high availability manager fails over the ME on a joined server



IBM Business Process Manager Advanced components

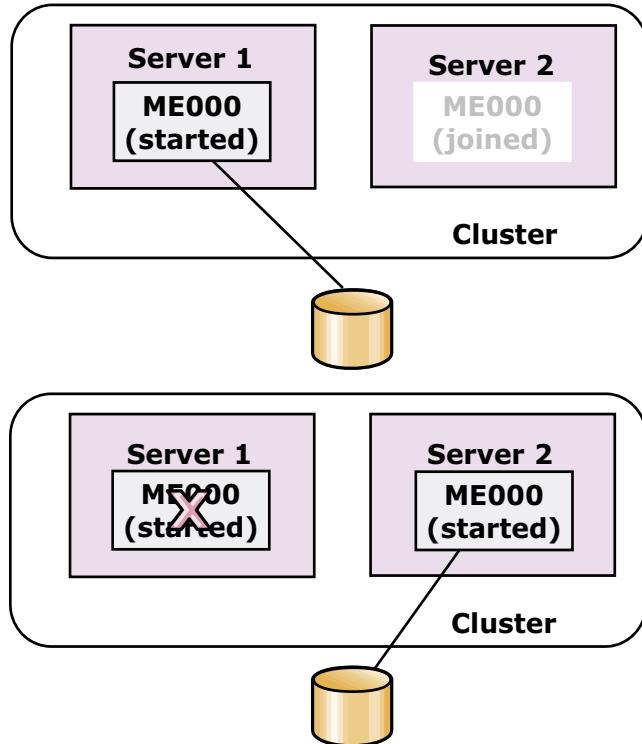
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Figure 4-9. Bus features

If the added bus member is a cluster, the mechanism is similar, but the messaging engine is now created automatically for each member of the cluster. At run time, only one instance of the messaging engine (ME) is started and capable of processing messages. The high availability (HA) manager manages which ME is started, which are joined, and their failover behavior.

Failover

- If the cluster member with the running ME fails, the HA manager runs that same ME on another cluster member
 - The newly started ME must activate all destinations before it is shown as “started” in the SystemOut.log file
- It then grabs a lock on the underlying data store (this lock is not persistent; it is connection-based)
- Persistent messages are stored in the data store and are accessible through the ME that is started



IBM Business Process Manager Advanced components

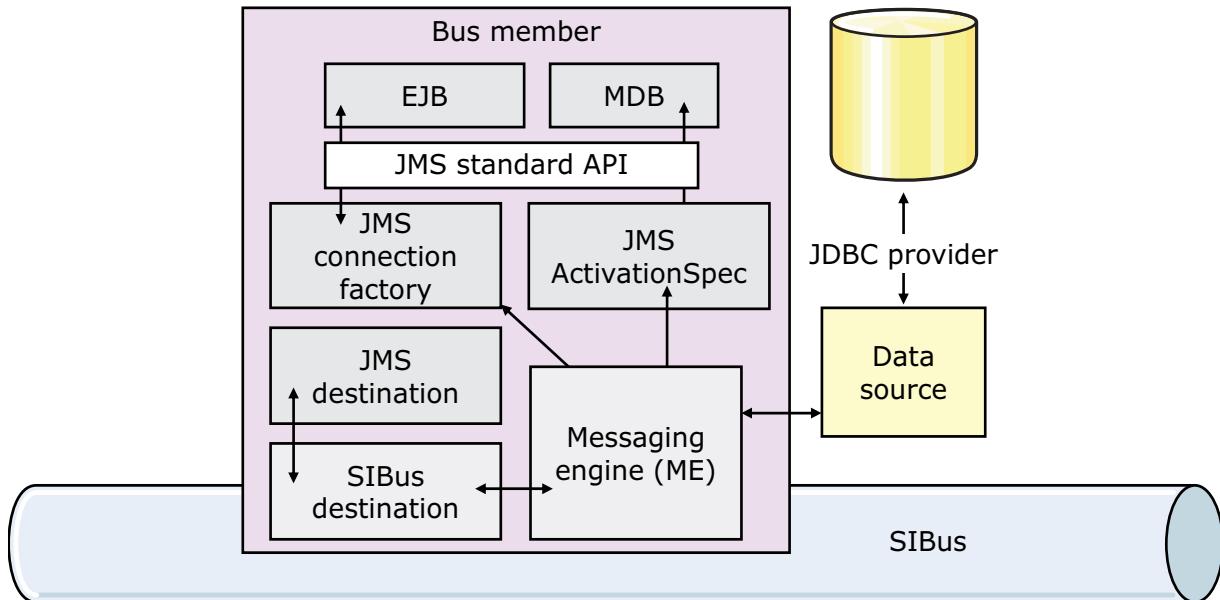
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Figure 4-10. Failover

In a clustered environment that allows for high availability, a messaging engine failover scenario works as depicted in this diagram.

In a failure in the started ME000 instance, the HA manager activates the ME000 instance available on Server 2. Since both ME instances use the same data store, ME000 on Server 2 can continue to process the persisted messages.

Bus components



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Figure 4-11. Bus components

When a new bus member is defined, one or more messaging engines (ME) are automatically created. MEs run inside the cluster member, and manage messaging resources. MEs provide a connection point for clients to put or get messages. An ME requires a persistent backing store for storing recoverable data such as messages. An ME can be configured to use a data source to connect to its message store. A bus destination is a virtual place within an SIBus, which applications (producers and consumers) use to exchange messages. Therefore, an SIBus destination is associated with bus members, associating it with the corresponding MEs. A bus destination is a logical name that applications use to exchange messages. Therefore, a bus destination is associated with one or more bus members, associating it with the corresponding MEs. A message point is the physical location on a messaging engine where messages are held for a bus destination. Java EE applications (producers, consumers) access the SIBus and the bus members through the JMS API.

JMS defines interfaces for accessing destinations:

- **ConnectionFactory:** Java EE components use it to connect to the SIBus through a messaging engine (typically used by producer applications).
- **ActivationSpec:** Message-driven beans use it to connect to the SIBus through a messaging engine (used by consumer applications).

JMS destinations are associated with SIBus destinations. The SIBus destination implements the JMS destination function.



Components (1 of 2)

- Process Server runtime
 - Where process applications are deployed and made available to run and manage process tasks
- Process Center server
 - Includes a repository for all process applications, business process diagrams, service components, and other assets that are created in the IBM BPM authoring environments

The screenshot shows a web-based application interface for managing process snapshots. At the top, there's a header bar with the title "Procurement Sample (STPPS1)" and icons for "Snapshots", "History", and "Manage". Below the header, a sub-header says "Sort Snapshots By:". The main content area contains two entries:

- Current**: Last changed on 9/3/13 by pcdeadmin. Not Yet Deployed to Process Center Server.
- Procurement Sample v85 (New)**: Created on 9/3/13 by pcdeadmin. Not Yet Deployed to Process Center Server. Not Yet Installed to Process Server.

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Figure 4-12. Components (1 of 2)

Each IBM Business Process Manager Process Server contains resources for running processes that are *installed* from Process Center. Every Process Server deployment environment contains a Process Server runtime, which runs the process applications that are installed from the Process Center repository.

Components (2 of 2)

- Performance Data Warehouse
 - Collects performance data that represents key business events and metrics as processes are run in the environment
 - The Performance Admin Console can be used to work with Performance Data Warehouse queues, manage data transfer errors, and monitor overall performance

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Figure 4-13. Components (2 of 2)

The Business Performance Data Warehouses in your IBM Business Process Manager configuration retrieve and store tracked performance data, which enables users in IBM Process Designer to create reports and also analyze processes by using the Optimizer.

Business Process Choreographer

- Business process container (Business Flow Manager)
 - To run applications that contain business processes on a Process Server, you must configure the necessary resources and install the business process container application
 - The business process container is installed in the Application cluster
- Human task container (Human Task Manager)
 - To run applications that contain human tasks on a Process Server, you must install the human task container
 - The human task container is installed in the application cluster
- Deployed as four enterprise applications

Health Center component (1 of 2)

[Deployment Environments](#) > [PServer DE](#) > Health Center

Use this page to evaluate the health of your IBM BPM server and identify potential problems. The table below lists the IBM BPM components and provides their status.

Status	Component	Scope
	CellDatabase	Cell=PROD-PServerCell
	CellSecurity	Cell=PROD-PServerCell
	ProcessPortal	Cluster=AppCluster
	RestGateway	Cluster=AppCluster
	ProcessServer	Cluster=AppCluster
	BusinessSpace	Cluster=AppCluster
	EmbeddedECM	Cluster=AppCluster
	DocumentStoreAdmin	Cluster=AppCluster
	BusinessEvents	Cluster=AppCluster
	ArtifactLoader	Cluster=AppCluster
	WbiSession	Cluster=AppCluster
	SCA	Cluster=AppCluster
	BPC	Cluster=AppCluster
	FailedEventManager	Cluster=AppCluster
	EventSequencing	Cluster=AppCluster
	Relationships	Cluster=AppCluster
	AppScheduler	Cluster=AppCluster

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Figure 4-15. Health Center component (1 of 2)

After you finish installing IBM Business Process Manager or at any time thereafter, you can use the Component Health Center. The Heath Center in the administrative console is used to check the status of the configured components in your IBM BPM deployment environment. Examples of configured components include IBM Process Server, Process Center, and Performance Data Warehouse.

The Component Health Center page contains a table that lists the configured components in the deployment environment and indicates the status of each component. Each component name has a hyperlink that you can click to open a Details page where you can view detailed health information for a selected component and investigate possible problems.

In determining the status of the configured components in the deployment environment, the following checks are automatically done:

- The associated resources for every component are checked to determine whether they are usable. For example, each component's database is checked to determine whether it is created and a connection can be established.
- The security configuration is checked to determine whether the essential requirements are met.

- IBM Process Server, Process Center, and Performance Data Warehouse are checked to determine whether they are usable. Several runtime checks are completed, such as whether the associated applications and message engines started.



Health Center component (2 of 2)

[Deployment Environments](#) > [PServer DE](#) > [Health Center](#) > [ProcessServer](#)

Use this page to view detailed health information for a selected component and investigate possible problems.

Configuration

General Properties

Component
ProcessServer

Description
Process Server provides a single BPM runtime environment that can support a range of business processes, service orchestration, and integration capabilities.

Application Name	Installed	Started	Exception Messages
IBM_BPM_ProcessAdmin_AppCluster	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
IBM_BPM_Teamworks_AppCluster	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
IBM_BPM_WebAPI_AppCluster	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
IBM_BPM_Help_AppCluster	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Data Source Name	JNDI Name	Database Name	Schema	Created	Connected	Exception Messages
BPM Process Server data source	jdbc/TeamWorksDB	PSBPMDB	db2inst1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

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Figure 4-16. Health Center component (2 of 2)

In the **Status** column, examine the status of the components. Icons are used to indicate the status of components or resources in the Component Health Center.

Applications are associated with many different components, such as the Process Server, Process Center, and Performance Data Warehouse components. In the Application table, examine the icons in the **Installed** and **Started** columns to determine whether each application is installed and started. Also, examine the **Exception Message column** to determine whether there are any messages for the applications.

More resources

- Production topology can include other resources:
 - User registry for security
 - One or more HTTP servers
 - Firewalls
 - Load balancers
- IBM Business Process Manager relies entirely upon WebSphere Application Server for user authentication
 - Users are authenticated against the WebSphere user registry
- Types of supported user registries:
 - File-based registry (default)
 - Stand-alone LDAP repository
 - Custom repository
 - Any combination of these options (federated repositories)

Figure 4-17. More resources

The installation wizard and profile management tool have a default of enabling administrative security. The default repository type is a file-based federated repository. Federated repositories provide for the use of multiple repositories with WebSphere Application Server.

4.2. Applications

Applications

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Figure 4-18. Applications

Administrative console applications

- Applications included in the deployment manager administrative console:
 - Relationship manager, which provides runtime access to relationship data
 - Failed Event Manager, which provides access to failed events that result from SCA system exceptions
- WebSphere supports running multiple deployment managers for high availability
 - Use the on-demand router (ODR) component of the Intelligent Management features
 - Multiple deployment managers can be configured
 - One deployment manager is active; others run in standby mode until a failure is detected
 - Not a critical need; the deployment manager does not need to be running in production unless administrative changes are needed

IBM Training 

Failed Event Manager

[Deployment Environments](#) > Failed Event Manager

The failed event manager is used to query and manage failed events.

 Failed events on this server

The following are some common methods for searching for failed events:

[Get all failed events](#)

[Search failed events](#)

 About your failed event manager

The Recovery sub-system is enabled.

Total failed events	4
---------------------	---

IBM WebSphere Application Server
Network Deployment, 8.5.5.2
Build Number: cf021414.01
Build Date: 4/8/14

Licensed Material - Property of IBM
5724-I08, 5724-I63, 5724-H88, 5724-H89.

 Documentation

For complete failed event manager documentation, as well as general IBM Business Process Manager documentation, visit the [IBM Business Process Manager Information Center](#). Documentation for WebSphere Application Server is available in the [WebSphere Application Server Information Center](#).

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Figure 4-20. Failed Event Manager

The Failed Event Manager is available from the administrative console under your deployment environment.

IBM Training 

Relationship Manager

Relationship Manager

The relationship manager is used to query and manage relationship instances.

Relationships

Following are the Relationship services MBeans on your System
 PROD-PServerCell:PServerNode01:AppClusterMember1 [Relationships](#)
 PROD-PServerCell:PServerNode02:MEClusterMember2 [Relationships](#)
 PROD-PServerCell:PServerNode01:SupClusterMember1 [Relationships](#)
 PROD-PServerCell:PServerNode01:MEClusterMember1 [Relationships](#)

About Relationship Services

Relationship services is enabled
 Relationship MBeans found: 4

[Relationship services configuration](#)

IBM WebSphere Application Server Network Deployment, 8.5.5.2 Build Number: cf021414.01 Build Date: 4/8/14

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Figure 4-21. Relationship Manager

The Relationship Manager is available from the administrative console under Integration Applications.

Business Process Choreographer Explorer client

- Web application that implements a user interface for interacting with business processes and human tasks
 - Built with reusable, customizable JavaServer Faces (JSF) components
- As administrator, view information about process and task templates, process instances, task instances, and associated objects
- As a user, view and act only on tasks that are assigned to you

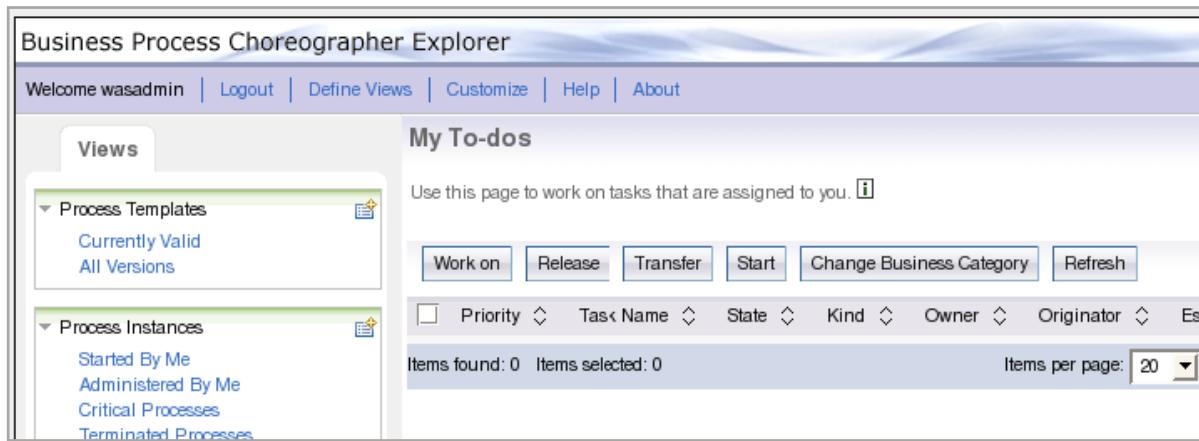


Figure 4-22. Business Process Choreographer Explorer client

Business Process Choreographer Explorer is a web application that can be installed as part of the configuration of the business process container. Before you can use Business Process Choreographer Explorer from a web browser, you must install the business process container, human task container, and the Business Process Choreographer Explorer application. The event collector application must be installed and running before you can use the reporting function.

Depending on your user role, you can use Business Process Choreographer Explorer to manage Business Process Execution Language (BPEL) business processes and human tasks, or to work with your assigned tasks. While BPEL business processes and tasks are running, the runtime can emit events that contain information about state changes of process instances and their related activities. Using reporting, you can retrieve statistical information that is based on these events and create reports on processes and activities.

Business Rules Manager client

- Web-based tool that assists the business analyst in creating, browsing, and modifying business rule parameter values
 - Allows an administrator to manage selection criteria, export rule changes, and similar items
- Business rules that are developed in Integration Designer by using if-then rule sets and decision tables
 - Rule sets and decision tables are set into templates
 - The templates control which aspects of a business rule you can modify at run time and by exactly how much



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Figure 4-23. Business Rules Manager client

The Business Rules Manager is a web-based tool that assists the business analyst in browsing and modifying business rule values. Business rules are designed and developed in IBM Integration Designer by using if-then rule sets and decision tables to implement their operations. The rule sets and decision tables are set into templates. The templates control which aspects of a business rule you can modify and by exactly how much. They define the structure of if-then rules, condition cases, and actions for decision tables.

The Business Rules Manager does not address rules and decision tables that are created in IBM Process Designer.



Business Space

- Not a separate product, it is included with the product
- Web application that is intended as a unifying front end for the UI components of the business process management runtimes
 - Easy to configure and use
 - Includes various widgets
- Widgets are small programs that you can easily put on your website or home page

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Figure 4-24. Business Space

Business Space is a browser-based graphical user interface that allows the customization of content. It provides a common presentation layer for application users to manipulate the web interfaces of IBM BPM applications.



Process Center Console

- The Process Center Console provides the web-based interface for managing the Process Center maintained projects
- You can use it to grant managers, analysts, process authors, and software developers access to the process applications in your repository
- It provides the tools that are needed to maintain the repository

The screenshot shows the "IBM Business Process Manager Proc..." window. The top navigation bar has tabs for "Process Apps", "Toolkits", "Servers", and "Admin". The "Process Apps" tab is selected. Below the tabs, there is a list of four process applications:

- Account Verification Skeleton (AVS) - Last updated on 6/13/11 by admin
- AccountServicesApp (ASA001) - Last updated on 6/12/11 by admin
- Hiring Sample (HSS) - Last updated on 5/28/11 by tw_admin
- Process Portal (TWP) - Last updated on 5/28/11 by tw_admin

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Figure 4-25. Process Center Console

The Process Center Console provides a web-based interface for managing the Process Center maintained projects. The default URL for Process Center Console is <http://localhost:9080/ProcessCenter>.

The Process Center includes a repository for all processes, services, and other assets. The Process Center Console provides the tools that you need for maintaining the repository.

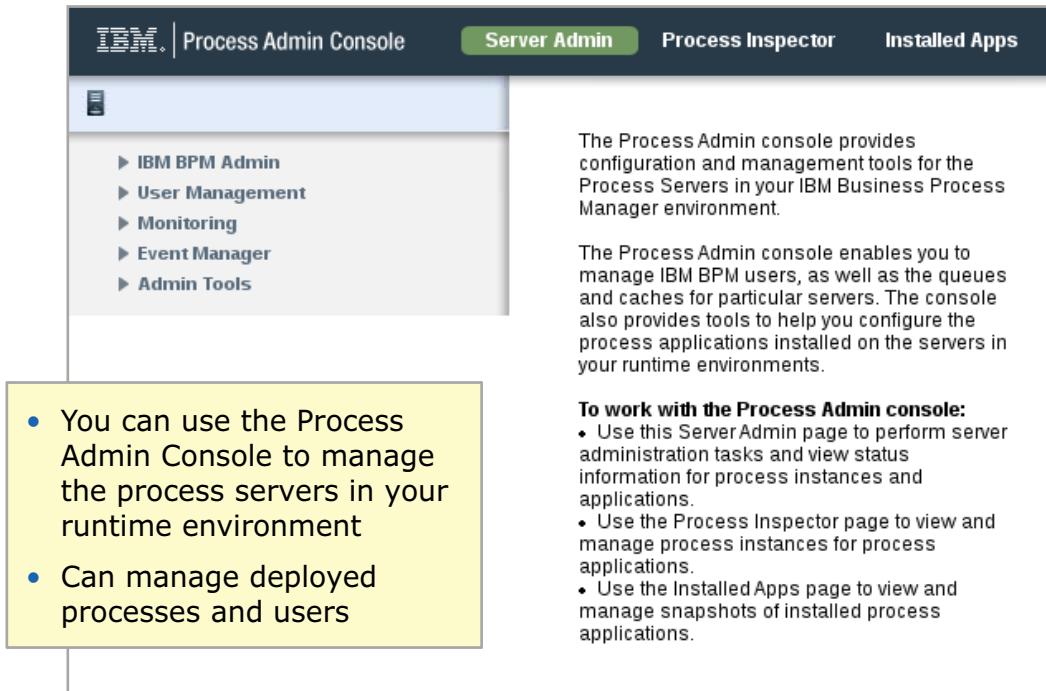
From the Process Center Console:

- You can create process applications and toolkits and grant other users access to those process applications and toolkits.
- Administrators can install process applications that are ready for testing or production on the Process Servers in those environments.
- Administrators manage running instances of process applications in configured environments.

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Process Admin Console



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Figure 4-26. Process Admin Console

The Process Admin Console allows administrators to manage the Process Servers in the runtime environments (staging, test, production). It is also available to manage the Process Center server that is part of the Process Center.

The most important management tasks are managing user accounts (creating and managing applications and participant groups) and managing installed applications (activating and deactivating applications, migrating in-flight instances).

The screenshot shows the IBM Business Process Manager Advanced components Process Monitor interface. At the top, there are tabs for Summary, Processes, and Services, with Summary selected. A yellow callout box highlights the text: "Process Monitor indicates what the process server is doing by BPMN monitoring". Below the tabs, there are two tables:

Active Processes Currently Executing		0
Active Services Currently Executing		0

Most Expensive Services

Process App	Service Name	Total Time	Total Steps
Hiring Sample (tip)	Submit Requisition HS	0:00:02.399	14
Process Portal (tip)	Process Performance	0:00:01.749	9
Process Portal (tip)	Team Performance	0:00:01.382	3
Process Portal (tip)	Team Performance	0:00:01.080	4

Most Expensive Processes

Process App	Process Name	Total Time	Total Steps
Hiring Sample (tip)	Standard HR Open New Position	0:00:04.405	195
Hiring Sample (tip)	Standard HR Open New Position	0:00:03.431	195
Procurement Sample (Procurement Sample v4)	ReplenishmentBPD	0:00:01.298	2

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Figure 4-27. Process Monitor

Process Monitor provides details on what services and BPDs are running and how long each step is taking. You can use it to identify items that are consuming large amounts of resources or stuck in a repeating loop due to the process modeling bus. You can kill a looping service if needed. Process Monitor gives you the ability to understand bottlenecks in your application. Process Monitor is per JVM, not cluster wide. You must go to each process server in the cluster to check the status of the server.



Instrumentation Monitor

Monitoring > Instrumentation

 Automatically refresh every ▾

Name	Count/Value	In Process	Average Duration (ms)
BPD			
Instances			
BPD Instances Completed	1		
BPD name is Default Snapshot Status Change	1		
BPD Instances Failed	0		
BPD Instances Resumed	0		
BPD Instances Started	5		
BPD name is Default Snapshot Status Change	1		
BPD name is ReplenishmentBPD	2		
BPD name is Standard HR Open New Position	2		
BPD Instances Terminated	0		
Cache			
Connectors			
Webservices			

Instrumentation Monitor is useful for identifying BPMN process instance performance bottlenecks

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Figure 4-28. *Instrumentation Monitor*

By using Instrumentation Monitor, you can display and collect instrumentation data. The Instrumentation Monitor is useful for identifying BPMN process instance performance bottlenecks and capturing instrumentation data. Instrumentation Monitor is available in the Process Admin Console.



Process Inspector

- Process Inspector shows information and details about failing instances
- Actions available to interact with processes
- In the Process Admin Console and in Process Designer
- Provides BPMN monitoring

ReplenishmentBPD:3

- ↳ ReplenishmentBPD
- ↳ Procurement Sample
- ↳ Procurement Sample v85

Status: **Active**

Start time: 2013 September 9
5:13:49 PM

Last action: 2013 September 9
5:13:51 PM

Due date: 2013 September 10
5:13:49 PM

Actions

- 暂停 [Suspend](#)
- 终止 [Terminate](#)

Tasks

- ApproveReplenishmentOrder
The task is owned by All Users, due in 54 minutes.

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Figure 4-29. Process Inspector

Process Inspector shows information and details about failing instances. You also can use it to suspend running instances and help to narrow down the issues that you are experiencing.




Event Manager Monitor

- The Event Manager Monitor displays tasks and activities that are successfully scheduled, initiated, and running in the Event Manager
 - Displays processes that are in the queue, running, or paused
 - Provides BPMN monitoring

Event Manager > Monitor

Scheduler ID	Status	Connect expiration	# Jobs Executing
PServerNode01_AppClusterMember01		Jun 12, 2014 1:37:11 PM	0

Total Jobs Executing: 0 Total Jobs: 1

Scheduler	Process App / Toolkit	Snapshot	Job Name	Job Queue	Scheduled Time	Last Scheduled Time	Last Execution Time	Next Scheduled Time	Job Status
	Process Portal	8.5.0.1	Execute UCA Periodic SLA Update, on set schedule	SYNC_QUEUE_1	6/12/14 1:45:00 PM	6/12/14 1:30:00 PM	6/12/14 1:30:00 PM	6/12/14 2:00:00 PM	Scheduled

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Figure 4-30. Event Manager Monitor

The Event Manager Monitor, included in the Process Admin Console, is useful for troubleshooting processes that are supposed to run automatically (through an undercover agent, for example) but fail to start. You can use the Event Manager Monitor to identify underlying problems and to control various aspects of Event Manager processing.



Performance Data Warehouse Performance Admin Console

- Used to view load, errors, and helping to identify bottlenecks environment
- Captures instrumentation data that can be used to further analyze any performance issues



Figure 4-31. Performance Data Warehouse Performance Admin Console

The Business Performance Data Warehouses in your IBM Business Process Manager configuration retrieve and store tracked performance data, which allows users in IBM Process Designer to create reports and also analyze processes by using the Optimizer.

As part of system maintenance, you might want to view the Performance Data Warehouse load queue to determine which records have yet to be loaded to the database. You might also want to view the error queue to determine whether any errors occurred while data was being loaded from the Process Server to the Performance Data Warehouse.



Process Portal

- Provides the primary graphical user interface for users to work with assigned tasks and other features to complete work efficiently
- Process Portal is redesigned to provide a highly collaborative work experience with increased social capabilities
- Dashboards help you visualize status data for one or more business processes

A screenshot of the IBM Business Process Manager Advanced components Process Portal. The left sidebar shows a user profile for 'pcdeadmin' with options like 'Edit Profile' and 'Log Out'. Below that is a 'Dashboards' section with 'Create Saved Search' and links to 'Work', 'Processes', 'Process Performance', 'Team Performance', and 'Launch' (with sub-options 'Advanced HR Open New Position', 'ReplenishmentBPD', and 'Standard HR Open New Position'). The main area is titled 'Work' and contains a search bar 'Enter search text...'. A task card is visible: 'Task: ApproveReplenishmentOrder ReplenishmentBPD:3 All Users Due: Jul 19, 2016 1:34 PM'.

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Figure 4-32. Process Portal

The Process Portal was introduced in Business Process Manager Advanced V7.5. It provides a highly collaborative work experience with features for managing an online conversation with experts and for subscribing to specific process instances. There is a built-in notification system, and a record of the conversations is stored in the business process “stream.” The stream is also a place where you and the experts can review all the steps that are previously finished and are currently active. You can also include supporting documentation as attachments to the business process streams.

4.3. Performance Data Warehouse overview

Performance Data Warehouse overview

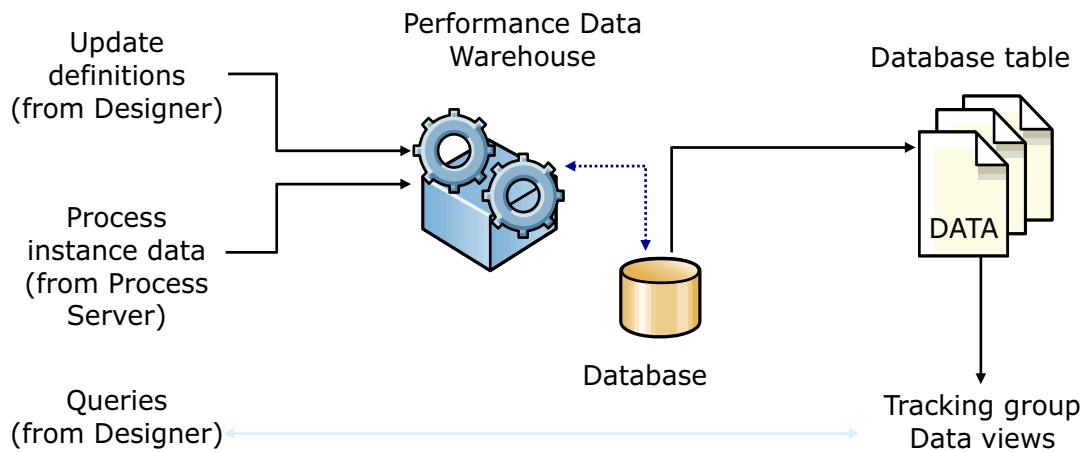
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Figure 4-33. Performance Data Warehouse overview

Overview

- Tracking definitions allow the Performance Data Warehouse to establish the schema for the database
- From the Performance Data Warehouse database table, a tracking group view is established
- You can retrieve and use tracked data from tracking group views



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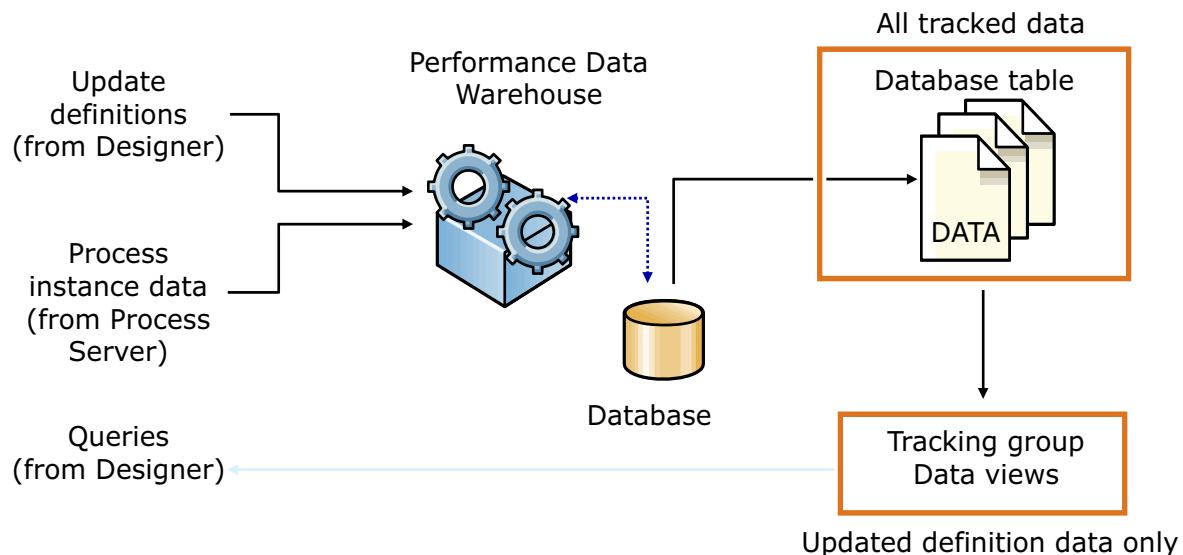
Figure 4-34. Overview

Tracking group views contain the same data as the Performance Data Warehouse database tables. This data includes a column for each tracked variable and several columns to capture timing and other important task information. The Performance Data Warehouse creates a view for each tracking group that is defined in the Process Designer and gives each view the same name as the corresponding tracking group in the Process Designer. When developers use one tracking group in multiple process applications, all data is stored in a single view, with an ID to distinguish each implementation.

The Tracking Group tables in the Performance Data Warehouse database differ from the tracking group views in that they contain all tracked data. Tracked data includes data for those variables that developers stopped tracking during the lifetime of the process. Only the views are updated when developers make such changes to the tracking requirements, or definitions.

Performance Data Warehouse tables

- Tracking group views and tracking group tables contain the same data
- Tracking group tables in the database differ from views in that they contain all tracked data, not just the updated definitions



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Figure 4-35. Performance Data Warehouse tables

Developers implement the tracking groups for a business process definition, mapping the tracked fields to variables within each application. When the developers send tracking definitions, the Performance Data Warehouse establishes the structure, or schema, in its database to store the data. The Process Server generates data when developers run instances of the processes. The Process Server sends the data to the Performance Data Warehouse. In the Performance Data Warehouse database table, the tracked data is captured into a single tracking group view that is named after the tracking group. IBM Business Process Manager captures the Performance Data Warehouse tracked data view to allow developers to retrieve and use the tracked data in any way they choose.

Viewing Performance Data Warehouse queues

- The Performance Data Warehouse load queue
 - Holds database records that are waiting to be loaded
 - You can view the pending records in this queue
 - You can see whether an error is preventing the records from loading
 - If no records are pending, the Load Queue is empty
- The Performance Data Warehouse error queue
 - Determines whether any errors occurred while data was being loaded from the Process server to the Performance Data Warehouse
 - You can remove selected records, or you can attempt to reprocess them

Type	Date	Properties	Failure Reason
Load Queue This displays the list of records in the business performance server that are waiting to be loaded.			

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Figure 4-36. Viewing Performance Data Warehouse queues

The Business Performance Data Warehouses in your IBM Business Process Manager configuration retrieve and store tracked performance data, which enables users in IBM Process Designer to create reports and also analyze processes by using the Optimizer.

Use the Performance Admin Console to work with Performance Data Warehouse queues, manage data transfer errors, and monitor overall performance. To access the Performance Admin Console, use one of the following options:

- Point your web browser to `http://[host_name] : [port] /PerformanceAdmin`, providing the name of the host where the Performance Data Warehouse is installed. Include the port that is designated for the Performance Data Warehouse during IBM BPM installation.
- If you are working on a Windows host where the Performance Data Warehouse is installed, click **Start > IBM Business Process Manager > Performance Admin Console**.
- Log in to the Process Admin Console with the administrator account and password that was specified on the Administrative Security page during IBM BPM profile creation.

Viewing Performance Data Warehouse data transfer errors

- The view errors page in the Performance Admin Console shows all errors that result from data transfer between the Process Server and Performance Data Warehouse
 - Select an error message for removal or reprocessing
 - You can claim the error for investigation

Business Performance Server Data Transfer Errors

Prev Next

Select	Claimed	Date Claimed	Reprocess	Error date	Error Reason
<input type="button" value="Delete All"/>	<input type="button" value="Delete Checked"/>	<input type="button" value="Reprocess All"/>	<input type="button" value="Reprocess Checked"/>		

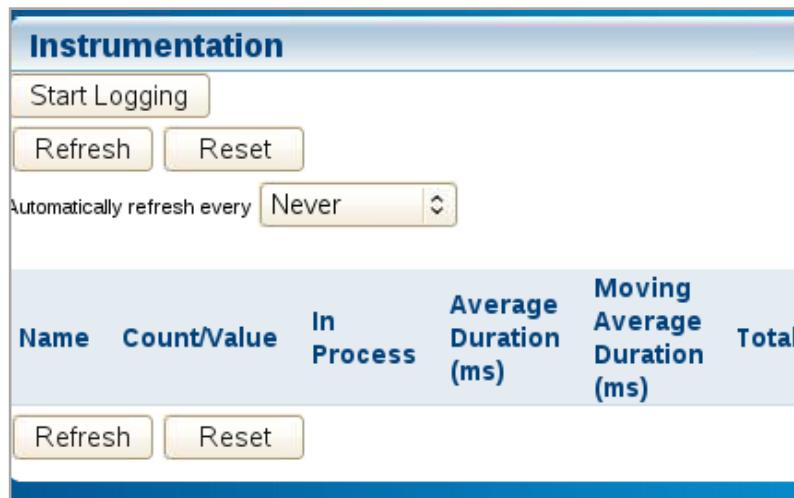
Data Transfer Errors

This displays the list of errors encountered when loading tracking data into the business performance server. You can choose to reprocess or delete any or all of the records.

Figure 4-37. Viewing Performance Data Warehouse data transfer errors

Monitor the Performance Data Warehouse

- To assess overall performance, you can view statistics (such as duration) for data transfer and other functions that run in the Performance Data Warehouse
- Use the View Instrumentation page to help identify performance bottlenecks to capture instrumentation data for further analysis



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Figure 4-38. Monitor the Performance Data Warehouse

To assess overall performance, you can view statistics (such as duration) for data transfer and other functions that are run in the Performance Data Warehouse. Use the View Instrumentation page to help identify performance bottlenecks to capture instrumentation data for further analysis.

To access the View Instrumentation page and display the most recent data:

- In the Performance Admin Console, click **View Instrumentation** and then click **Refresh**.
- To automatically refresh the displayed data, select the time interval that you want from the drop-down list.

To log instrumentation data to an external .dat file:

- In the Performance Admin Console, click **View Instrumentation**.
- Click **Start Logging**. The View Instrumentation page displays the path and file to which the data is saved.
- Click **Stop Logging** to end data capture to the log file.

Performance Data Warehouse command line tool

- To ensure that performance databases are performing optimally, use the command line tool to resolve any pending records
 - Generates an SQL script that can be used to make the appropriate database changes
 - Run the resulting SQL scripts by using the database application appropriate for your environment, or you can use the “execute” argument that is included with the command line tool

- Before you run the command:
 - Verify that the Performance Data Warehouse is installed or upgraded to the newest version of IBM Business Process Manager
 - Start the Performance Data Warehouse
 - In a clustered environment, ensure that all servers in the cluster are running
 - Create a backup of the performance database

Figure 4-39. Performance Data Warehouse command line tool

To ensure that performance databases are performing optimally, use the command line tool to resolve any pending records. When you run the command available with the tool, it generates an SQL script that you can use to make the appropriate database changes.

You can run the resulting SQL scripts by using the database application appropriate for your environment, or you can use the execute argument that is included with the command line tool.

To use the command line tool, go to the following directory:

[IBM_BPM_home] \BPM\ Lombardi\ tools\ perfdw-tool

Before running a command, complete the following tasks:

- Ensure that you installed or upgraded your Performance Data Warehouses to the newest version of IBM BPM.
- Start the Performance Data Warehouse. If you are running in a clustered environment, ensure that all servers in the cluster are running.
- Create a backup of the performance database.
- Go to the following directory: [IBM_BPM_home] \BPM\ Lombardi\ tools\ perfdw-tool

The syntax for starting the command line tool is:

```
perfDWTool [.cmd or .sh] -u [user_name] -p [password] command-name - [command-arg]  
[-groups tracking-group-name-1 tracking-group-name-2 ...]
```

Unit summary

- Describe the main components of IBM Business Process Manager Advanced
- Describe the deployment considerations for the databases
- Describe the service integration bus and messaging engine
- Describe the applications that are used to manage a clustered environment
- Describe the Performance Data Warehouse

Review questions

1. Business Process Choreographer uses which database?
 - A. BPMDB
 - B. PDWDB
 - C. CMNDB

2. True or False: Business Process Choreographer Explorer is a web browser-based client where users can work on their tasks and process administrators can administer process templates, process instances, task templates, and task instances.

3. Use the Performance Admin Console to work with which of the following items?
 - A. Records that have yet to be loaded to the database
 - B. Data transfer errors
 - C. Monitor overall performance
 - D. Business processes



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Figure 4-41. Review questions

Write your answers here:

- 1.

- 2.

- 3.

Review answers

1. Business Process Choreographer uses which database?
 - A. BPMDB
 - B. PDWDB
 - C. CMNDB

The answer is C.
2. True or False: Business Process Choreographer Explorer is a web browser-based client where users can work on their tasks and process administrators can administer process templates, process instances, task templates, and task instances.
The answer is True.
3. Use the Performance Admin Console to work with which of the following items?
 - A. Records that have yet to be loaded to the database
 - B. Data transfer errors
 - C. Monitor overall performance
 - D. Business processes

The answer is A, B, and C.



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Figure 4-42. Review answers

Unit 5. IBM Business Process Manager Advanced deployment topologies

Estimated time

01:00

Overview

This unit provides an overview of the IBM Business Process Manager Advanced deployment topologies and deployment environment creation.

How you will check your progress

- Checkpoint
- Lab exercises

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Explain the purpose of a deployment environment
- Identify and explain the clustered topologies for IBM Business Process Manager Advanced:
 - Single cluster
 - Application, Remote Messaging, and Remote Support
- Explain how to create a deployment environment by using multiple tools
- Explain how to create a deployment environment by using the BPMConfig utility
- Use the IBM Business Process Manager Advanced Configuration Editor
- Explain IBM Business Process Manager Advanced Pattern

Topics

- Overview of deployment environment topologies
- Process Federation Server
- Advanced messaging concepts
- Single cluster topology
- Application, Remote Messaging, and Remote Support topology
- Creating a deployment environment by using multiple tools
- Creating a deployment environment by using the BPMConfig utility
- IBM BPM patterns

5.1. Overview of deployment environment topologies

Overview of deployment environment topologies

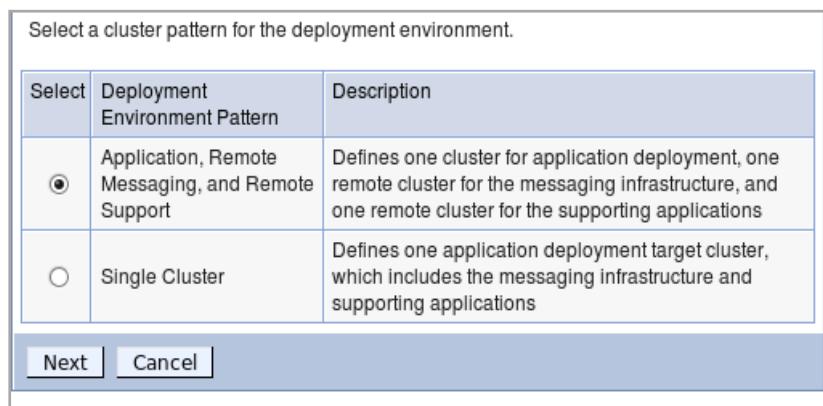
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Figure 5-3. Overview of deployment environment topologies

Deployment environment patterns

- A topology is the physical layout of the deployment environment that is required to meet your business needs for capacity, availability, and scalability
 - A network deployment environment can have many topologies
 - Can be created from several standard topology patterns
- Two IBM-supplied patterns from which to choose



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Figure 5-4. Deployment environment patterns

A deployment environment topology pattern specifies the constraints and requirements of the components and resources that are involved in a deployment environment. There are IBM-supplied topology patterns for each topology layout. These topology patterns provide rules and guidelines for component interaction that are characteristic of the most commonly used IBM BPM topology patterns. The IBM-supplied topology patterns are based on well-known and tested configuration scenarios. They contain a repeatable and automated method of creating a deployment environment.

Selecting a topology

- Selecting a topology depends on a number of factors, including:
 - Available hardware resources and operating system
 - Types of business processes that you plan to implement
 - Resource requirements and constraints
 - Scalability requirements
 - Administrative effort that is involved
 - Proof-of-concept (POC), testing, demonstration, or a fully functional production environment
- Consider the advantages and disadvantages of each topology pattern
 - Application, Remote Messaging, and Remote Support is the preferred pattern for IBM Business Process Manager Advanced
- The design characteristics of each topology are captured as *topology patterns* that are supplied as configuration templates with the product

Figure 5-5. Selecting a topology

A topology is the physical layout of the deployment environment. You can create the topology that best addresses your business needs by choosing an IBM provided pattern or by creating your own customized pattern.

Selecting an appropriate topology for your deployment environment depends upon several factors. When you select a topology pattern, consider these factors:

- Available hardware resources
- Application invocation patterns
- Types of business processes that you plan to implement (interruptible versus non-interruptible)
- Individual scalability requirements
- Administrative effort that is involved

The IBM-supplied topologies can be applied to both Process Server and Process Center topologies. Therefore, Process Center and Process Server network deployment environments can be organized in a similar way.

The procedures for creating environments for Process Server and Process Center that are based on IBM-supplied topologies are also similar. The only difference that is related to IBM-supplied

patterns is the suggested patterns for a production environment, and the components that are configured on the clusters for those patterns.

Deployment environment requirements

- For a network deployment environment, you need the following required databases:
 - The Common database (CMNDB)
 - The Process database (BPMDB)
 - The Performance Data Warehouse database (PDWDB)
- Understanding the function that each cluster can provide in an IBM-supplied topology pattern
- The number of clusters in your deployment environment depends on the topology pattern that you are using
 - Application deployment target
 - Support infrastructure
 - Messaging engine infrastructure
- A deployment environment administrative user (DeAdmin)

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Figure 5-6. Deployment environment requirements

Before you plan your deployment environment, finish the following tasks:

- Choose a database type
- Identify available resources
- Identify necessary security authorizations

Application deployment target: An application deployment target is the set of servers (cluster) to which you install your applications (for example, human tasks, business processes, and mediations). Depending on which deployment environment topology pattern you choose, the application deployment target might also provide messaging infrastructure and supporting infrastructure functions. Select the appropriate product, which depends on the type of applications that you intend to deploy. If the applications contain human task or business process artifacts, install an Advanced Process Server or Advanced Process Center, and then create an Advanced Process Server, Advanced Process Center, or Advanced-only Process Server patterned deployment environment. In a Single Cluster topology pattern, the application deployment target provides the entire functions of the deployment environment.

Supporting infrastructure: The supporting infrastructure includes several services. These services include business rules, selectors, human tasks, and business processes. The business rules are not tied to the supporting infrastructure cluster. In fact, business rules can exist and work

everywhere in the cell. The business rules administrative function (completed from the Business Rules Manager) can be deployed on the supporting infrastructure cluster (in a three-cluster configuration). The same principle applies to the human tasks and business processes. The human tasks and business processes run on the application deployment target cluster because that is where the human task and business process containers are configured. However, you administer processes and tasks from the Business Process Choreographer Explorer, which can run on the supporting infrastructure cluster (in a three-cluster configuration).

Messaging engine infrastructure: The messaging infrastructure is the set of servers (cluster) where the messaging engines are located. The messaging infrastructure is used to provide asynchronous messaging support for your applications and for the internal messaging needs of the IBM Business Process Manager components. The messaging engines facilitate communication among the nodes in the deployment environment.

Deployment environment types (1 of 2)

- After product installation, you can create a network deployment configuration that is based on the topology pattern templates that are packaged with the software
- The following template types are included:
 - Advanced Process Center deployment environment
 - Standard Process Center deployment environment
 - Advanced Process Server deployment environment
 - Standard Process Server deployment environment
 - Advanced-only Process Server deployment environment
- There are various methods to create deployment environments
 - Multiple tools to create profiles and deployment environment
 - BPMConfig command

Figure 5-7. Deployment environment types (1 of 2)

Setting up a network deployment environment involves many decisions, such as the number of physical workstations and the type of pattern you choose. Each decision affects how you set up your deployment environment. When you plan the layout of interconnected servers, you must make decisions. These decisions influence trade-offs that you make between the available hardware and physical connections, the complexity of the management and configuration, and requirements such as performance, availability, scalability, isolation, security, and stability.

You can configure a standardized network deployment environment that is based on a topology pattern template included with the software, and you can implement it using the BPMConfig command or the Deployment Environment wizard.

Deployment environment types (2 of 2)

- Advanced Process Center deployment environment
 - Run and administer process applications and toolkits that are developed in Process Designer and Integration Designer
- Standard Process Center deployment environment
 - Run and administer process applications and toolkits that are developed in Process Designer
- Advanced Process Server deployment environment
 - Run processes, services, and modules that are deployed from Process Center
- Standard Process Server deployment environment
 - Run processes that are deployed from Process Center
- Advanced-only Process Server deployment environment
 - Run SCA modules that are created in Integration Designer

- Multiple deployment environments per cell are supported
 - For Process Server deployment environments only

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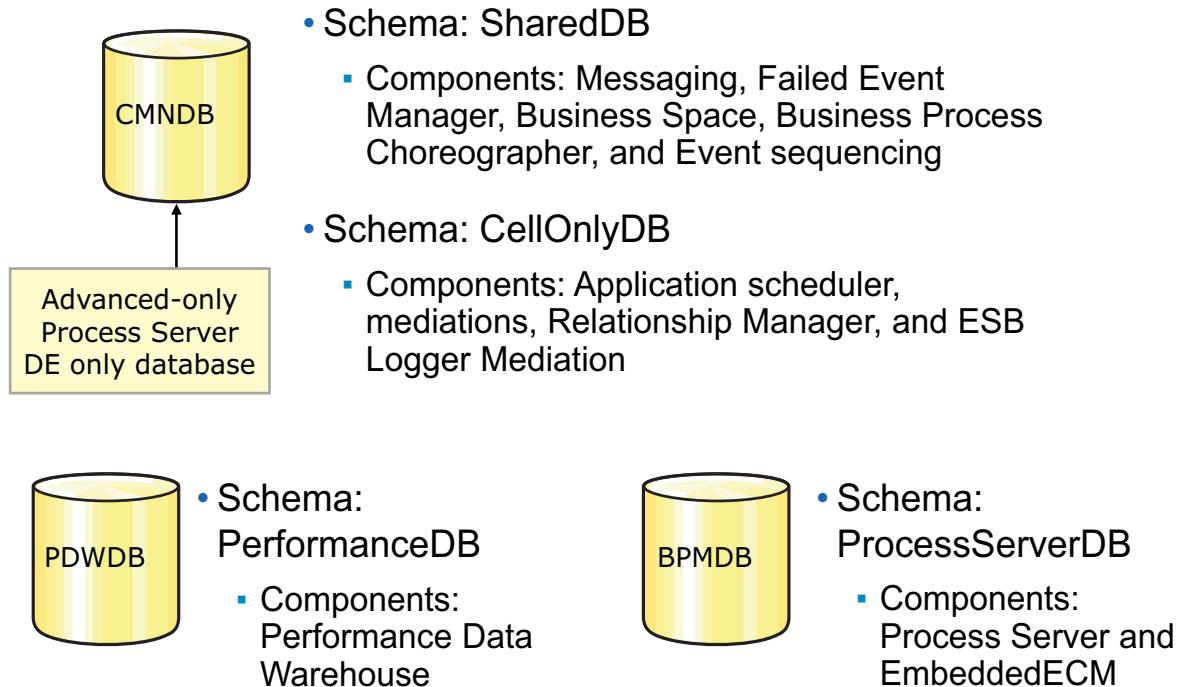
Figure 5-8. Deployment environment types (2 of 2)

The following options are available based on your installation.

For IBM Business Process Manager Advanced:

- **Advanced Process Center:** For storing, testing, and administering process applications and toolkits that are authored in Process Designer and Integration Designer.
- **Advanced Process Server:** For running processes, services, and modules that are contained in process applications that are deployed from the Advanced Process Center, or for running SCA modules that are deployed directly.
- **Standard Process Center:** For storing, testing, and administering process applications and toolkits that are authored in Process Designer.
- **Standard Process Server:** For running processes and services that are contained in process applications that are deployed from the Standard Process Center.
- **Advanced-only Process Server:** For running SCA modules only. You deploy these modules from the command line or the administrative console. This server is the IBM Business Process Manager equivalent of IBM WebSphere Process Server.

Required databases for a topology



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Figure 5-9. Required databases for a topology

The Process Server and Performance Data Warehouse components do not support case-sensitive databases. These databases must *not* be case-sensitive.

For Microsoft SQL Server and Oracle databases, the following restrictions apply:

- For Microsoft SQL Server databases, components other than Process Server or Performance Data Warehouse require that their databases be case-sensitive.
- For Oracle databases, the Process Server, Performance Data Warehouse, and Common database components must use a separate schema or user. They can use the same instance.

5.2. Process Federation Server

Process Federation Server

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Figure 5-10. Process Federation Server

IBM Process Federation Server

- Optional component for IBM Business Process Manager Standard and Advanced environments
- Creates a single point of access for the user task list and launch list, regardless of the backend system on which the process artifacts are stored
- Aggregates both BPD and BPEL-related tasks from:
 - Multiple servers
 - Multiple different versions of IBM Business Process Manager
 - Multiple versions of a process
- Allows the organization to phase out process applications that are running on previous versions, while new instances of the process run on the newest server and newest release of IBM Business Process Manager

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Figure 5-11. IBM Process Federation Server

IBM Process Federation Server is an optional component for IBM Business Process Manager environments. Install this component to create a federated process environment that provides business users with a single point of access to their task list and launch list, regardless of the type of process that they are working on and the IBM Business Process Manager backend system on which the process artifacts are stored.

Consider installing Process Federation Server in the following situations:

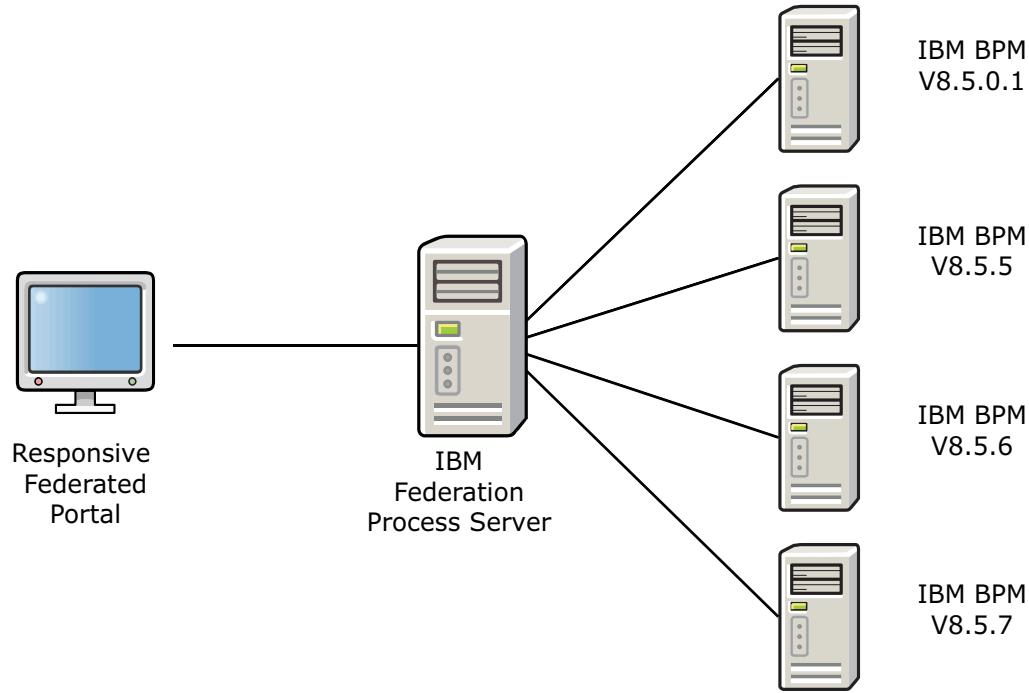
- Your process applications are deployed on different IBM Business Process Manager deployment environments. Your users must log on to several different Process Portals to get their work done.
- Your users work with both BPD-related and BPEL-related processes and tasks.
- Your IBM Business Process Manager environment contains multiple versions of IBM Business Process Manager that each runs a different version of the same process application. Your users need to work with the older versions of the process applications while process instances are still running, which means that they need to log on to the Process Portal application that runs on the associated version of IBM Business Process Manager.

Process Federation Server aggregates both BPD and BPEL-related tasks from all the IBM Business Process Manager backend systems, including systems that run previous versions of IBM

Business Process Manager that are supported by Process Federation Server. You can take advantage of this support to gradually phase out process applications that are still running on previous versions, while new versions of the process applications run on the latest release of IBM Business Process Manager.

You can install, configure, and enable Process Federation Server in environments that are run either IBM Business Process Manager Standard or IBM Business Process Manager Advanced.

Typical IBM Federated Process Server topology



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Figure 5-12. Typical IBM Federated Process Server topology

The following figure shows an overview of a federated environment and how Process Federation Server provides a single point of access to business users for all their tasks regardless of the IBM Business Process Manager system on which the tasks reside.

Responsive Federated Portal is a new sample coach-based portal that you can use as a starting point for creating and extending your own portals. It is available as a technology demonstration from IBM Bluemix DevOps Services. You can configure Responsive Federated Portal to work on a single system by using the BPD-related REST APIs that are provided with IBM Business Process Manager Standard. For federated environments, configure Responsive Federated Portal to use the REST APIs that are provided with Process Federation Server.



Important

Because Process Portal does not use federated APIs, you can use it only on single IBM Business Process Manager systems.

5.3. Advanced messaging concepts

Advanced messaging concepts

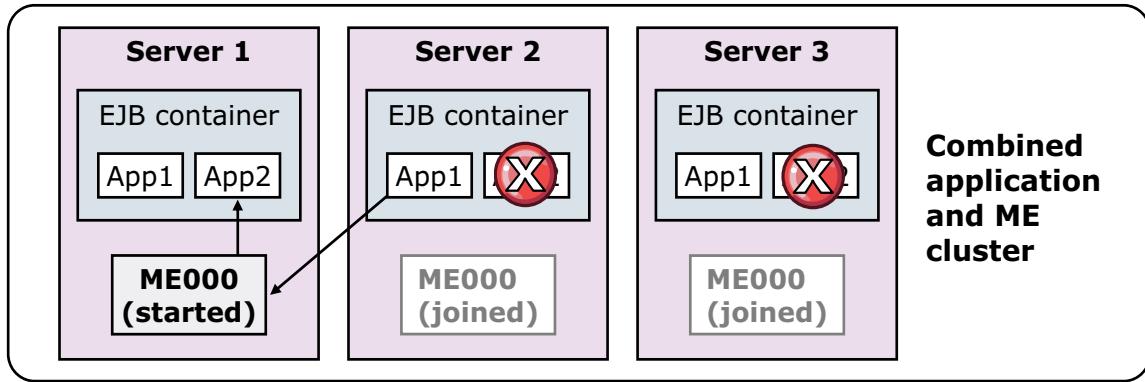
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Figure 5-13. Advanced messaging concepts

Applications and MEs in the same cluster

- Combined application and ME clusters do not allow for load balancing
 - App1 interacts with App2 asynchronously
 - App1 writes message to the ME that is on Server 1 to call App2
 - According to the default, a local consumer is called
- HA messaging engine, applications
 No scalability (App2 never runs on Server 2 and Server 3)
 No workload balancing, workload is transferred onto Server 1



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Figure 5-14. Applications and MEs in the same cluster

The first situation is a combined application and messaging engine cluster. In other words, the application and ME run within the same cluster member. Only one ME is active for the entire cluster. This setup leads to an unbalanced situation for the cluster in case of asynchronous communication between applications.

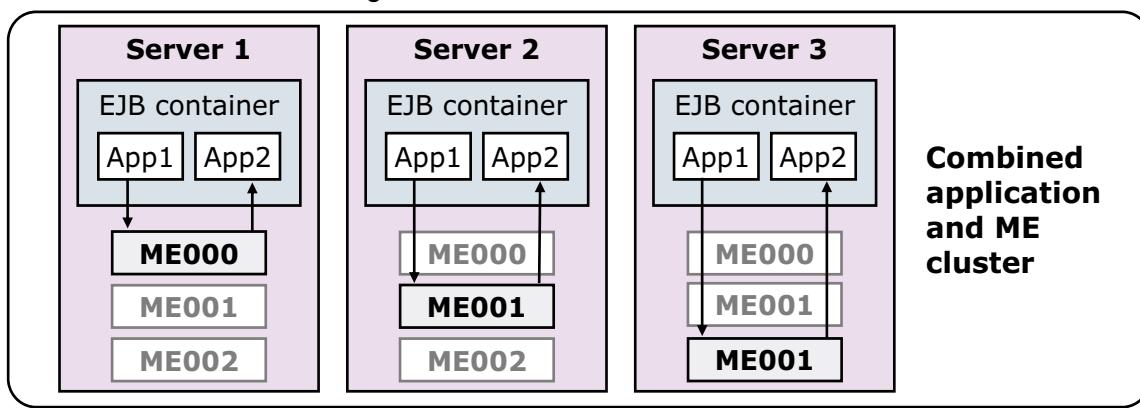
Details on the slide include:

- App1, which is running on cluster member Server 2, communicates asynchronously with App2.
- The only active ME is on Server 1, so App1 writes a message to a queue that is on Server 1 to call App2.
- By default, a local consumer is always called, so App2 is called on cluster member Server 1.

Thus, App2 never runs on cluster member Server 2 or Server 3, and most of the workload is transferred onto Server 1.

Scalability solution

- More active MEs (Server 2 and Server 3) create partitioned queues
 - App1 interacts with App2 asynchronously
 - App1 writes to ME on local server to call App2
 - According to the default, a local consumer is called
 - HA messaging engine
 - ME scalability
 - Application scalability
 - Lost message order
 - Possible stranded messages



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Figure 5-15. Scalability solution

The first solution to this problem is:

- Add active messaging engines (one for each cluster member), thus creating a topology with partitioned queues.

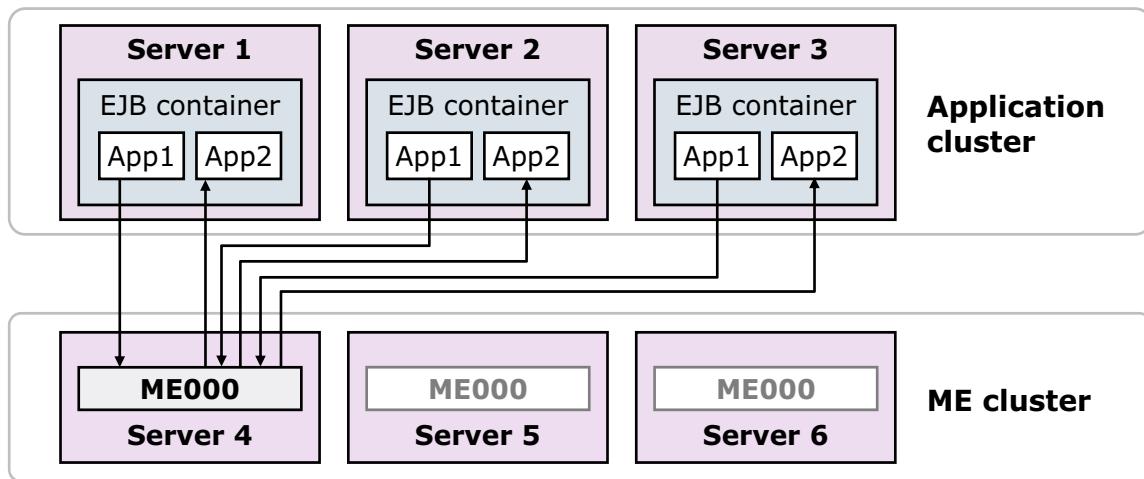
This topology provides high availability for applications and messaging engines and allows scalability. Because the application prefers the local ME on each cluster member, App1 does not call App2 on another cluster member. For cases in which the scalability limit of a cluster member is reached, another member might be added. As you already saw on previous slides, this solution (partitioned queues) requires administration effort because more MEs and policies must be created and maintained manually.

Within a clustered environment, multiple messaging engines can be created to share any workload that is associated with queue destinations that are deployed to the cluster.

If there is only one messaging engine in the cluster, the destination is local to that messaging engine. This topology has the advantage of being highly available. To achieve scalability, more MEs can be added manually. If there is more than one messaging engine in the cluster, the destination is partitioned across all messaging engines in the cluster. Each messaging engine deals with a subset of the messages that the destination handles. The availability characteristics of a partition are the same as the characteristics of the messaging engine through which it is localized.

High availability solution

- Create dedicated clusters for applications and MEs
 - App1 interacts with App2 asynchronously
 - App1 writes message to the ME that is on Server4 to call App2
 - HA messaging engine, applications
 - Application scalability (App2 runs on each member)
 - Limited ME scalability (within Server 4 capabilities)



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Figure 5-16. High availability solution

Solution two is as follows:

- Split the application and messaging engine into two dedicated clusters.
- The application cluster is not a bus member (only the ME cluster is a bus member).

This topology provides HA for applications and messaging engines, and allows for application scalability. The asynchronous calls of App1 can reach App2 on each cluster member. The messaging resources are located by using JNDI (Java Naming and Directory Interface) names.

There is limited scalability for this solution because it depends on the capabilities of the Server 4 system.

Applications and MEs with partitioned queues in separate clusters (1 of 2)

- Separate application and ME clusters might result in unprocessed messages
 - App1 interacts with App2 asynchronously
 - Message is put on ME000 by App 1
 - App2 does not receive from ME000

HA messaging engine, applications

Application and ME scalability

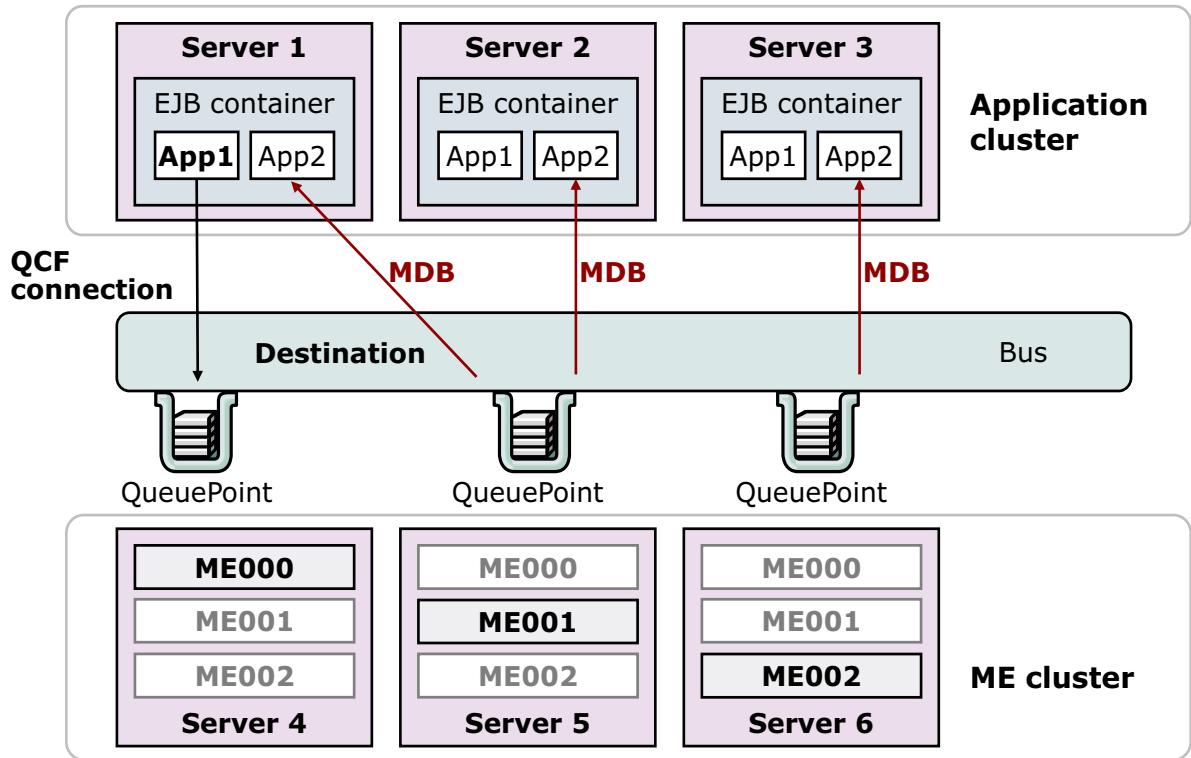
“Unprocessed message situation”

Figure 5-17. Applications and MEs with partitioned queues in separate clusters (1 of 2)

This topology provides application and messaging engine scalability. However, the main drawback is the possibility of unprocessed messages, which cause applications to hang.

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Applications and MEs with partitioned queues in separate clusters (2 of 2)



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Figure 5-18. Applications and MEs with partitioned queues in separate clusters (2 of 2)

The reason for the behavior of the components that are involved in messaging include:

- App1 communicates asynchronously with App2.
- Depending on the queue connection that is established at run time, the message is stored in one of the available MEs (in the sample, it is stored in ME000).
- Message-driven beans (MDB) are responsible for delivering the message to App2.
- Depending on the established binding of the MDB, only messages in the dedicated ME can be processed.
- If this binding is not established to the ME on which App1 puts the message, the message remains unprocessed in ME000.

5.4. Single cluster topology

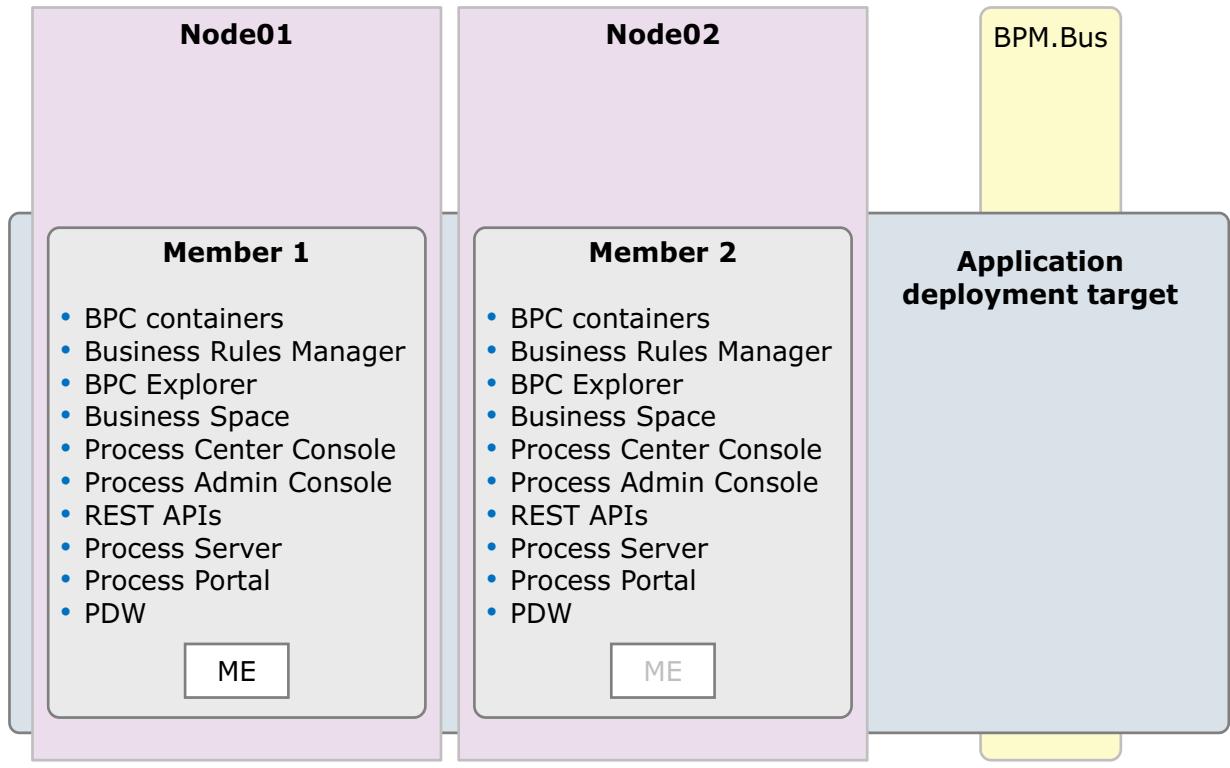
Single cluster topology

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Figure 5-19. Single cluster topology

Single cluster topology (1 of 2)



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Figure 5-20. Single cluster topology (1 of 2)

Use this legend to identify components in each topology:

- BPC: Business Process Choreographer
- PC: Process Center
- BRM: Business Rules Manager
- PDW: Process Data Warehouse

Typically, this topology is used for testing, proofs of concept, and demonstration environments.

Note the following aspects of this example:

- All of the components are configured in a single cluster.

The application deployment target cluster is a member of the IBM BPM bus. The Business Process Choreographer is configured in the cluster, so each cluster member has a business process container and a human task container. All of the supporting infrastructure applications are configured in the cluster: the Business Process Choreographer Explorer, the Business Process Choreographer reporting function, the Business Rules Manager, the Common Event Infrastructure, and Business Space. Each cluster member is an application deployment target. Cluster member 1 has the active messaging engine. Cluster member 2 has a joined messaging engine.

The behavior of the messaging engines in a single cluster topology is different from the behavior that occurs when the messaging engines are in a remote cluster. When the messaging engines and the applications are collocated, the default behavior is for message producers and consumers to always use a local active messaging engine if one is available. For example, there might be a situation in which two applications that communicate asynchronously are deployed to each cluster member. After each message producer places messages in the queues, the message consumer on the computer where the engine is local always consumes all of the messages that are produced. Thus, the consuming application processes messages on only one server, which is the server with the local messaging engine.

Read and write local also creates a unique set of issues if you attempt to partition the destinations. When you create more than one active set of messaging engines, partitioning results, and the active messaging engines of each server contain a portion of the queues that are assigned to that engine. Thus, you can attain more throughput if there are active messaging engines on each server. However, this configuration can create issues for your applications.

If you partition destinations when the applications and messaging engines are in the same cluster, you no longer can maintain message order. In addition, partitioned destinations can create unpredictable behavior if one or more messaging engines fail in a single cluster topology. If you are prepared to endure possible unpredictable behavior and the loss of message order, partitioning the destinations in a single cluster topology might be acceptable. However, this configuration is discouraged.

Single cluster topology (2 of 2)

- The cell consists of:
 - One deployment manager node
 - One or multiple nodes
 - One or multiple servers per node
 - One cluster
- The deployment manager node runs:
 - The administrative console, the Relationship Manager, and the Failed Event Manager
- All other components are in one cluster
 - The business process and human task containers
 - The Business Process Choreographer Explorer, Business Rules Manager, and Business Space
 - The Process Center, Process Admin, Process Portal, and Performance Admin Consoles
 - The messaging engine
 - The Performance Data Warehouse and Process Server

Figure 5-21. Single cluster topology (2 of 2)

In a Single Cluster topology pattern, all deployment environment functions and components are run on a single cluster.

Decision criteria

- Advantages:
 - Can run on limited hardware (fewer computers)
 - Easier to set up and administer
 - Scalability is easy: add new cluster members or new nodes
 - Requires more hardware resources, but less than a full Remote Messaging and Remote Support topology
- Disadvantages:
 - Memory requirements are much greater
 - Performance tuning is much more critical
 - Extensive use of the messaging infrastructure interferes with application processing as they are in the same cluster
 - Infrastructure components cannot be scaled independently; components are scaled at the same rate
 - Adding a cluster member adds capability to every component

Figure 5-22. Decision criteria

From an administrative and scalability perspective, the Single Cluster topology pattern has advantages. A single cluster, where each member runs all the IBM Business Process Manager components, is simpler to administer. Instead of several server instances in multiple clusters, you have a single cluster with fewer members. If the needs of your environment grow, scaling the infrastructure is a simple matter of adding more nodes and cluster members. Thus, the process of adding capability is simple, but all components are scaled at the same rate. For example, each additional cluster member adds component processing whether you need it or not. If the messaging engines that are spread across server members use policies, there might be some additional administrative effort in creating and maintaining the policies.

5.5. Application, Remote Messaging, and Remote Support topology

Application, Remote Messaging, and Remote Support topology

IBM Business Process Manager Advanced deployment topologies

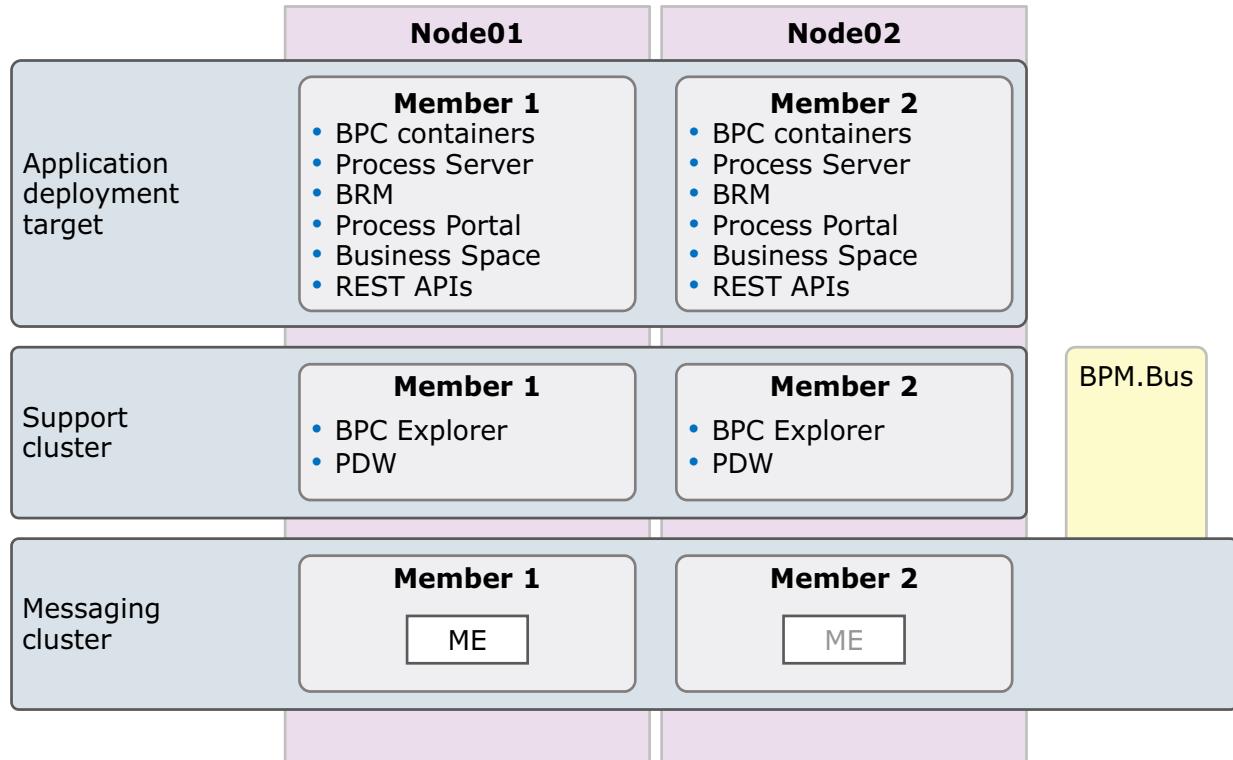
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Figure 5-23. Application, Remote Messaging, and Remote Support topology

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Application, Remote Messaging, and Remote Support topology (1 of 2)



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Figure 5-24. Application, Remote Messaging, and Remote Support topology (1 of 2)

The Application, Remote Messaging, and Remote Support topology pattern is a topology for production environments. This topology provides three separate clusters:

- A remote messaging cluster
- A remote support cluster
- An application deployment target cluster

Note the following aspects of this example:

- All of the applications are deployed to the application deployment target cluster.
- The Business Process Choreographer is configured in the application deployment target cluster so each cluster member has a business process container and a human task container.
- The messaging cluster is a member of the required IBM BPM bus.
- Supporting infrastructure applications are configured in the support cluster: the Business Process Choreographer Explorer and Performance Data Warehouse.

The behavior of the messaging engines in an Application, Remote Messaging, and Remote Support topology is different from the behavior that occurs when the messaging engines are collocated with the applications. Because the messaging engines are in a remote cluster, there is no preference for the message producers and consumers as to using a local messaging engine.

Each member of the application deployment target cluster connects to the appropriate bus and uses the remote messaging engine for that bus.

This behavior creates issues if you attempt to partition the destinations in the remote messaging cluster. When you create more than one active set of messaging engines, partitioning results. The active messaging engines of each server contain a portion of the queues that are assigned to that engine. Thus, you can attain more throughput if there are active messaging engines on each member of the messaging cluster. However, this configuration can create issues for your applications. If you partition destinations when the application and messaging engines are in separate clusters, you no longer can maintain message order. Any time you partition destinations, you lose message order.

In addition, partitioned destinations can create other issues when the messaging engines are remote. By default, you have no control over which active messaging engine your applications use at run time. This behavior can create situations in which two applications on the same server attach to two different messaging engines. If one application produces messages for one engine, and the message consumer is using a different engine, then stranded messages can result. Thus, partitioned destinations are discouraged in a remote messaging and remote support scenario.

Application, Remote Messaging, and Remote Support topology (2 of 2)

- The cell consists of:
 - One deployment manager node
 - One or multiple Process Server nodes
 - One or multiple servers per node
 - Three clusters
- Three clusters include:
 - A messaging engine cluster
 - A support cluster with the Business Process Choreographer Explorer and Performance Data Warehouse
 - An application cluster with the business process container and the human task container, Process Server, Business Rules manager, Process Portal, and REST API Services
- The deployment manager node runs
 - The administrative console, the Relationship Manager, and the Failed Event Manager

Figure 5-25. Application, Remote Messaging, and Remote Support topology (2 of 2)

The Application, Remote Messaging, and Remote Support topology pattern provides an ideal environment for long-running business processes, state machines, human tasks, and asynchronous interactions (including JMS and MQ/JMS bindings).

Because the application deployment target cluster runs your business integration applications only, performance tuning and diagnostic messages are much simpler than in the topology patterns where the application target cluster has extra responsibilities. The Application, Remote Messaging, and Remote Support topology pattern is also ideal for environments that make extensive use of monitoring and auditing (including environments with IBM Business Monitor).

Decision criteria

- Advantages
 - Ideal from a performance perspective as each component can be tuned independently
 - Each component can be scaled independently
 - Good topology for long-running processes, human tasks
 - Independent messaging cluster allows extensive use of asynchronous communication
 - Independent support cluster
- Disadvantages
 - Three clusters, many nodes, many servers
 - Must performance tune all clusters
 - Scalability of messaging is still limited
 - Multiple active messaging engines are not supported
- You must also configure a routing server to ensure that requests that are intended for Process Portal are directed to the correct cluster

Figure 5-26. Decision criteria

For large computing infrastructures, the Application, Remote Messaging, and Remote Support topology pattern is the preferred environment. The hardware requirements for distributed platforms are more intensive. However, you have greater flexibility in adjusting and tuning memory usage for the Java virtual machines (JVMs) when you have three or more clusters with multiple members that do specific functions.

When you create three clusters, each with specific functions and applications, you add another administrative burden. As you add clusters and cluster members, your performance tuning plan and the troubleshooting burden can expand greatly. Spreading messaging engines across the members of the messaging cluster also adds to the administrative burden associated with creating and maintaining policies.

From a scalability standpoint, the Application, Remote Messaging, and Remote Support topology pattern provides the most flexibility. Because each of the distinct functions within IBM Business Process Manager is divided among the three clusters, you can pinpoint performance bottlenecks and adjust the cluster size fairly easily. If you need more processing capability for your business processes or human tasks, you can add more nodes and members to the application target cluster. Because expanding the messaging infrastructure beyond three cluster members has no effect on processing capability, the scalability limitations of the Application, Remote Messaging, and Remote Support topology pattern apply.

5.6. Creating a deployment environment by using multiple tools

Creating a deployment environment by using multiple tools

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Figure 5-27. Creating a deployment environment by using multiple tools

Configuring by using multiple tools

- You can use multiple tools to configure the profiles and the deployment environment
- Profiles must be created first by using multiple tools
 - Profile Management Tool
 - The `manageprofiles` command line utility
- The deployment environment is created by using the Deployment Environment wizard in the administrative console
- Databases must be created before you run the Deployment Environment wizard
 - The database administrator can create tables beforehand, or the Deployment Environment wizard creates the tables during configuration

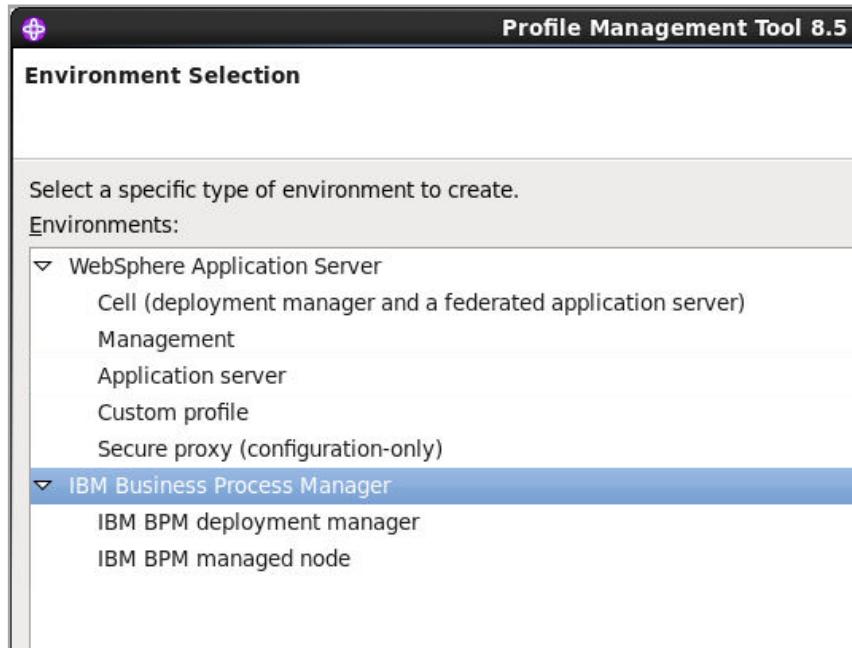
Figure 5-28. Configuring by using multiple tools

You can use multiple tools to configure the profiles and the network deployment environment. You can use the `manageprofiles` command line utility or the Profile Management Tool to create or augment the network deployment profiles, and the Deployment Environment wizard to create the network deployment environment.

When you use the Deployment Environment wizard to create a three-cluster deployment environment, the process might take more time to complete. In that case, you can do one of the following steps to create the three-cluster environment:

- Use the Deployment Manager to increase the transaction timeout value, and re-create the deployment environment.
- Do not create tables during the deployment environment creation. After creating the environment, create the databases, tables, and then run the bootstrap command.

Creating profiles by using the Profile Management Tool



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Figure 5-29. Creating profiles by using the Profile Management Tool

After you install the product, you must create or augment a deployment manager and one or more managed node profiles to define the runtime environment.

Creating a deployment environment (1 of 10)

- Deployment environments are a simplified means to configure a clustered environment
- Templates help you to set up clusters
- A wizard is available from the administrative console of the deployment manager

The screenshot shows the 'Integrated Solutions Console' interface with the title bar 'Welcome bpmadmin'. The left sidebar has a 'View' dropdown set to 'All tasks' and sections for 'Welcome', 'Guided Activities', 'Servers' (with sub-options 'New server', 'Server Types', 'Clusters', 'Deployment Environments'), 'DataPower', and 'Core Groups'. The main content area is titled 'Deployment Environments' with the sub-instruction 'Select the deployment environments to manage. You can manage deployment environment that are created using patterns.' It includes 'Start', 'Stop', and 'New...' buttons, and a toolbar with icons for search, refresh, and sorting. A table lists one deployment environment:

Select	Status	Deployment Environment Name	Features	Pattern	Description
<input type="checkbox"/>		PCenter_DE	IBM BPM Advanced Process Center	Single Cluster	

Total 1

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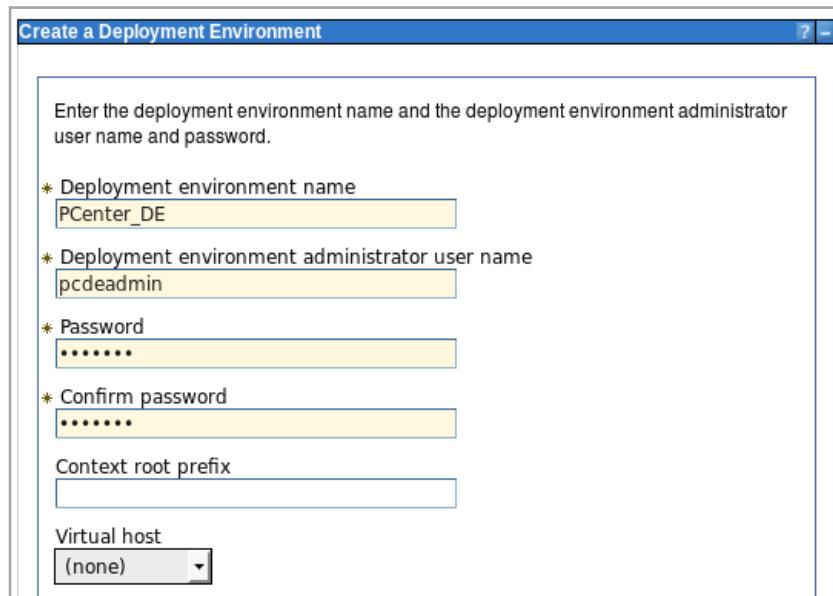
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Figure 5-30. Creating a deployment environment (1 of 10)

Deployment environments are an easy way to set up a clustered environment. There are templates to help you to set up clusters. From the administrative console, a wizard supports the process of creating a deployment environment. The figure shows an empty list of deployment environments after creating a profile for deployment manager and federating a node into the cell.

Creating a deployment environment (2 of 10)

- Define the deployment environment name and administrator user name



Create a Deployment Environment

Enter the deployment environment name and the deployment environment administrator user name and password.

* Deployment environment name
PCenter_DE

* Deployment environment administrator user name
pcdeadmin

* Password

* Confirm password

Context root prefix

Virtual host
(none)

Figure 5-31. Creating a deployment environment (2 of 10)

Deployment environments can be exported and imported where you can configure identical topologies; for example, for preproduction and production.

Creating a deployment environment (3 of 10)

- Select the type of environment that you intend to build

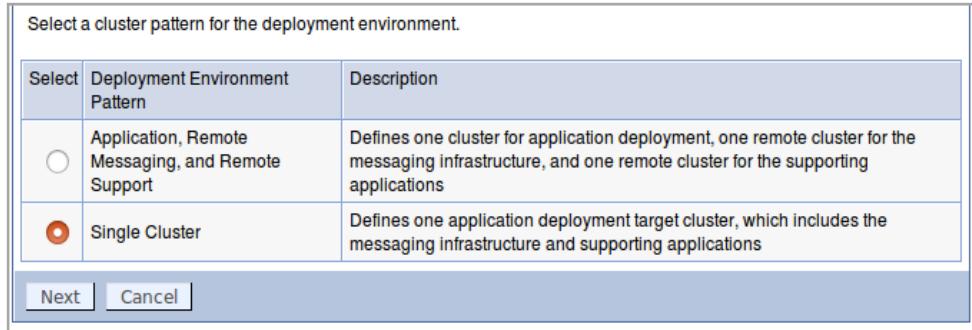
Select	IBM BPM Deployment Environment Type	Description
<input type="radio"/>	Standard Process Center	Store, test, and administer process applications and toolkits that are authored in Process Designer.
<input type="radio"/>	Standard Process Server	Run processes and services in process applications that are deployed from the Standard Process Center.
<input checked="" type="radio"/>	Advanced Process Center	Store, test, and administer process applications and toolkits that are authored in IBM Process Designer and IBM Integration Designer.
<input type="radio"/>	Advanced Process Server	Run processes, services, and SCA modules in process applications that are deployed from the Advanced Process Center, or run modules that are deployed directly.
<input type="radio"/>	Advanced-only Process Server	Run SCA modules only. You deploy these modules from the command line or the WebSphere administrative console. This server is the IBM BPM equivalent of IBM WebSphere Process Server.

Figure 5-32. Creating a deployment environment (3 of 10)

To begin building the deployment environment, select the type of environment that you intend to build.

Creating a deployment environment (4 of 10)

- Select a template to define the clusters in the environment and how functions are distributed across those clusters



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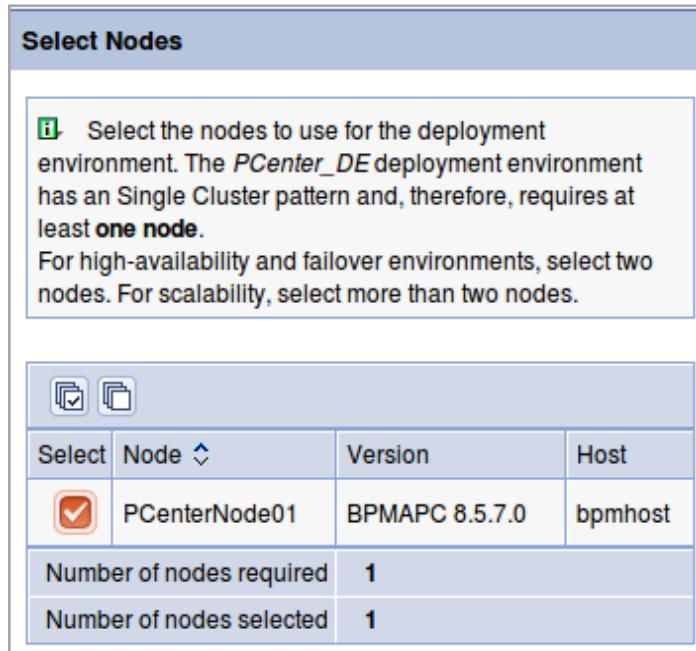
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Figure 5-33. Creating a deployment environment (4 of 10)

Select the deployment environment pattern template. Templates define the number of clusters in your environment and how functions are distributed across those clusters.

Creating a deployment environment (5 of 10)

- Add nodes to participate in the deployment environment



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Figure 5-34. Creating a deployment environment (5 of 10)

Add nodes to participate in the deployment environment. In this example, a single node was federated into the cell, hence there is only one node to select. However, if you have just a single node, it is a good practice to build a managed cell with a deployment manager and multiple clusters. Following this practice, you can increase the capacity of the cell.

Creating a deployment environment (6 of 10)

- Specify number of servers per cluster to create on the individual nodes

Define Clusters

Map each cluster to the listed nodes by indicating the number of cluster members per node.

Node	Version	Application Deployment Target
PCenterNode01	BPMAPC 8.5.7.0	<input type="text" value="1"/>

Figure 5-35. Creating a deployment environment (6 of 10)

You can specify the number of servers per cluster to create on the individual nodes. By default, one cluster member is assigned on each node for each function. You change the number by entering the number in each column.

Creating a deployment environment (7 of 10)

- Specify a name for each cluster, cluster member, and starting port

Customize Cluster Name and Ports

Customize a cluster and its cluster members by entering names or port numbers. Starting ports in the have a difference of at least 20 between their port numbers.

Application Cluster

* Cluster Name
PCenter_DE.AppCluster

Node Name	Cluster Member Name	Starting Port
PCenterNode01	PCenter_DE.AppCluster.member1	

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Figure 5-36. Creating a deployment environment (7 of 10)

On the Customize Cluster Name and Ports page, customize the cluster names or cluster member names for the cluster type. You can use the default values provided, or customize the cluster details, and click **Next**.

You can specify the starting port for the cluster members. The system generates default values for cluster member names and the starting port. Ensure that the starting port numbers that you specify are at least 20 ports apart. Port numbers are reserved and assigned to each node for the cluster members by using the port number that is specified. If you specify an initial port when you create the deployment environment, that same initial port that is specified would be assigned to the cluster member. For example, if the port number for the first cluster member is 2000, it would use the port numbers 2000, 2001, 2002, and so forth. The port number of the second cluster member would be 2020 and the port numbers would be 2020, 2021, 2022, and so forth. The port number of the third cluster member would be 2040.

Creating a deployment environment (8 of 10)

- Specify configuration settings for the Process Server
 - Only for Process Server environment type configurations

Configure Process Server

Configure the Process Server properties.

Process Server

* Environment name:

Environment type:

Process Center Connection Information

Use server offline

* Protocol:

Host name or virtual host in a load-balanced environment:

Port:

User name:

Password:

Confirm password:

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Figure 5-37. Creating a deployment environment (8 of 10)

This pane is available only for configuring a Process Server deployment environment.

Creating a deployment environment (9 of 10)

Configure Databases

Edit the database parameters for the data sources that are used by this deployment environment.

* Select provider: DB2

Shared parameters:

* User name: db2inst1	* Password: XXXXXXXX	* Confirm password: XXXXXXXX
* Server: bpmhost	* Port: 50000	<input checked="" type="checkbox"/> Create Tables

Databases:

- Cell database: PCCMNDB
- Common database: PCCMNDB
- Process database: PCBPMDB
- Performance Data Warehouse database: PCPDWDB

- Databases must exist
- The wizard can create the tables during configuration, or a database administrator can manually create the tables
 - If manual table creation, you must load the database with system information after you create the deployment environment

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Figure 5-38. Creating a deployment environment (9 of 10)

On this page, define the following database information for the components that are included in this deployment environment. Where possible, the wizard supplies default information for the parameters, but change those values to match the values that you defined when you planned the environment. The database that is specified in this pane must exist. Deployment environment configuration never creates a database.

The parameters include the following options:

- **User name:** Type the user name to connect to the database.
- **Password:** Type the password for the user name.
- **Confirm password:** Type to confirm the password for the user name.
- **Server:** Type a server name where the database is located.
- **Port:** Type the port number to connect to the database.
- **Create Tables:** Select to create the required tables.

You can clear the **Create Tables** check box if you want to create the tables manually instead of having the configuration wizard create the tables automatically. The scripts to create tables are generated in the `BPM_Install/profiles/DmgrProfile/dbscripts/` directory. You can run the

scripts from the `dbscripts` folder and do not need to generate scripts by using the `BPMConfig` command.

You can edit all key parameters, such as the database name, to create tables and the data source runtime user name for the deployment environment. You can select which database to use for the particular component.

The `cellDB` option is visible only when you create the first advanced deployment environment. After the creation, every advanced deployment environment that you create shares the `cellDB` of the first environment.



Creating a deployment environment (10 of 10)

- Review the summary
- Final options
 - Export for Scripting
 - Generate Deployment Environment

	ProcessServerDB	BPMDB	DB2	bpmhost
	SharedDb	CMNDB	DB2	bpmhost
	PerformanceDB	PDWDB	DB2	bpmhost

[Previous](#) |
 [Export for Scripting](#) |
 [Generate Deployment Environment](#) |
 [Cancel](#)

- When the deployment generation is completed and saved, the deployment environment is available
- Create the tables and load the database with system information by running the `bootstrapProcessServerData` command after the deployment environment is created
 - Tables are created if you selected the Create Tables option

Figure 5-39. Creating a deployment environment (10 of 10)

Review the summary for the deployment environment settings. Be sure to scroll through the entire list since it is lengthy.

If you postponed the Process database table creation by clearing the create table option on the Database page, create the tables and load the database with system information by running the `bootstrapProcessServerData` command. The bootstrap code runs automatically if the Process database table creation is selected on the Database page wizard.

For Advanced or Advanced-only deployment environments, the deployment manager and node agents must be restarted for the cell scoped configuration to take effect. The restart is required only for the first deployment environment that you create.

5.7. Creating a deployment environment by using the BPMConfig utility

Creating a deployment environment by using the BPMConfig utility

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Figure 5-40. Creating a deployment environment by using the BPMConfig utility

BPMConfig command utility

- The `BPMConfig` command is used to create or extend a typical network deployment environment.
 - An alternative to the Deployment Environment wizard
- The `BPMConfig` command can also be used to:
 - Create the database scripts
 - Create the database tables
 - Create profiles
 - Start and stop the deployment environment
 - Validate the deployment environment configuration
- The `BPMConfig` command uses a properties file, which contains all of the values that are used in the configuration of your deployment environment
 - Sample properties files are provided for you to copy and customize to configure your own environments

Figure 5-41. *BPMConfig command utility*

The `BPMConfig` command is used to create or extend a typical network deployment environment. It can also be used to create the database scripts and profiles, start and stop the deployment environment, and validate the deployment environment configuration.

Before you process the customization definition for a deployment manager, you must ensure that the `BPMConfig` properties file contains the required IBM Business Process Manager configuration settings for the profile and databases to be created.

Sample properties files

- Begin with the sample file that most closely resembles the environment that you want to configure

```
root@bpghost:/opt/IBM/BPM/BPM/samples/config/advanced
File Edit View Search Terminal Help
[root@bpghost advanced]# ls
Advanced-PC-SingleCluster-DB2.properties
Advanced-PC-SingleCluster-DB2zOS.properties
Advanced-PC-SingleCluster-Oracle.properties
Advanced-PC-SingleCluster-SQLServer.properties
Advanced-PC-SingleCluster-SQLServer-WinAuth.properties
Advanced-PC-ThreeClusters-DB2.properties
Advanced-PC-ThreeClusters-DB2zOS.properties
Advanced-PC-ThreeClusters-Oracle.properties
Advanced-PC-ThreeClusters-SQLServer.properties
Advanced-PC-ThreeClusters-SQLServer-WinAuth.properties
Advanced-PS-SingleCluster-DB2.properties
Advanced-PS-SingleCluster-DB2zOS.properties
Advanced-PS-SingleCluster-Oracle.properties
Advanced-PS-SingleCluster-SQLServer.properties
Advanced-PS-SingleCluster-SQLServer-WinAuth.properties
Advanced-PS-ThreeClusters-DB2.properties
Advanced-PS-ThreeClusters-DB2zOS.properties
Advanced-PS-ThreeClusters-Oracle.properties
Advanced-PS-ThreeClusters-SQLServer.properties
Advanced-PS-ThreeClusters-SQLServer-WinAuth.properties
[root@bpghost advanced]#
```

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Figure 5-42. Sample properties files

The `BPMConfig` command uses a properties file to configure your environment according to the settings that you specify. Your Business Process Manager Advanced installation includes several sample configurations files that are provided as a starting point for your configuration. These sample files are composed of common properties and settings for different IBM Business Process Manager environments. Before you begin your configuration, select a sample file that most closely resembles the configuration that you want, copy the file, and customize it to suit your own environment.

Customizing the BPMConfig properties file

- The BPMConfig properties file is formed of name-value pairs of configuration settings
- The properties file provides input to the BPMConfig script
 - The script runs during the configuration process to create the deployment environment and generate database scripts for creating the required databases

```
#####
# Deployment environment basic properties.  #
#####
bpm.de.name=PServer DE
# Options: true, false If this is set false, database tables are created during deployment environment creation when
BPMConfig is run with the create de action . If set to true, the tables need to be created manually.
bpm.de.deferSchemaCreation=true
# Type of product configuration: Express, Standard, Advanced or AdvancedOnly
bpm.de.type=Advanced
# Type of deployment environment: Process Center or Process Server
bpm.de.environment=Process Server
bpm.de.psServerName=PROD-ProcessServer
# The intended purpose for this deployment environment. Options: Test, Staging, Production
bpm.de.psPurpose=Production
# Options: true, false. Set to false if the Process Server is online and can be connected to the Process Center
bpm.de.psOffline=true
# The transport protocol to access the Process Center specified above. Options: http or https.
bpm.de.psProcessCenterTransportProtocol=http
# The host name of the Process Center specified above.
bpm.de.psProcessCenterHostname=
# The port number for the Process Center specified above.
bpm.de.psProcessCenterPort=
```

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Figure 5-43. Customizing the BPMConfig properties file

Before you create a deployment environment, you must create all the databases manually that are specified in the properties file. The `BPMConfig` command does not create the databases. It creates the schema and tables. You also must create all the users that you specify in the properties file.

IBM BPM Configuration Editor (1 of 6)

- Displays the configuration in an easy-to-use way and highlights issues that need to be resolved
 - Removes the need for manual editing of property files
- Use it to open and edit an IBM BPM properties file
- Uses a wizard to guide you through all the sections in the properties file or go to a particular section
- Key tasks include
 - Configure the topology and databases
 - Secure the environment
 - Tune for performance
 - View and correct configuration errors



IBM BPM Configuration Editor (2 of 6)

IBM BPM Configuration Editor

Edit configuration properties for IBM Business Process Manager 8.5.7.0

The IBM BPM Configuration editor provides an intuitive interface for configuring your deployment environment. Using the configuration editor, you can graphically edit a configuration properties file -- either a sample file or a file that has been exported from any supported version of IBM BPM. After you have edited the properties file, you can use the `BPMConfig` command and modified properties file to create a new deployment environment or update an existing deployment environment.

Before you begin

1. Install the new version of IBM BPM on each machine in your cell.
2. Ensure that the following information is readily available:
 - The host name of each host in your new deployment environment
 - The WebSphere administrative passwords for your IBM BPM configuration
 - The host name for the database server that you will use
 - The database administrator names and passwords for each database
 - The host name and properties of the LDAP server (if referenced in the properties file)
3. If you want to add a new property, add it to the configuration properties file before you open the file in the IBM BPM Configuration editor.

Launch the IBM BPM Configuration editor

1. Click **Browse** to select a configuration properties file. You can select a sample configuration properties file or a properties file that has been exported using the `BPMConfig` command.

Browse
...

2. Click **Open Editor** to launch the editor and configure the environment.

Open Editor
...

IBM Business Process Manager Advanced deployment topologies

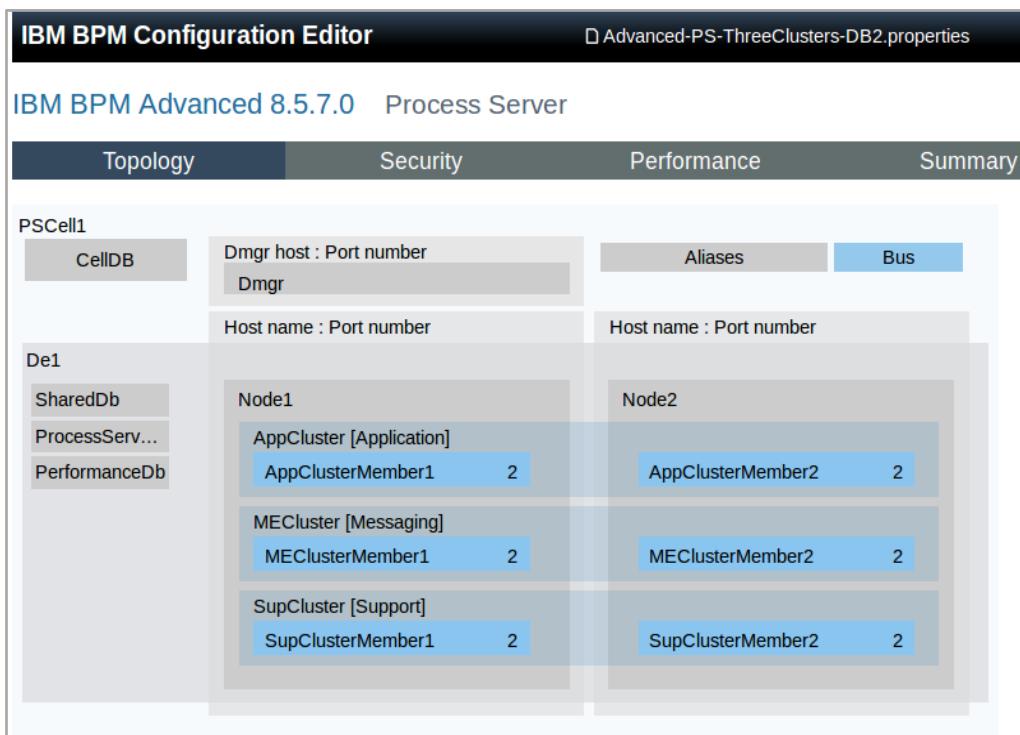
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Figure 5-45. IBM BPM Configuration Editor (2 of 6)

The IBM BPM Configuration editor is a browser-based interface for configuring your new deployment environment. You can graphically edit the configuration properties file that was exported from your source environment by the `BPMConfig -export` command. After you modify the properties file in the editor, you can use the `BPMConfig -create` command to create a deployment environment that is based on the modified file.



IBM BPM Configuration Editor (3 of 6)



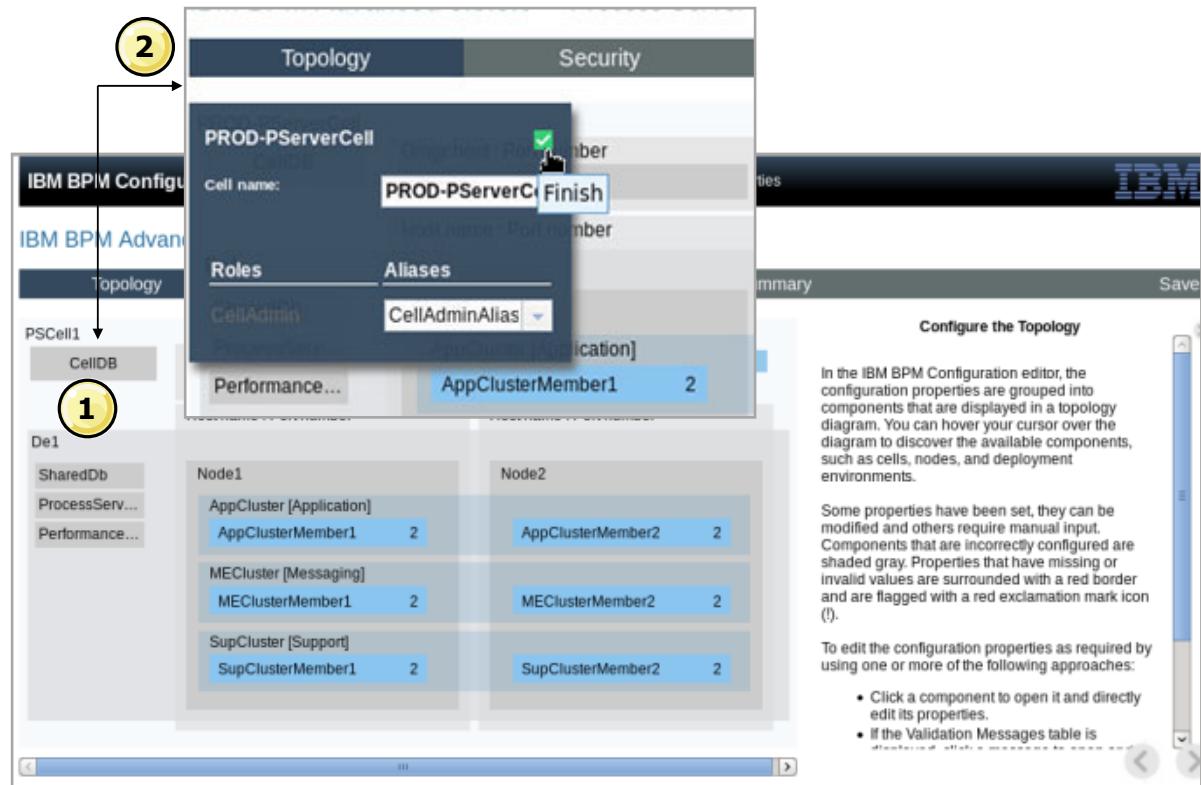
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Figure 5-46. IBM BPM Configuration Editor (3 of 6)

IBM Training

IBM BPM Configuration Editor (4 of 6)



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Figure 5-47. IBM BPM Configuration Editor (4 of 6)



IBM BPM Configuration Editor (5 of 6)

Topology	Security	Performance	Summary	Save
LDAP	Server type: IBM Directory Service LDAP Server ID: <input type="text" value="ldap103"/> Host: <input type="text" value="9.115.64.103"/> : <input type="text" value="389"/> The property name is not valid. Bind password: <input type="password"/> Confirm password: <input type="password"/> Authentication: <input type="text" value="simple"/> Enable SSL: <input type="text" value="false"/> SSL configuration: <input type="text"/> Certificate map: <input type="text" value="exactdn"/>			
LDAP Repository	DN: <input type="text" value="uid=wps.ou=wps7005.ou"/> Referral: <input type="text" value="ee"/> ! Dereference alias: <input type="text"/> Connection pool: <input type="text" value="false"/> Connection timeout: <input type="text"/> Certificate filter: <input type="text"/>			
Process Admin Console				
Process Server				
Custom Properties				

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Figure 5-48. IBM BPM Configuration Editor (5 of 6)



IBM BPM Configuration Editor (6 of 6)

Topology	Security	Performance		Summary			Save
Data Sources	Database	Name	JNDI Name	Description	Minimum Connections	Maximum Connections	Statement Cache Size
Thread Pools	BusinessSpaceDb	Business Space data source	jdbc/mashupDS	Business Space data source	1	10	10
Activation Specifications	ProcessServerDb	Process Server data source	jdbc/TeamWorksDB	Process Server data source	1	10	10
Work Managers	PerformanceDb	Performance Data Warehouse data source	jdbc/PerformanceDB	Performance Data Warehouse data source	1	10	10
JVM Settings	ProcessServerMEDb	Process Server ME data source	jdbc/com.ibm.ws.sib/twprocsvr_bus	Process Server Messaging Engine data source	1	10	10
Connection Factories	PerformanceDWMEDb	Performance Data Warehouse ME data source	jdbc/com.ibm.ws.sib/twperfsrvr_bus	Performance Data Warehouse Messaging Engine data source	1	10	10
ORB Data	CellOnlyDb	WPS data source	jdbc/WPSDB	WPS data source	1	10	10
Web Containers	DEScopeCMNDb	BPM CommonDB data source	jdbc/CommonDB	WPS data source	1	10	10
Messaging Engine							

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Figure 5-49. IBM BPM Configuration Editor (6 of 6)

Creating the deployment environment

- Use the following command to create the deployment environment:

```
BPMConfig -create -de <properties_file>
```

- The `create` command completes the following functions:

- Creates the deployment manager that is based on the values in the properties file and starts the deployment manager
- Creates a managed node that is based on the specified values, or each node that is specified in the configuration properties file
- Federates each managed node and adds the node to the deployment environment
- Generates the deployment environment
- Creates any profiles that are specified in the configuration properties file that do not exist
- Creates or defers the creation of the database tables
- Runs the bootstrap utility to load the Process database with system information so there is no need to do this step manually if tables are created

Figure 5-50. Creating the deployment environment

Run the `BPMConfig` command on the computer that has the deployment manager by passing the name of the properties file you created as a parameter to the command.

For Advanced or Advanced-only deployment environments, the deployment manager and node agents must be restarted for the cell scoped configuration to take effect. The restart is required only for the first deployment environment that you create.

5.8. IBM BPM patterns

IBM BPM patterns

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Figure 5-51. IBM BPM patterns

What are patterns? A system and software perspective

- From a practical view, the goal of patterns is to create:
 - Consistent and repeatable middleware topologies
 - Manageable and repeatable software lifecycles
 - Manageable and repeatable software stacks
- IBM PureApplication System implements these patterns:



Virtual application patterns



Virtual system patterns

Figure 5-52. What are patterns? A system and software perspective

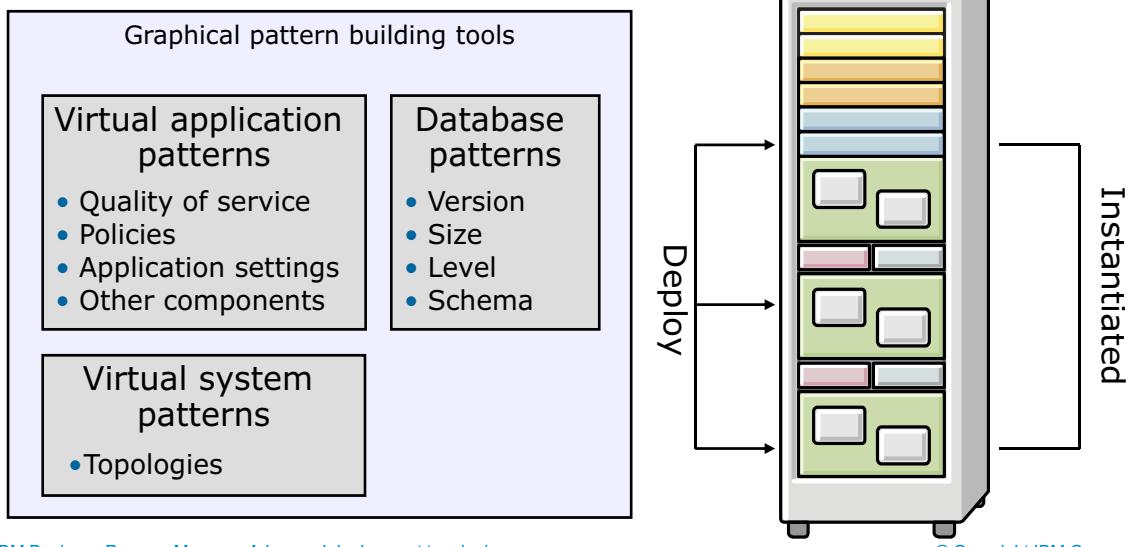
IBM PureApplication System bases its ability to provision virtual systems, virtual applications, and databases to the cloud on the concept of patterns. Patterns are logical descriptions of both the physical and virtual assets that form a particular solution. Using patterns allows an organization to construct an individual element or integrated solution one time, and then dispense the final product on demand.

IBM PureApplication System provides two types of patterns to assist with the rapid deployment and integration of private cloud capabilities: virtual system and virtual application patterns. The appliance includes preinstalled patterns of each type that represent varying degrees of automation and customization. The patterns are optimized with the most appropriate configurations and settings for the solutions that they support. The preinstalled patterns are based on industry-recommended practices.

The patterns are assets that include processes, best practices, methodologies, and technology capabilities that eventually lead to lower cost of maintenance. A recent shift in focus from enterprises, from cost of development to the ownership of patterns, addresses the challenges of reducing cost of operations and maintenance.

Patterns and IBM PureApplication System

- Patterns are a strength of IBM PureApplication System
 - You specify the components of a pattern at a logical level
- When the pattern is instantiated, IBM PureApplication System deploys and configures the details of the runtime environment consistent with the specified quality of service



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Figure 5-53. Patterns and IBM PureApplication System

PureApplication System has graphical tools to build and deploy patterns.

This section provides a preview of patterns, which are a strength of IBM PureApplication System. The client specifies components on a logical level, and IBM PureApplication System deploys and configures the details of the runtime environment consistent with the specified quality of service. Constructing the runtime environment is a significant example of built-in expertise. In the preview screens that follow, notice the level of abstraction and the support within the graphical user interface.

Virtual application patterns

- Virtual application patterns address these questions:
 - Which components do you need (web applications, databases, queues, and other components)?
 - What are the characteristics of each component (application module files, database tables, and other characteristics)?
 - What is the behavior of each component (scalability requirement, multi-tenancy, security, and others)?
 - What are the relationships between components?



Figure 5-54. Virtual application patterns

Virtual applications are an IBM implementation of PaaS (platform as a service). Traditionally when discussing application deployment, the first item that is discussed is usually middleware requirements. Virtual applications focus on the application, and PureApplication System determines which middleware is needed to run the application. The lifecycle of the application is managed, including growing and shrinking servers that are needed to satisfy service level agreements. This simple interaction model is application-focused, rather than product-focused, providing the highest value of the different models.

Virtual system patterns

- Virtual system patterns address these questions:
 - Which resources to use (storage, computational nodes, and others)
 - Which virtual machines to create
 - How to configure the operating systems inside the virtual machine
 - How to configure the software inside the virtual machine
 - How to solve software interdependencies, scalability, high availability, and other issues



Figure 5-55. Virtual system patterns

Using a virtual system pattern, you can describe the topology of a system that you want to deploy. Virtual system patterns provide repeatable system deployment that can be reproduced. To build virtual system patterns, you can use parts from one or more virtual images, add-ons, and script packages.

Efficient and flexible virtualized application platform

Complete systems

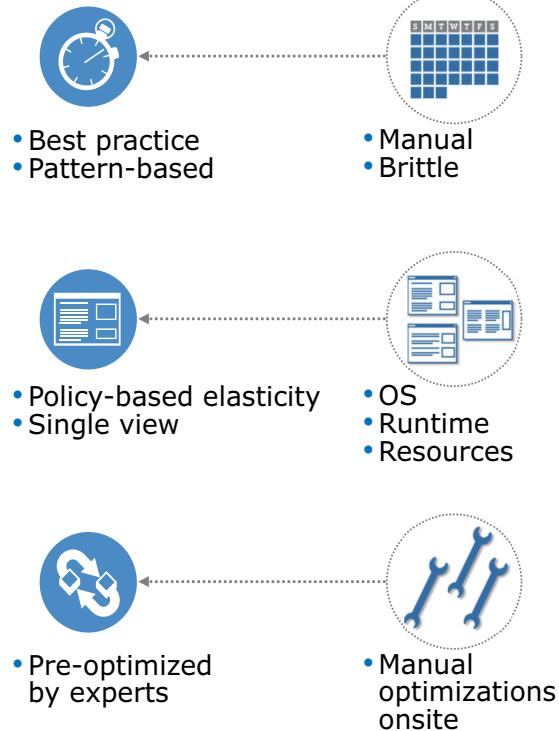
- Pre-integrated, up and running in less than 4 hours
- Pre-optimized for enterprise application
- Elastic application runtimes and workloads

Simplify ongoing tasks

- Single point of platform and application management
- Repeatable self-service application provisioning

Built for cloud

- Platform as a service



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Figure 5-56. Efficient and flexible virtualized application platform

This integrated system provides key value in a simple, efficient, flexible, and virtualized infrastructure for applications. Project PureApplication System is complete and ready to go. It is pre-optimized for highest workload performance, virtualized across the stack for efficiency, and built on a resilient, secure, scalable infrastructure. It is delivered, arriving pre-integrated with a single point of management, and is easy to integrate within your existing IT environment. Finally, PureApplication System is ready for cloud and includes integrated middleware with elastic runtimes and data, and application-aware workload management.

IBM BPM patterns

- IBM Business Process Manager Application Pattern V8.5.7 offers a pattern configuration of IBM BPM that is optimized to work with
 - IBM PureApplication System
 - IBM PureApplication Service on SoftLayer
 - IBM Cloud Orchestrator
- Optimized to help accelerate the setup and management of complex, highly available, business process environments
- Enables higher hardware use, while it helps you focus your critical resources on added value activities and strategic initiatives
 - Instead of focus on installation and configuration
- IBM BPM pattern deployment takes 90 minutes on average
 - Compared to 5 – 10 days or more to deploy the comparable solution by using traditional deployment methods

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Figure 5-57. IBM BPM patterns

This optimized pattern is intended to help accelerate the setup and management of complex, highly available business process environments. It is also intended to help customers to focus their critical resources on critical activities instead of installation and configuration. In addition, the pattern offers elastic scaling policies to automatically detect when the configuration capacity should be increased to meet increasing demands on your process solutions.

IBM BPM pattern deployment takes 90 minutes on average, as compared to 5 or 10 days or more to deploy the comparable solution by using traditional deployment methods.

IBM BPM Pattern V8.5.7 includes the following highlights:

- Adds support for Linux on System z
- Delivers an IBM BPM pattern that is built to operate on the enhanced pattern engine that was introduced with IBM PureApplication System Software V2.0

Unit summary

- Explain the purpose of a deployment environment
- Identify and explain the clustered topologies for IBM Business Process Manager Advanced:
 - Single cluster
 - Application, Remote Messaging, and Remote Support
- Explain how to create a deployment environment by using multiple tools
- Explain how to create a deployment environment by using the BPMConfig utility
- Use the IBM Business Process Manager Advanced Configuration Editor
- Explain IBM Business Process Manager Advanced Pattern

Review questions

1. Which topology is typically used for testing, proofs of concepts, and demonstration environments?
 - A. Single cluster
 - B. Application, Remote Messaging, and Remote Support
2. Which topology is ideal from a performance perspective and the best topology for long-running processes and human tasks?
 - A. Single cluster
 - B. Application, Remote Messaging, and Remote Support
3. The number of clusters in the deployment environment depends on which of the following patterns?
 - A. Topology pattern
 - B. Database usage pattern
 - C. Business process pattern



Figure 5-59. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. Which topology is typically used for testing, proofs of concepts, and demonstration environments?
 - A. Single cluster
 - B. Application, Remote Messaging, and Remote Support

The answer is A.

2. Which topology is ideal from a performance perspective and the best topology for long-running processes and human tasks?
 - A. Single cluster
 - B. Application, Remote Messaging, and Remote Support

The answer is B.

3. The number of clusters in the deployment environment depends on which of the following patterns?
 - A. Topology pattern
 - B. Database usage pattern
 - C. Business process pattern

The answer is A.

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Figure 5-60. Review answers



Exercise: Configuring the Process Center environment

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Figure 5-61. Exercise: Configuring the Process Center environment

Exercise objectives

- Create the Process Center deployment manager and a custom profile
- Federate the custom profile
- Edit the `soap.client.props` file
- Verify the database configuration
- Create the three required databases
- Create a Process Center deployment environment
- Verify the creation of the database tables



Unit 6. Introduction to IBM Process Center

Estimated time

01:15

Overview

This unit teaches you how to use Process Center to deploy, test, and manage process applications.

How you will check your progress

- Checkpoint
- Lab exercise

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe the purpose and business value of Process Center
- Define the components of Process Center
- Describe how to manage the Process Center repository
- Describe how to use the Process Center Console to deploy, test, and manage process applications
- Manage access to Process Center
- Purge data in the Process Center environment

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Figure 6-1. Unit objectives

Topics

- Introduction to Process Center
- Components of Process Center
- Using Process Center to test, deploy, and manage process applications
- Managing access to Process Center
- Purging data in Process Center

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Figure 6-2. Topics

6.1. Introduction to Process Center

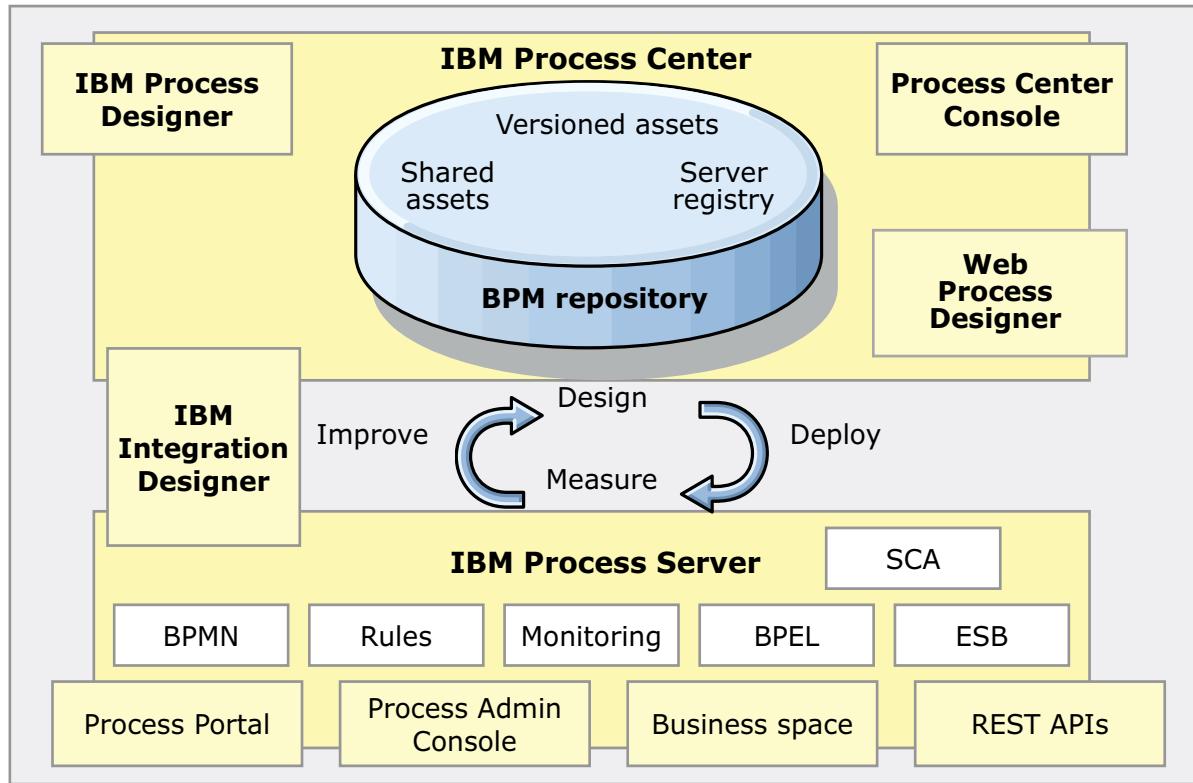
Introduction to Process Center

Introduction to IBM Process Center

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Figure 6-3. Introduction to Process Center

IBM Business Process Manager Advanced V8.5.7



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Figure 6-4. IBM Business Process Manager Advanced V8.5.7

IBM Business Process Manager Advanced V8.5.7 uses a concept that is called the shared model. In simple terms, the shared model means that no matter what is being done within the overall solution, there is only one common repository and a single representation of that solution. Because of this representation, it is impossible to get two phases of the same solution out of sync with each other.

The IBM BPM components realize this shared model through Process Center. Process Center is a key component within IBM Business Process Manager Advanced V8.5.7. Part of Process Center is a data repository, which is called the repository. Within the repository, there exists the representation of the solution. The IBM BPM tools connect as clients to the Process Center to obtain copies of the solution for working upon. When a user makes and saves changes, the results are written back to the repository.

The Process Center repository is implemented as tables within a database (commonly DB2).

Process Center capabilities

- Repository for all IBM BPM assets
 - Process applications, reusable toolkits, monitor models, and many more
- Lifecycle management and deployment of all applications
 - Manage dependencies, versions, deployment to servers
- Includes execution environment for development and testing
- Sharing of toolkits from one repository with other Process Centers
- Central governance
- Web interface by using Process Center Console

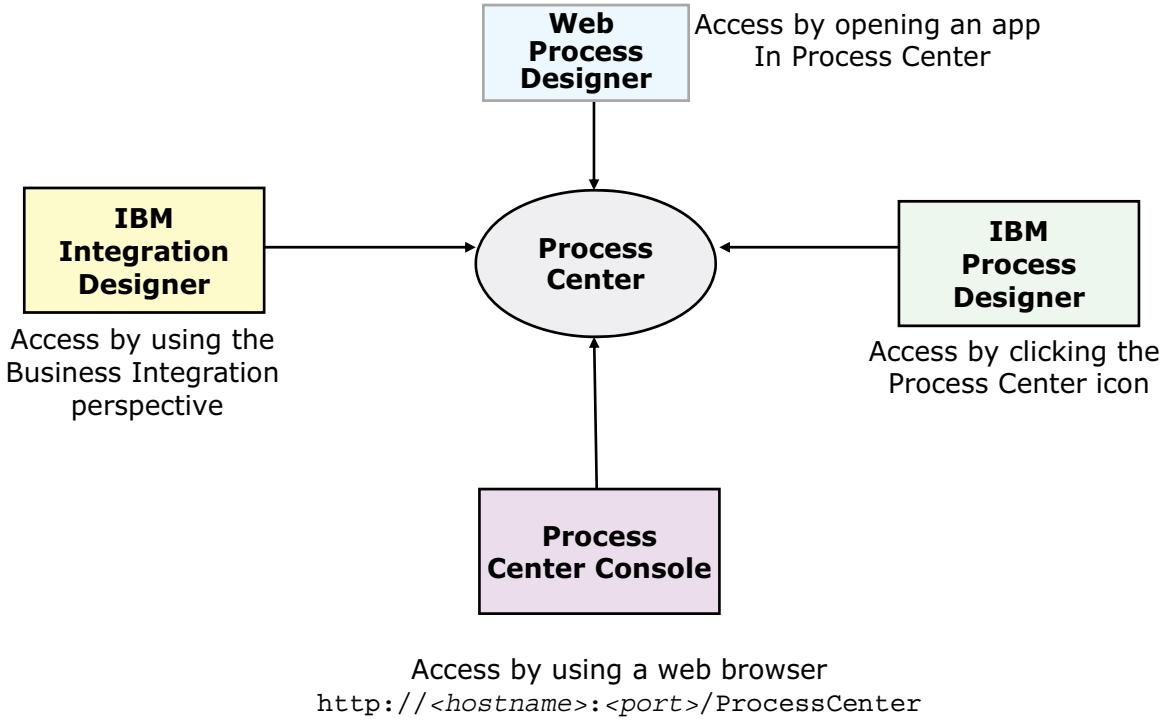
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Figure 6-5. Process Center capabilities

You can use the Process Center repository to share artifacts with other users who are developing process applications and toolkits.

Accessing Process Center



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Figure 6-6. Accessing Process Center

Process Center can be accessed in several ways:

- Switching to the Process Center perspective in the IBM Integration Designer
- Clicking the Process Center icon at the upper right in the IBM Process Designer
- By using a web browser at the default URL: `http://localhost:9080/ProcessCenter`

The Process Center view and capability might vary slightly depending which tool you are using.

6.2. Components of Process Center

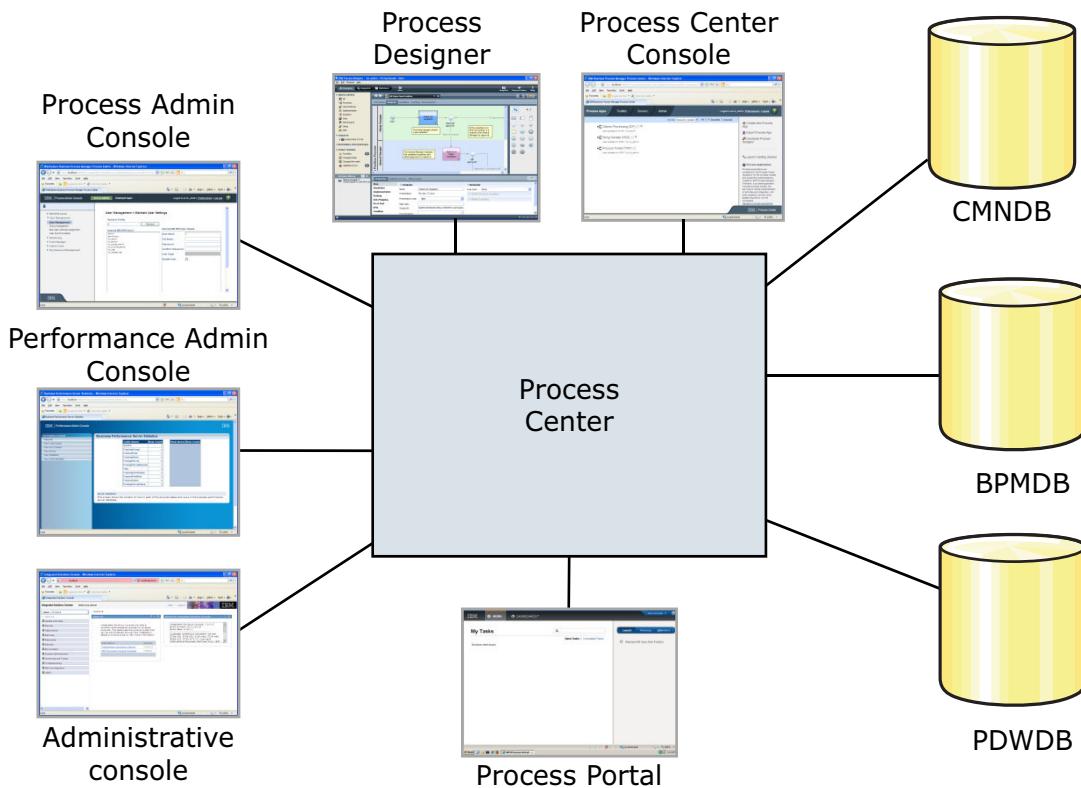
Components of Process Center

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Figure 6-7. Components of Process Center

Architecture (1 of 2)



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Figure 6-8. Architecture (1 of 2)

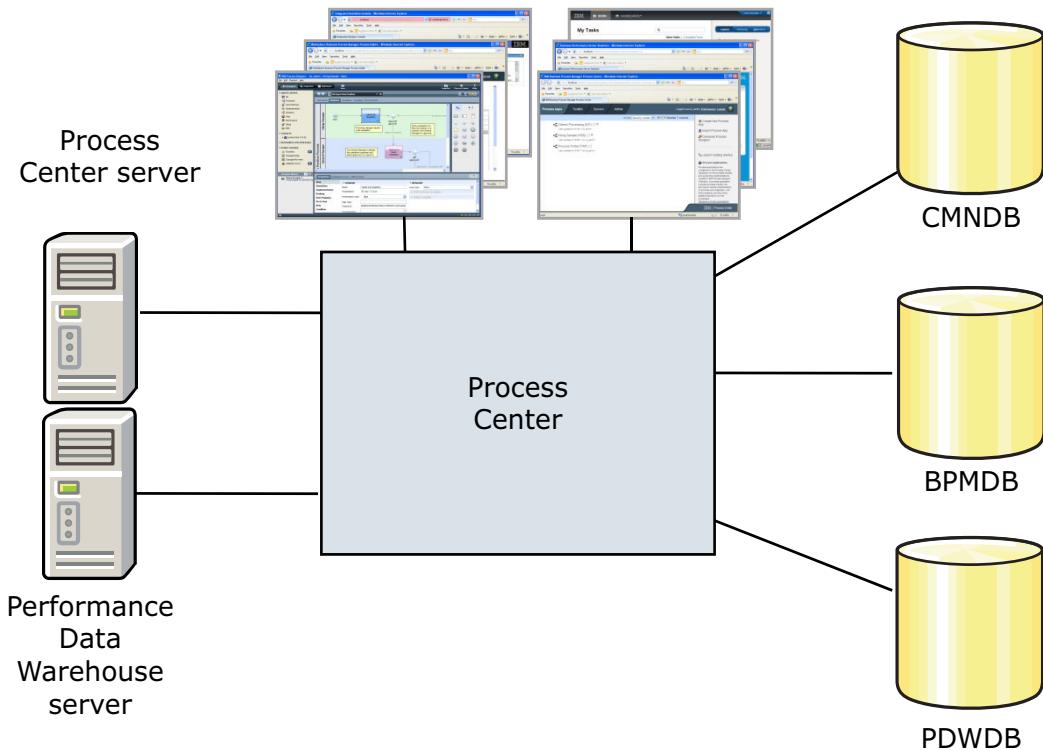
Process Center is a centralized tool that uses WebSphere Application Server and a database as a repository. The tool provides perspectives that developers can use to work with assets that are stored in the Process Center repository. The components of Process Center include:

- **Application server:** A WebSphere Application Server profile that offers all the expected functions of WebSphere Application Server Network Deployment, including clustering, and a runtime engine. In the Express configuration of IBM Business Process Manager, clustering is not supported. Process Center is used as the runtime engine for the Express and Standard configurations, but not for the Advanced configuration. In the Advanced configuration, Process Server is the runtime engine.
- **Database:** Process Center uses a repository, which by default is based on DB2 Express. The repository might be installed on other databases at installation time.
- **Administration console:** Process Center offers a web-based administration console, which can be started from a browser. This same interface is also offered in development tool perspectives (IBM Process Designer and IBM Integration Designer).

Process Center also supports numerous administrative functions. From the Process Center Console, administrators install process applications that are ready for staging, testing, or production on the process servers. The administrators can also manage running instances of process applications in configured environments.

From the Process Admin Console and Performance Admin Console, administrators can manage and maintain all runtime servers. Use the Process Admin Console to manage the Process Center server and process servers in your runtime environments. Use the Performance Admin Console to identify performance bottlenecks and to capture instrumentation data for further analysis.

Architecture (2 of 2)



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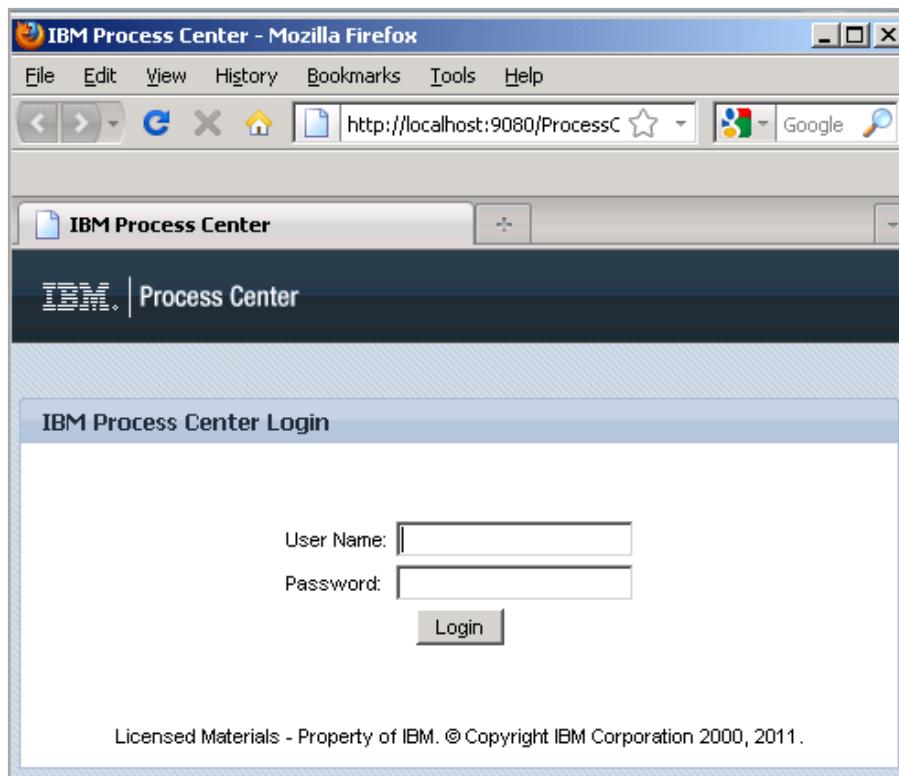
Figure 6-9. Architecture (2 of 2)

The Process Center includes two servers, the Process Center server and the Performance Data Warehouse server. With these servers, developers who are working in Process Designer can run their process applications and store performance data for testing and playback during development efforts. Performance Data Warehouse retrieves tracked data from Process Server or Process Center Server at regular intervals.



Process Center Console

- The Process Center Console provides a web-based interface for managing the Process Center maintained projects
- It provides the tools that are needed to maintain the repository



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Figure 6-10. Process Center Console

The Process Center Console provides a web-based interface for managing the Process Center maintained projects. The default URL for Process Center Console is:

<http://localhost:9080/ProcessCenter>

The Process Center includes a repository for all processes, services, and other assets. The Process Center Console provides the tools that you need for maintaining the repository.

From the Process Center Console:

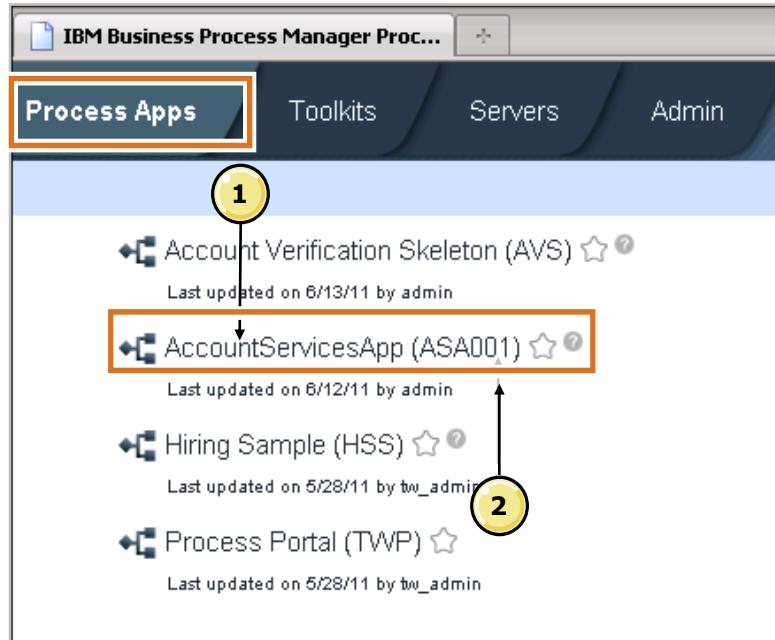
- You can create process applications and toolkits and grant other users access to those process applications and toolkits.
- Administrators can install process applications that are ready for testing or production on the Process Servers in those environments.
- Administrators manage running instances of process applications in configured environments.

Terminology

- **Process:** A collection of BPDs and items that are grouped for the process
 - A process is more like a workspace than a deployable object
- **Track:** A splitting of the process workspace
 - When multiple tracks are present, there are multiple versions of the process, which can be edited
- **Toolkit:** Similar to a process and it contains a collection of items
 - To be used, it needs to be a dependence of a process
- **Snapshot:** A deployable version of a process or toolkit
 - It is a snapshot of the process at the time it is taken
 - A snapshot is not editable
- **Tip snapshot:** A specialized snapshot available on Process Center referring to the current work on a process or track
- **BLA:** Business Level Application, which is a grouping of applications (EARs) and libraries (JARs)

Process Center: Process Apps

- A process application is the container for a solution
- Initially created with the Process Center Console
- Identified by the following details:
 1. Name
 2. Tag that is called an acronym
- The process application and its artifact contents are stored in the Process Center repository



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Figure 6-12. Process Center: Process Apps

A process application is the container for a solution. You can loosely think of it as a project. The process application is initially created through the Process Center Console. It is given a name and a tag that is called an acronym. The acronym must be unique and can be no more than 7 characters in length. After the process application container is created, artifacts can then be further created within it by using the IBM Process Designer.

The process application and its artifact contents are stored within a Process Center repository. The main Process Apps page has a button to create a process application.



Process Center: Toolkits

The screenshot shows the 'Toolkits' tab selected in the navigation bar of the IBM Business Process Manager Process Center. Below the tabs, there are two toolkit entries listed:

- Account Verification Services (AVS101)**: Last updated on 6/11/11 by admin.
- System Data (TWSYS)**: Last updated on 5/28/11 by tw_admin.

- Container for artifacts that are used in solutions
- Toolkits are not deployable applications
- Toolkits can be:
 - “Included” or “Used” by process applications, similar to a library with artifacts
 - Can be added as a dependency to a process application
- You can share toolkits in one Process Center repository with other Process Centers

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Figure 6-13. Process Center: Toolkits

Similar to a process application, a toolkit can also be thought of as a container for artifacts that are used in solutions. Unlike a process application, a toolkit does not result in a deployable application. Instead, the contents of the toolkit can be “included” or “used” by one or more process applications.

When Process Center is installed and configured, a toolkit that is called System Data is automatically imported into the repository. This toolkit is marked as read-only and is implicitly dependent upon all other process applications and toolkits. The System Data toolkit contains the core definitions for data structures and other items common across all process applications.

Toolkits have their own tabs in the Process Center Consoles. From these tabs, new toolkits are managed in a similar fashion to process applications.

You can use Process Center sharing to share toolkits between Process Centers. From one Process Center, a toolkit can be declared to be shareable. Through an inter-Process Center registration process, other Process Centers can then subscribe to the shared toolkit. The toolkit and all of its dependencies are then copied to the subscribing Process Center.



Process Center: Snapshots

- A snapshot is a copy of the state of all the artifacts in a Process Application or Toolkit at the point in time when the snapshot was made

- Allows for creating a version of toolkits and process applications

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Figure 6-14. Process Center: Snapshots

A snapshot is a copy of the state of all the artifacts in a process application or toolkit at the point in time when the snapshot was made. The purpose of taking a snapshot is to revert in time to the state of the snapshot if that is needed. A snapshot can be captured by clicking the **Snapshot** icon in IBM Process Designer.

A snapshot is required in some circumstances such as:

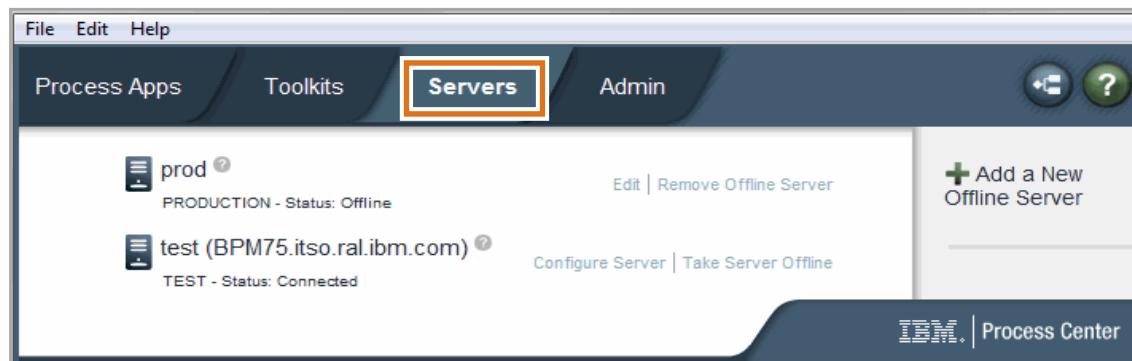
- A snapshot of a toolkit is required before it can be added as a dependency on other toolkits or process applications.
- A snapshot of a process application is required before that application can be installed on Process Server.
- A snapshot is required before a “workspace” can be created.

Just like process applications, toolkits can have snapshots that are taken of them allowing all the artifacts in a toolkit to be controlled according to version.

To add a toolkit as a dependency to a process application, the toolkit must first have a snapshot that is associated with it. This requirement is because the dependency added to the process application is not just the name of the toolkit, but is instead a specific snapshot of that toolkit.



Process Center: Servers



- The **Servers** tab lists the Process Servers that are connected to the Process Center
 - Process Server that is connected can be a stand-alone server
 - Process Server that is connected can be a server that is running inside the Integration Designer test environment
 - Multiple servers can be connected
 - Multiple environments can be connected which include development, testing, staging, and production

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Figure 6-15. Process Center: Servers

The servers that are shown are Process Servers that are connected to the Process Center. Authorized users can install snapshots of process applications on connected Process Servers. For each server, you can view the snapshots that are currently installed.

The **Servers** tab in the Process Center Console shows the list of Process Server environments that the Process Center manages.

Clicking **Configure Server** in a listed Process Server takes you to the Process Admin Console corresponding to that particular Process Server.

Offline Process Server environments can be created by clicking **Add a New Offline Server** on the right side pane. It is suggested that you manage the Process Server environments that are used for production purposes in offline mode.

The process applications can be installed to offline servers by creating a deployment package specific to that environment. For more information about what commands to run to install the deployment package, see the IBM Knowledge Center.



Process Center: Admin

The screenshot shows the 'Admin' tab of the IBM Business Process Manager Process Center. The 'Manage Users' section displays two groups: 'tw_admins' and 'tw_authors'. The 'tw_admins' group has a checked checkbox next to its name. The 'tw_authors' group has an unchecked checkbox. To the right of the list is a sidebar with a green button labeled '+ Add Users/Groups' and a link labeled 'Admin'.

- **Admin** tab displays a list of users and groups
 - You can provide users and groups access to the Process Center repository
- Best way to manage access to the Process Center repository is by using groups
 - Add groups of users to `tw_authors`, which is the default group with access to the repository
 - Add groups of users to `tw_admins`, which is the default group with administrative access to the repository

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Figure 6-16. Process Center: Admin

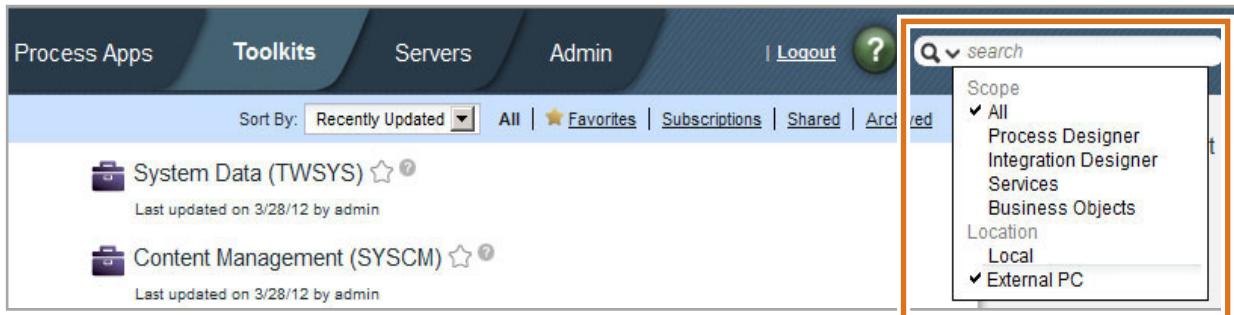
Granting users authority to access the repository allows them to log in to the Process Center Console. The authority does not give privileges to work on or even see all the process applications in the environment. Process applications and toolkits are individually controlled with their own access control lists. From within the process applications section of the IBM Process Designer or the Process Center Console, an application can be selected and the Manage tab can be clicked. On that tab, there is a section into which users and groups might be associated which defines the permissions for those entities.

Users or groups are assigned one of three roles:

- **Read:** Allows a user or group to see the project and artifacts within it. The read role cannot be removed without removing the user or group association completely. If a user or group is not associated with the process application, then the user or group has no authorities on that application. If a user with read authority opens an artifact, the artifact is flagged as read-only in the editor.
- **Write:** Allows the user or group to update or add artifacts into the process application.
- **Admin:** Allows the user or group to administer the process application.

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Process Center: Search scope



- Search scope and returned results
 - **All**: All metadata that is specified for search
 - **Process Designer**: Only Process Designer items can open directly
 - **Integration Designer**: Only Integration Designer items can open directly
 - **Business Objects**: Only business objects

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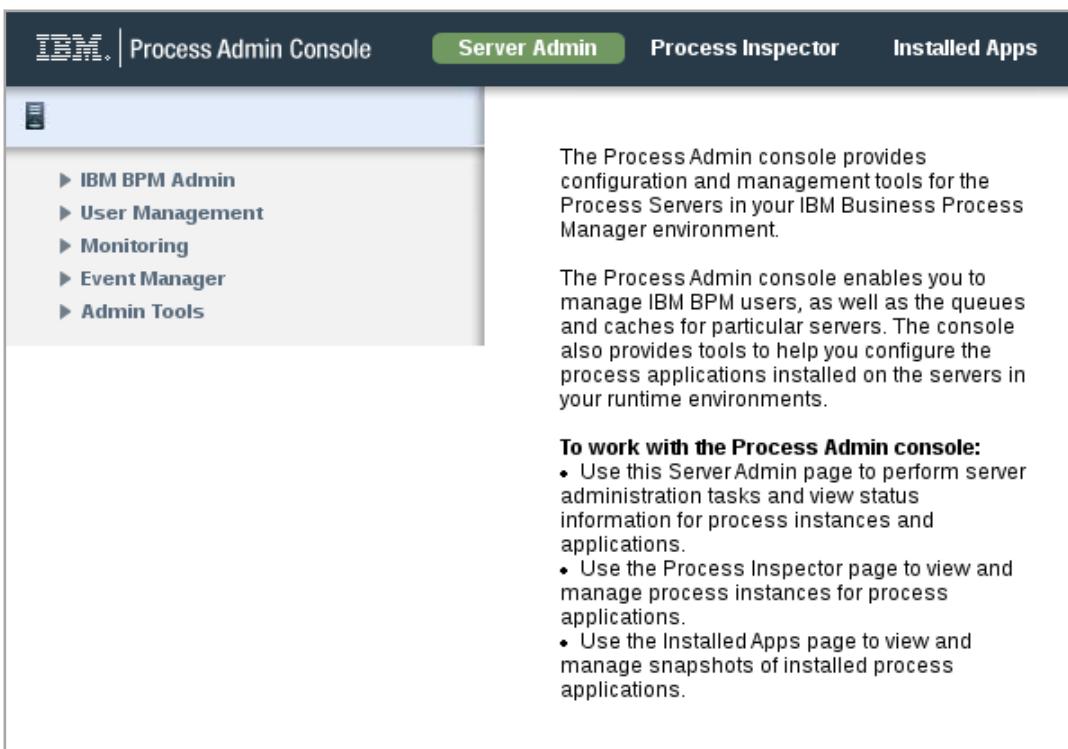
Figure 6-17. Process Center: Search scope

Process Center search gives you the ability to search for artifacts within a local Process Center or shared artifacts from a remote Process Center. The search uses keywords, with results based on matching keywords that are found in artifact names, tags, and descriptions. There is also the ability to filter the results according to component type.

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Process Admin Console



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Figure 6-18. Process Admin Console

The Process Admin Console enables administrators to manage the Process Servers in the runtime environments (staging, test, production). It is also available to manage the Process Center server that is part of the Process Center.

The most important management tasks are managing user accounts and managing installed applications (activating and deactivating applications, migrating in-flight instances).

The screenshot shows the IBM Process Inspector interface. At the top, there's a blue header bar with the text "IBM Training" on the left and the "IBM" logo on the right. Below the header, the title "Process Inspector" is displayed in a large, bold, dark blue font. The main content area has a white background. At the top of this area, there are four tabs: "Process Admin Console" (disabled), "Server Admin" (disabled), "Process Inspector" (selected and highlighted in green), and "Installed Apps" (disabled). To the right of the tabs, it says "Logged in as bpmadmin | Preferences". On the left side, there's a sidebar with a "Search" input field and a magnifying glass icon. Below the search field is a "Filter by:" section with a "Status" heading and several checkboxes: Active (1), Completed (0), Executing (0), Failed (0), Late (0), and Suspended (0). There's also a "Process Applications" button with a plus sign. The main pane on the right shows a list of process instances. At the top of this list, there are two buttons: "Select All" and "Sort by Date of Last Action". Below these buttons, the text "1 of 1 results" is displayed. The list contains one item: "ReplenishmentBPD:3" (status Failed). It includes a link to "ApproveReplenishmentOrder", a note that it's assigned to "All Users", and a due date of "in 47 minutes". A timestamp indicates the "last action" was 12 minutes ago by "All Users" due in 1 week.

- A tool that can be used to view and manage process instances that are running on a specific process server
 - Users can search for process instances on a process server by specifying different filtering criteria
- Provides detailed information about a specific instance
- Started from the Process Admin Console

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Figure 6-19. Process Inspector

Process Inspector is a tool that can be used to view and manage process instances, running on a specific process server. You can use the Process Inspector to search for process instances on a process server by specifying different filtering criteria. Criteria include status, process application name, person, date range, or searching for specific text. The result set shown here is based on Complete status. By default 20 rows are shown in a page.

When you click a process instance in the Process Inspector, specific details are displayed in a separate pane. You can view detailed information about one specific process instance or view a summary of information about an entire group that you select. The sample screen capture shows details of one failed process instance. The process instance details pane shows information about the process instance you selected. This information includes process instance status such as Active and all actions that are possible on the process instance, such as Terminate and Delete. Also included are open and completed tasks, date, and time information such as the starting time or when the item is due.

When to use which console?

- Process Center Console
 - To create and grant users access to process applications and toolkits
 - To deploy process applications on the Process Servers
 - To activate, deactivate, or clone snapshots that are deployed on a Process Server
- Process Admin Console
 - To activate, deactivate, stop, or undeploy snapshots that are deployed on a Process Server
- Administrative console
 - To stop and start BPEL templates that are associated with process applications
 - To create and manage JDBC providers, data sources, authentication aliases, and other tasks
- Performance Admin Console
 - To work with Performance Data Warehouse queues, manage data transfer errors, and monitor overall performance
- Process Portal
 - For business users who work with business processes and human services

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Figure 6-20. When to use which console?

The purpose of this slide is to talk about the scenarios in which you might switch to the other two administrative consoles. After a process application is installed to a Process Server, the administrative operations on the snapshot are different. Operations, which include activate, deactivate, undeploy, and similar tasks, are done by using the Process Admin Console.

When you have BPEL processes used as part of the process application, the WebSphere Application Server administrative console can be used to stop and start the associated templates. Also, you can use this console for creating resources like JDBC providers, data sources, and authentication aliases.

Remember two things when using other consoles:

- The administrative console cannot be used for modifying the states of a deployed snapshot.
- After a snapshot is deployed to Process Server, the Process Admin is the only console that is used for all other operations corresponding to that snapshot.

6.3. Using Process Center to test, deploy, and manage process applications

Using Process Center to test, deploy, and manage process applications

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Figure 6-21. Using Process Center to test, deploy, and manage process applications

Overview of deployment of a process

- **Import** process application from Process Center repository
- **Associate** any modules or libraries
- **Synchronize** versions in workspace and Process Center repository
- **Publish** synchronized process application to Process Center repository
- **Deploy** process application to Process Server

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Figure 6-22. Overview of deployment of a process

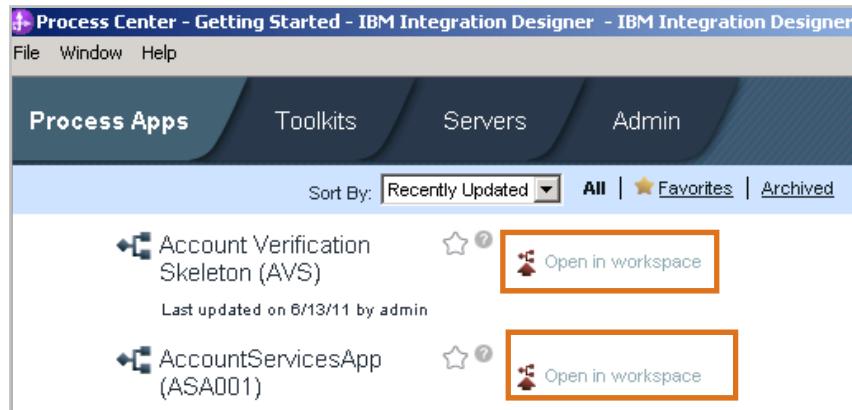
A process application snapshot can be deployed to a Process Server by using the Process Center Console. After the snapshot is deployed, you use the Process Admin Console corresponding to that server to do the administrative operations on the snapshot.

Deactivating a snapshot allows all existing Business Process Definition instances to complete, but no new instances can be started. Using the Deactivate action from the Process Admin Console does not stop a BPEL process that is part of a process application.

You use the administrative console to stop the BPEL processes manually.



Importing from the Process Center repository



- Import process applications and toolkits into your workspace from the Process Center repository
 - Can now use them with your modules and libraries
- Must be in the Process Center perspective to import the process application or toolkit into the workspace
- View and work with the newly imported workspace in the Business Integration perspective

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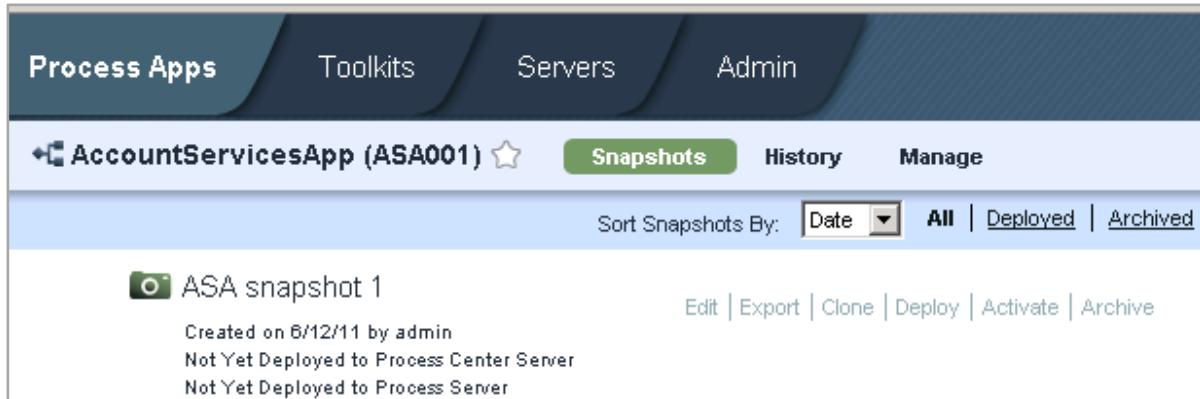
Figure 6-23. Importing from the Process Center repository

You can import process applications and toolkits into your workspace from the Process Center repository, and then you can use them with your modules and libraries.

To open the process application into a workspace in the Integration Designer, you must access the Process Center by using the IBM Integration Designer.

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Deploy



The screenshot shows the IBM Process Center interface. At the top, there are tabs for 'Process Apps', 'Toolkits', 'Servers', and 'Admin'. Under 'Process Apps', a sub-menu is open for 'AccountServicesApp (ASA001)' with options 'Schemas', 'History', and 'Manage'. The 'Schemas' tab is selected. Below this, there is a sorting dropdown set to 'Date' and buttons for 'All', 'Deployed', and 'Archived'. A list item 'ASA snapshot 1' is shown, with details: 'Created on 6/12/11 by admin', 'Not Yet Deployed to Process Center Server', and 'Not Yet Deployed to Process Server'. To the right of the list item are buttons for 'Edit', 'Export', 'Clone', 'Deploy', 'Activate', and 'Archive'.

- Snapshots can be deployed to Process Servers that are connected to the Process Center
- Both the Process Center server and the Process Server environment where the application is being deployed must be running
- When deployed, dependencies are also deployed

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Figure 6-24. Deploy

Snapshots can be deployed to Process Servers that are connected to the IBM Process Center.

Both the Process Center server and the Process Server where the application is being deployed must be running.

When deployed, the dependencies are deployed as well.

The screenshot shows the 'Manage' interface of IBM Process Center. The top navigation bar includes 'IBM Training' on the left and the 'IBM' logo on the right. Below the navigation bar, the word 'Manage' is displayed in large blue text. The main content area has a dark header with tabs: 'Process Apps' (which is selected and highlighted in blue), 'Toolkits', 'Servers', and 'Admin'. On the far right of the header are two circular icons: one with a question mark and another with a refresh symbol. Below the header, there is a toolbar with the text 'Sort By: Recently Updated' followed by a dropdown arrow, the word 'All', a star icon labeled 'Favorites', and a button labeled 'Archived' which is highlighted with a red box. The main body of the interface lists a single process application: 'AccountServicesApp (ASA101)' with a star icon and a question mark. Below the application name, it says 'Last updated on 8/10/12 by admin'. To the right of the application listing are two buttons: 'Restore' with a downward arrow icon and 'Delete' with a red X icon, both of which are highlighted with red boxes.

- Removing process applications from the Process Center repository
 - Use the Process Designer to first archive the process application and then delete it

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Figure 6-25. Manage

Governance

- Provides control over the installation of process application snapshots
 - Ensures that testing is done and approvals are secured before installation
- When governance is enabled, a custom built governance process receives snapshot installation requests made from Process Center
 - Snapshot is installed, only if the approvals defined in the process are completed
- Custom governance process uses the system governance toolkit
 - Triggered, even when a snapshot is installed to an offline Process Server
 - Runs as tip on the Process Center server
 - If more than one governance process is defined, each is notified during snapshot installation
 - Does not trigger if a wsadmin command is used for installing snapshots

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Figure 6-26. Governance

The governance of process applications provides a level of control over the installation of Process App snapshots. A system governance toolkit is provided to enable this control. Using the artifacts in the toolkit, you can build your own custom governance processes that conform to the requirements of your organization.

The governance of snapshot installation feature provides you with control over the installation of process application snapshots. Users can create a governance process that defines the approvals that are required before a snapshot can be installed. When this governance process is in place and enabled on a process application, requests made from Process Center to install a snapshot of that process application pass through the governance process. The snapshot is installed on a process server only after the defined approvals are completed. In addition to snapshot installation, the governance feature is also extended to tracking snapshot status. This feature sends notification events every time a new snapshot gets created or a status of the snapshot gets changed. The administrators are allowed to do the snapshot status governance on both the process applications and toolkits. The governance process that you defined to control the snapshot installation always runs on the Process Center server.

Enable governance for a process application

- Select the **Delegate installation to a governance process** check box to enable governance
- Make sure that a governance process is defined in the Process Center server before governance for a process application is enabled
- Administrative authority is required to enable or disable governance for a process application



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Figure 6-27. Enable governance for a process application

Before enabling the governance process for a process application, the governance process that is described in the previous slides should be defined. Only users with administrative rights can enable or disable governance for a process application. To enable governance for a process application, you select the process application in the Process Center perspective of IBM Process Designer and then go to the Manage page. Inside, the Manage page the **Delegate installation to a governance process** check box is selected. When this check box is selected, any request that is made for the installation of the snapshot of this process application from the Process Center to online Process Server goes through the approval process. The approval process is defined in the governance process.

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Figure 6-28. Installing snapshot on IBM Process Server

1. On the Snapshots tab of a process application, notice that the status is **Not Yet Installed to Process Server**. Click **Install**.
2. You get the window to select on which server to install the snapshot. Select the server, and the installation process begins. It first goes to the governance process to take the necessary approvals, described in the next slide.



Status messages

- Status message below the snapshot changes to “Installation in progress”



- After a few seconds, the status message updates to “Waiting for approval to install”



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Figure 6-29. Status messages

These status messages can be set by using the “Set installation status” integration service of System Governance Toolkit.

6.4. Managing access to Process Center

Managing access to Process Center

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Figure 6-30. Managing access to Process Center

Managing access to the Process Center

- Administrators control user access to process applications in the Process Center Console
- The Process Center Console displays security groups and users from the following sources:
 - IBM Business Process Manager internal security provider
 - External security provider
- Groups added in the administration section gain access to log in to IBM Business Process Manager through the authoring environment
- Users and groups are managed by using the Process Admin Console

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Figure 6-31. Managing access to the Process Center

The best way to manage access to Process Center and its repository is by using groups. For example, the easiest way to manage access to the Process Center repository is to add pre-existing groups of users from your external provider to tw_authors. tw_authors is an IBM BPM group whose members have access to the repository by default. Then, when changes are required, you can add or remove individual users from the groups that exist in your external security provider. This practice ensures that the security maintenance that you complete in your external provider does not require more work in IBM Business Process Manager.

The same is true for administrative access to the Process Center repository. You can add pre-existing groups of users from your external provider to tw_admins, which is an IBM Business Process Manager group whose members have administrative access to the repository by default.



Configuring IBM Process Designer access

- The groups `tw_authors` and `tw_admins` are authorized to access the Process Center repository by default
 - These accounts can log in to IBM Business Process Manager, but `tw_authors` do not have administrative privileges
- To add more users or groups of users:
 - Click **Manage Users > Add Users or Groups**
 - Groups now have access to log in to IBM Business Process Manager through Process Designer

A screenshot of the IBM Process Center Admin interface. The top navigation bar includes links for Process Apps, Toolkits, Servers, Admin, a help icon, and a search bar. The Admin tab is selected. Below the navigation is a sub-menu with three tabs: Manage Users (selected), Activity Log, and Registration. The main content area is titled "Admin" and shows a list of users: "tw_admins" and "tw_authors". To the right of the list is a "Remove" button with a trash icon. On the far right, there is a sidebar with buttons for "Add Users" and "Add Groups", and a link to "Admin".

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Figure 6-32. Configuring IBM Process Designer access

You must restart the server for Process Designer to recognize any new WebSphere Application Server Virtual Member Manager (VMM) User repository security groups or LDAP User repository security groups. After you restart the server, click **Add Group** to see the new groups.



Configuring administrator access

- By default, every user account in the `tw_admins` group has access to administer in the Process Center Console
- DeAdmin role can grant administrative access to other users
- Administrators can also create process applications and toolkits
 - To add more security groups or users as Process Center administrators, open the Process Center Console and click **Admin**
- Click **Manage Users**; then, add users or groups
- Enable **Admin** access in the left column

A screenshot of the IBM Process Center Admin interface. The top navigation bar includes links for Process Apps, Toolkits, Servers, and Admin. The Admin link is highlighted. Below the navigation is a secondary menu with options: Manage Users (which is selected and highlighted in green), Activity Log, and Registration. The main content area is titled "Admin" and lists two user groups: "tw_admins" and "tw_authors". Each group entry includes a small icon and a "Delete" link.

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Figure 6-33. Configuring administrator access

By default, IBM Business Process Manager includes the user in the DeAdmin role, which provides administrative access to the Process Center repository. This default administrator can grant administrative access to other users.

Configuring process application and toolkit access

- Set different levels of access to process applications and toolkits
 - Select the process application or toolkit
 - Click **Manage**
 - Click **Add Users/Groups** and select the access level
- There are three different access levels:
 - Read access
 - Write access
 - Admin access



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Figure 6-34. Configuring process application and toolkit access

The three access levels are as follows:

- **Read access:**
 - Can view process application or toolkit in Process Center Console
 - Can view all library items included in process application or toolkit in Designer view
 - Edits are not allowed
 - Mostly intended for use with toolkits
- **Write access:**
 - Can view process application or toolkit in Process Center Console
 - Can create, edit, or delete library items in the Designer view
 - Can also create and edit snapshots of process application or toolkit either in the Process Center Console or Designer view
- **Admin access:**
 - Have all capabilities included with write access, with more actions in the Process Center Console

- Can edit process application and toolkit settings
- Can create, edit, or archive workspaces
- Can archive snapshots
- Can modify user access to the process application or toolkit



Creating groups and adding users

The screenshot shows the 'User Management > Group Management' interface. On the left, a sidebar lists various groups: Debug, tw_admins, tw_allusers, tw_allusers_managers, tw_authors, tw_managers, tw_portal_admins, tw_process_owners, and twem. The 'tw_admins' group is selected and highlighted with a green background. On the right, the 'tw_admins' group details are shown, including its status as a 'Team Manager Group (deprecated)' and a note that it has 'No Team Manager Group'. Below this, there are 'Add Users' and 'Add Groups' buttons, and a list of users currently assigned to the group: bpmadmin (bpmadmin) and pcdeadmin (pcdeadmin).

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Figure 6-35. Creating groups and adding users

To create and maintain groups, log in as an administrative user, such as the default administrative user account, or an account that you added during installation that has administrator privileges. If you added a new administrative user, the user is added to the tw_admins user group. Members in the administrators group, by default tw_admins, can administer Process Servers, Performance Data Warehouses, and internal users and groups.

If you configured IBM Business Process Manager to work with an external security provider, you can view the groups from that external provider in the Process Admin Console, but you cannot edit the external groups. However, you can add users and groups from your external provider to any IBM BPM security groups that you create. You can also combine accounts from different providers into one group.

Authorization key information

- Users with Process Designer access can create process applications
 - If a user creates a process application, the user is automatically granted Admin rights to that application
- Process Server access
 - Useful to view progress in IBM Business Process Manager
 - Allows users to see how to interact with the application
 - Can be granted to business users or managers

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Figure 6-36. Authorization key information

If you want business users or managers to view progress, give them access to a Process Server instead of the Process Designer. It allows them to see how they interact with the application.

Administration of process applications

- If developers have administration access to a process application, they can authorize users and groups on that application
 - The Process Center console allows them to look up users and groups, and then add those users or groups directly to process applications they administer
- Many developers might add users instead of groups because they do not know the members of each security group if they are not in close communication with IBM Business Process Manager administrators

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Figure 6-37. Administration of process applications

6.5. Purging data in Process Center

Purging data in Process Center

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Figure 6-38. Purging data in Process Center

Process applications and toolkits (1 of 2)

- Archive a process application or toolkit
 - You can also archive snapshots
 - Does not delete the process application or toolkit, just removes it from the main view
 - Data still exists in the database
 - Restore the archived process application or toolkit later if needed
- Delete a process application or toolkit
 - Deletes the data from the repository, which includes snapshots and instances
 - You must archive first before deletion
 - No restore action available
- Archiving, restoring, and deleting can be done by using the Process Center Console only



Process applications and toolkits (2 of 2)

- Archive a process application or toolkit

The screenshot shows the 'Manage' tab selected for the 'Mortgage Application Process (MAP)' in the 'Process Apps' section. The 'Manage' tab is highlighted with an orange box. On the right side, there are two buttons: 'Archive Process App' and 'View Archived Tracks', both enclosed in orange boxes.

- Delete a process application or toolkit

The screenshot shows the 'Archived' tab selected in the 'Process Apps' section. The 'Archived' tab is highlighted with an orange box. On the right side, there is a 'Delete' button, which is enclosed in an orange box.

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Figure 6-40. Process applications and toolkits (2 of 2)

Snapshots

- Process Center holds snapshots of process applications and toolkits as they are developed
 - Includes named and unnamed snapshots
 - Named snapshots of a process application are deployed to a server runtime
 - Unnamed snapshots are created each time a business author saves in Process Designer
- Snapshots can be archived or deleted
 - Archive snapshots by using the Process Center Console
 - Delete snapshots by using either a wsadmin command or an automated method
 - Named snapshots must be archived first before deletion
- To delete snapshots, use the `BPMSSnapshotCleanup` command
 - Deletes both named and unnamed snapshots

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Figure 6-41. Snapshots

Over time, as process applications change, the number of snapshots can grow and can take up space in the Process Center database. In many situations, it is a good idea to purge unneeded or unnamed snapshots on a regular schedule. Unnamed snapshots are created every time a Process Designer user saves work. You can also accumulate named snapshots that were active at one time, but are no longer used.

The BPMSnapshotCleanup command (1 of 2)

- You must archive named snapshots before you delete them
- You cannot delete the first snapshot of a process application or toolkit
 - The first snapshot contains original information about the snapshot that is displayed in the history pane in Process Designer
- Run the command when there are no operations on Process Center or connections to Process Designer
- Deleting snapshots in batch provides better performance

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Figure 6-42. The BPMSnapshotCleanup command (1 of 2)

Because issues were discovered with the BPMDeleteSnapshot and BPMSnapshotCleanup commands, these commands require the interim fixes. For more information, see:

<http://www.ibm.com/support/docview.wss?uid=swg21669992>

The BPMSnapshotCleanup command (2 of 2)

- The BPMSnapshotCleanup command parameters:
 - containerAcronym: Where are the snapshots to be deleted
 - [containerTrackAcronym]: Where are the snapshots to be deleted
 - [containerSnapshotAcronyms]: Where are the snapshots to be deleted
OR
 - [keptNumber]: Number of unnamed snapshots to keep
OR
 - [createdBeforeLocal]: Delete unnamed snapshots that are created before this date
 - [createdAfterLocal]: Delete unnamed snapshots that are created after this date
 - [createdBeforeSnapshotAcronym]: Delete unnamed snapshots that are created before this name
 - [deleteArchivedSnapshot]: Delete archived named snapshots also; default is false
 - [ignoreDependency]: Delete even if other projects depend on this snapshot; default is false
 - [outputFile]: Fully qualified location to place the log file

Automating snapshot deletion

- You can configure automatic cleanup of unnamed snapshots
 - Removes unnamed snapshots only, does not remove named snapshots
 - Runs only if the server is running
 - Introduced in fix pack 1 (V8.5.0.1)
- Randomly chooses which process applications and toolkits to work on
- Removes unnamed snapshots in chunks of 100 to limit database contention
- Done by adding entries to the `100Custom.xml` file
 - Examine the results by using the `SystemOut.log` file for the server

```
<unnamed-snapshots-cleanup-config>
  <enabled>true</enabled>
  <cleanup-start-time>23:59:59</cleanup-start-time>
  <cleanup-duration-minutes>5</cleanup-duration-minutes>
  <clean-after-number-named-snapshots>4</clean-after-number-named-snapshots>
</unnamed-snapshots-cleanup-config>
```

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Figure 6-44. Automating snapshot deletion

Keep in mind the following points while you plan how to use this feature:

- Automatic deletion never removes named snapshots.
- Automatic deletion randomly chooses which process applications and toolkits to work on, so specify a duration that is long enough to process all the active projects in your Process Center.
- Automatic deletion removes unnamed snapshots in chunks of 100 to limit database contention. If the duration time expires before all the unnamed snapshots are removed, automatic deletion might not remove all the unnamed snapshots between two named snapshots.
- Automatic deletion runs only when the server is running. If the server is down when the configured start time occurs, automatic deletion will not run until the next time the deletion feature is configured to start.

The feature to automatically delete unnamed snapshots is controlled with a set of configuration options in the `100Custom.xml` file.

Advanced content in Process Center (1 of 2)

- A process application might have content from Integration Designer, which indicates an Advanced Integration service (AIS)
 - AISs are implemented in SCA modules and deployed as EAR files
- For every process application or toolkit that contains an SCA module or library, a business-level application (BLA) is created
 - BLA is created for the current snapshot and every named snapshot
- Each snapshot corresponds to its own set of EAR files
- Proliferation can happen quickly, especially on the Process Center server
 - Created either when doing a playback from Process Designer or when publishing to Process Center from Integration Designer
 - Can affect server start time, memory consumption, and general performance

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Figure 6-45. Advanced content in Process Center (1 of 2)

An Advanced Integration service is a collaboration between a business user that is working with IBM Process Designer and an integration developer that is working with IBM Integration Designer. For example, your business process might need a list of computer parts in your warehouses in Canada. Checking with an integration developer, you realize that a service is being built in Integration Designer to query the Canadian warehouses and return an inventory list of the computer parts available. You might create an Advanced Integration service that would use this Integration Designer service as an activity in your business process.

Advanced content in Process Center (2 of 2)

- Have a regular practice of deleting the BLAs and EARs if they are no longer needed
 - You can delete all BLAs except the ones of the process application snapshot tip
 - There is no built-in method for purging this content
- Archiving a process application causes the BLA to be uninstalled and deleted
 - Uninstallation of SCA BPELs causes instances to be deleted
 - A good practice is to use the AIS Facade pattern
 - You still get multiple copies of the facade EAR for each consuming process application
 - The EAR is smaller as it is only that small pass-through proxy

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Figure 6-46. Advanced content in Process Center (2 of 2)

If you have IBM BPM Advanced, you might have process applications and toolkits that contain advanced content, such as BPEL processes. In this case, you need to have a strategy for deleting the business-level applications (BLA) and enterprise applications that are created in the Process Center playback server by the existence of that content.



Deleting BLAs by using the Process Center Console

The figure consists of two screenshots of the IBM Process Center Console interface, labeled 1 and 2.

Screenshot 1: Shows the 'Hiring Sample Advanced (HSAV1)' screen. It displays two entries: 'Current' (Last changed on 5/13/14 by pcdeadmin, Not Yet Deployed to Process Center Server) and 'Hiring Sample Advanced v8501' (Created on 5/13/14 by pcdeadmin, Not Yet Installed to Process S). A context menu is open for 'Hiring Sample Advanced v8501', with the 'Deactivate' option highlighted. A callout box to the right of the menu says: 'To delete named snapshots, first use the **Deactivate** action'.

Screenshot 2: Shows the same screen after the 'Deactivate' action has been performed. The 'Hiring Sample Advanced v8501' entry now has a different status. A context menu is open for it, with the 'Undeploy' option highlighted. A callout box to the left of the menu says: 'To delete BLAs, use the **Undeploy** action'.

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Figure 6-47. Deleting BLAs by using the Process Center Console

Unit summary

- Describe the purpose and business value of Process Center
- Define the components of Process Center
- Describe how to manage the Process Center repository
- Describe how to use the Process Center Console to deploy, test, and manage process applications
- Manage access to Process Center
- Purge data in the Process Center environment

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Figure 6-48. Unit summary

Review questions

1. The authoring environment for BPMN processes is:
 - A. Process Center
 - B. Process Server
 - C. Integration Designer
 - D. Process Designer
2. True or False: Toolkits are deployable applications from Process Center.
3. True or False: Process Center serves as a repository for process applications, reusable toolkits, and monitor models.
4. True or False: Named snapshots must be archived first before deletion.



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Figure 6-49. Review questions

Write your answers here:

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

Review answers (1 of 2)

1. The authoring environment for BPMN processes is:
 - A. Process Center
 - B. Process Server
 - C. Integration Designer
 - D. Process Designer

The answer is D.

2. True or False: Toolkits are deployable applications from Process Center.
The answer is False. Toolkits are not deployable applications. Toolkits can be included as a dependency to a process application.



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Figure 6-50. Review answers (1 of 2)

Review answers (2 of 2)

3. True or False: Process Center serves as a repository for process applications, reusable toolkits, and monitor models.
The answer is True.

4. True or False: Named snapshots must be archived first before deletion.
The answer is True.



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Figure 6-51. Review answers (2 of 2)

Exercise: Administering Process Center

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Figure 6-52. Exercise: Administering Process Center

Exercise objectives

- Administer the Process Center environment
- Administer the Process Center repository
- Use the Health Center to verify the deployment environment
- Export, delete, and import a process application
- Use the Process Center Console to deploy a snapshot
- Use Business Process Choreographer Explorer to start a process instance
- Use the Process Admin Console to examine process instance details and statistical information
- Use the Process Inspector to examine details for a process instance



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Figure 6-53. Exercise objectives

Unit 7. Overview of Process Portal

Estimated time

00:30

Overview

This unit provides an overview of Process Portal.

How you will check your progress

- Checkpoint
- Lab exercise

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Explain the use of Process Portal
- Work with assigned tasks
- Use the Team Performance dashboard
- Use the Process Performance dashboard

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Figure 7-1. Unit objectives

Overview of Process Portal

- A simple, business-friendly user interface for effective task management and completion
 - Provides capability for business users to work with business processes and human services
 - Users can start and stop processes, manage and run tasks for each process, and view the performance of individuals, teams, and processes
- Provides the capability for users to complete the tasks that result from running processes on the Process Center server or a process server in a runtime environment
- Displays coaches for users to complete their tasks
- Collaboration capabilities among process participants and experts
- It is desktop and mobile ready

[Overview of Process Portal](#)

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Figure 7-2. Overview of Process Portal

Process Portal is used to run and test the business process applications in the various test and quality assurance environments. There are features for monitoring and managing all aspects of the business processes. If you decide to use Business Space as your production environment, then you want to be able to test your business processes there as well.

Process Portal can be customized to fit the graphical look and feel of each company. Customers might also opt to create their own process portal. However, it is important that you consider the value that you can get by reusing the portal capabilities that IBM Business Process Manager offers ready for immediate use.

Features of Process Portal

- Allows you to track the progress of your process instances
- The ability to request help from experts and collaborate with experts and other users in real time to complete work
- Highly configurable allowing users to view tasks and data that is relevant to their role
- The ability to add comments and attach documents to a specific process or task
- Subscription to process instances that a user is interested in, providing process-related notifications and activity updates
- Activity streams that display activity updates, such as task creation and completion, user comments and actions, and notifications
- Ability to bookmark a page to replace the default Process Portal start page

[Overview of Process Portal](#)

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Figure 7-3. Features of Process Portal



Process Portal interface

- Use a web browser to access Process Portal
`http://<host>:<port>/portal`

The screenshot shows the Process Portal interface. On the left is a navigation sidebar with the user profile 'pcdeadmin' at the top, followed by sections for Dashboards, Work, Processes, Process Performance, Team Performance, Launch, and Advanced HR Open New Position. The 'Work' section is currently selected. The main area is titled 'Work' and contains a search bar 'Enter search text...'. Below the search bar is a list of tasks: 'Task: ApproveReplenishmentOrder' (ReplenishmentBPD:3, All Users, Due: Jul 19, 2016 1:34 PM).

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Figure 7-4. Process Portal interface

The Process Portal interface includes the following items:

- The start page icon: Your designated start page is shown whenever you log in to Process Portal. You can bookmark a different page, including a search results page or a dashboard page, to be your start page.
- The Work page: This page contains both the tasks that you claimed to work on and the tasks that are available for you to claim.
- The Team Performance dashboard: Use this dashboard to monitor the performance of your teams and their members, and to balance workload across members of a team. You must be a member of a team of managers to access this dashboard.
- The Process Performance dashboard: Use this dashboard to monitor the performance of processes, and the progress of individual process instances. You must be a process owner to access this dashboard.
- The organize tabs icon: Click the icon to display a list of all the dashboards and saved searches that are available to you. Drag pages in the list to reorder the tabs and to designate which pages are visible. There are links to your user preferences page and logout. Click your name to work with your user preferences, for example, to update your business card information, or to change your notification preferences.

- The tabbed area: The tabs that are shown here depend on the Process Portal page that you are using.
- The other spaces icon: This icon is available only for Process Portal on IBM Business Process Manager Advanced. Click the icon to go to other Process Portal spaces.
- The copy link icon: Use this link to refer to the current Process Portal page in documents and emails, or to directly access the page in a browser window.



Process Portal layout

The screenshot illustrates the layout of the Process Portal. At the top, there is a header bar with a user profile (pcdeadmin), "Edit Profile", and "Log Out" options. Below the header is a navigation sidebar on the left containing:

- A "Dashboards" section with "Create Saved Search" and links to "Work", "Processes", "Process Performance", and "Team Performance".
- A "Launch" section with links to "Advanced HR Open New Position", "ReplenishmentBPD", and "Standard HR Open New Position".

The main content area on the right is titled "The work list" and features a search bar ("Enter search text..."). It displays a single task entry:

Task: ApproveReplenishmentOrder
ReplenishmentBPD:3
All Users
Due: Jul 19, 2016 1:34 PM

Below the task list, a yellow callout box labeled "Tasks that you can work on" points to the task entry. To the left of the sidebar, two callout boxes provide additional context:

- "Navigation to various dashboards" points to the "Dashboards" section in the sidebar.
- "Business processes that you can launch" points to the "Launch" section in the sidebar.

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Figure 7-5. Process Portal layout



Profile preferences

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Figure 7-6. Profile preferences

You can change the following settings in your user profile:

- Contact information, including a photo. Your photo appears in your posts and comments.
- Portal preferences. These preferences include settings for your working language, receiving confirmation messages when you claim a task, and receiving notifications by email or an IBM Connections notification.
- Notification preferences. By default, you receive a notification when an event occurs that affects you, for example, a task is assigned to you, an activity is updated, or you are mentioned in a post.

The first thing that you see is the profile picture, which is optional and can be changed at any time. The user information, such as title and contact information, comes from the user registry. It can be managed by using the bulk user attributes in the Process Admin Console or by directly editing the values in the profile. The rest of the profile is for configuring your preferences, such as language, calendar type, and notifications. Here, you can choose not to receive a confirmation message every time you claim a new task.



Work dashboard

- Provides a task list for the currently logged-in user
- Enables authorized users to view or work with process instances
- Default start page

The screenshot shows the Work dashboard interface. At the top, there is a search bar labeled "Enter search text...". Below the search bar, there are three task cards:

- Step: Approve / reject requisition**
Advanced Employee Requisition NG (List) for Tom Miller (4)
Due: Jul 19, 2016 3:34 PM
- Task: ApproveReplenishmentOrder**
ReplenishmentBPD:5
All Users
Due: Jul 19, 2016 4:04 PM
- Step: Submit job requisition**
Advanced Employee Requisition NG (List) for Roland Peisl (6)
Due: Jul 19, 2016 4:06 PM

Each task card has a small icon with a play button and a refresh symbol at the bottom right.

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Figure 7-7. Work dashboard



Process Portal coaches

The screenshot shows a process portal interface for approving a replenishment order. At the top, it says "Task: ApproveReplenishmentOrder ...". Below that, the title "Approve for Replenish Order" is displayed. The form fields include:

- Order ID:** OID_111
- Part number:** PN_111
- Quantity:** 500
- Order amount:** 25,000.00
- Approved:** A checkbox labeled "Approved" is checked.
- Comment:** An empty text input field.

At the bottom right of the form is a blue button labeled "Okay".

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Figure 7-8. Process Portal coaches



Processes dashboard

- Provides a list of active and completed instances
 - You can enter search filters to reduce the number of instances in the list

The screenshot shows the 'Processes' dashboard with the title 'Process Instances'. It includes a search bar, filter options for 'Active' or 'Completed' status, and a list of four process instances:

Process Name	Created	Due
Standard Employee Requisition for Tom Miller (Standard HR Open New Position)	July 29, 2016 12:38 PM	July 29, 2016 4:38 PM
Standard Employee Requisition for Tom Miller (Standard HR Open New Position)	July 29, 2016 12:40 PM	July 29, 2016 4:40 PM
ReplenishmentBPD:11	July 29, 2016 12:36 PM	July 30, 2016 12:36 PM
ReplenishmentBPD:12	July 29, 2016 12:37 PM	July 30, 2016 12:37 PM

Showing 4 out of 4 results

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Figure 7-9. Processes dashboard



Track the progress on a process instance

The screenshot shows the 'Manage Dispute Item:153' process instance. The interface is organized into several sections:

- Data (1):** Displays key business data: Credit Card Number (1234123412341234), Customer Email (riki@email.com), Customer Name (Rikki Ray), and other details like Dispute Amount (8.888.88) and Transaction Id (99).
- Documents (2):** Shows related documents: 'Customer...' (Admin, 3:50 PM), 'Dispute M...' (Admin, 12/10/15), and 'Rikki Ray ...' (Admin, 3:50 PM). A note indicates 'Retrieved items: 3'.
- Tasks (3):** Lists open and completed tasks: 'Step: Review Dispute Item' (Due: January 11, 2016 4:50 PM, Dispute Agents) and 'Step: Contact Customer' (Due: January 11, 2016 4:50 PM, Dispute Agents).
- Progress Bar (4):** A horizontal progress bar showing the status of a task. It includes a gear icon, a progress bar from 3:50 PM to 1:50 PM, and a note 'Stream'.
- Activities (5):** A section for other activities, with a 'Contact Customer' button and a note 'Ready | In Progress | Completed | All'.

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Figure 7-10. Track the progress on a process instance

1. Key business data
2. Related documents
3. Open and completed tasks
4. Progress bar and history stream
5. Other activities that can be performed



Modifying the Work dashboard (1 of 2)

Name	Instance name	Priority	Customer Name	Mortgage Amount
Step: Travel Request	Travel Request	Medium	Laga Vulin	2000000
Step: 2nd level A...	Process Mortg...	Medium	Ben Nevis	730000
Step: Evaluate re...	Process Mortg...	Received	Ben Nevis	730000
Step: Evaluate M...	Process Mortg...	Received	Glen Grant	190000
Step: Evaluate M...	Process Mortg...	Received	Glen Grant	190000
Step: Approve m...	Process Mortg...	Received	Ben Nevis	1000000
Step: Approve m...	Process Mortg...	Received	Glen Morangie	210000
Step: Approve m...	Process Mortg...	Received	Laga Vulin	2000000
Step: Approve m...	Process Mortg...	Received	James Son	1400000
Step: Approve m...	Process Mortg...	Received	Laga Vulin	1200000
Step: Activity	P1:133	Medium		
Step: Activity	P1:131	Medium		
Step: Activity	P1:130	Medium		
Step: Activity	P1:127	Medium		
Step: Activity	P1:121	Medium		
Step: Activity	P1:115	Medium		
Step: LOADER - ...	Mortgage Proc...	Very low		

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Figure 7-11. Modifying the Work dashboard (1 of 2)

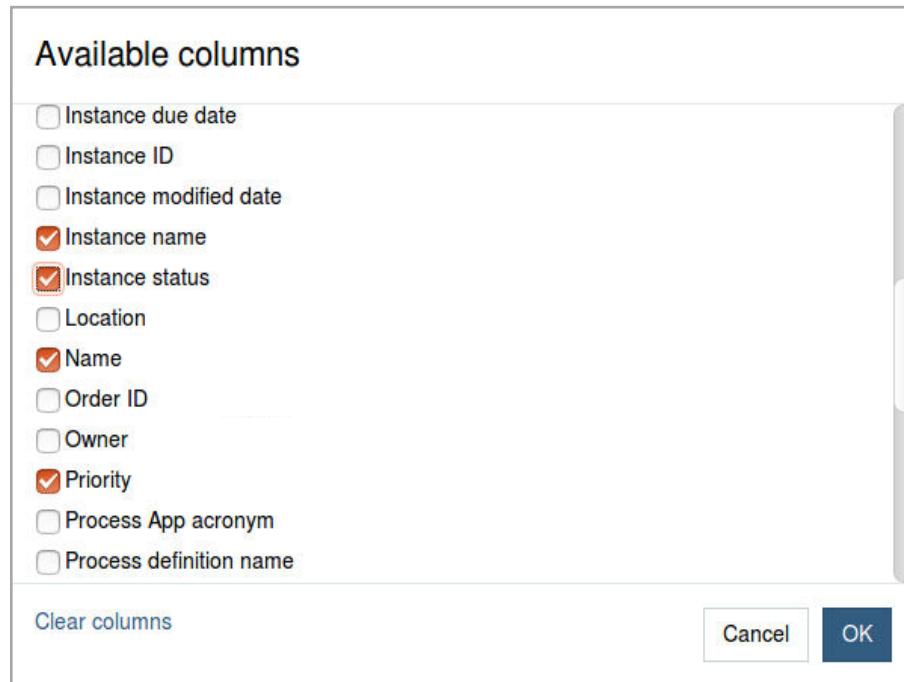
Process Portal is a powerful, yet flexible environment. As a user, there are a number of ways to configure the Process Portal to suit your individual needs. One way is to edit the columns that are displayed in the Work dashboard. Click the ellipsis (...) below the title bar to open the menu.

The number of total tasks and corresponding pages is limited to 500 tasks by default. This can be changed in process-search-engine-count-optimization configuration option in `100_Custom.xml`. Task counts are suffixed with a + when they are past the limit. It is possible to navigate beyond this limit by paging to the last page. When more pages are available, the user can page to the next available page.

When navigating beyond the limit, more available page is only available one at a time beyond the current page.



Modifying the Work dashboard (2 of 2)



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Figure 7-12. Modifying the Work dashboard (2 of 2)

This slide shows a list of available columns that can be displayed.

Process Portal actionable dashboards

- Process owners: Can view current performance against expectations
- Team managers: Can visualize and manage the work of their teams
- Participants: Can see their own task performance measurements
- Dashboards provide the ability to
 - Take action directly to resolve issues and balance work
 - Create custom dashboards by using coach views

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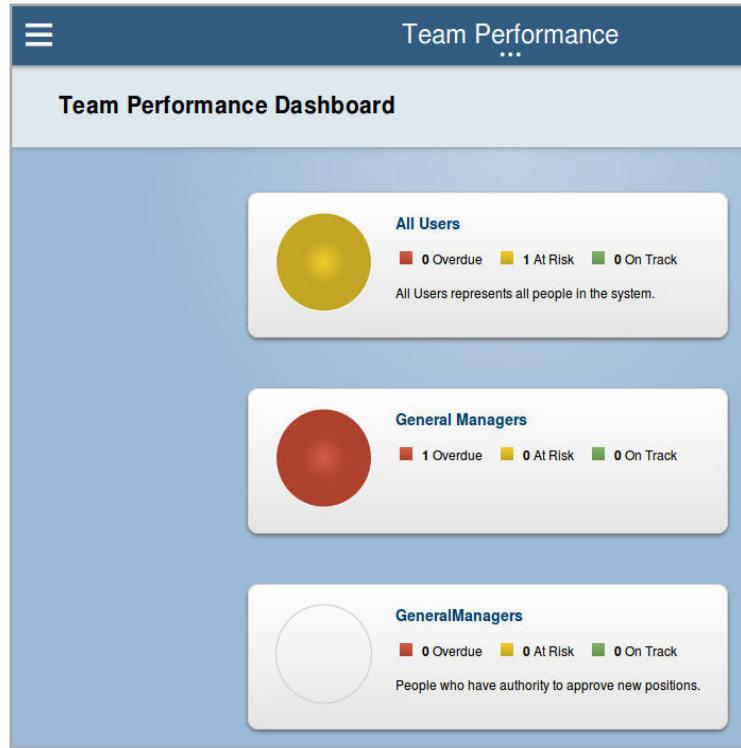
Figure 7-13. Process Portal actionable dashboards

IBM Business Process Manager provides built-in dashboards for visibility. These dashboards are appealing, functional, and powerful: **Team Performance** and **Process Performance**.



Team Performance Dashboard

- Accessible to users (Managers) that belong to tw_managers group and are managers of the teams
- Shows quick overview of a team status (At Risk, Overdue, On Track)
- Has a link to explore the team performance at a deeper level



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Figure 7-14. Team Performance Dashboard

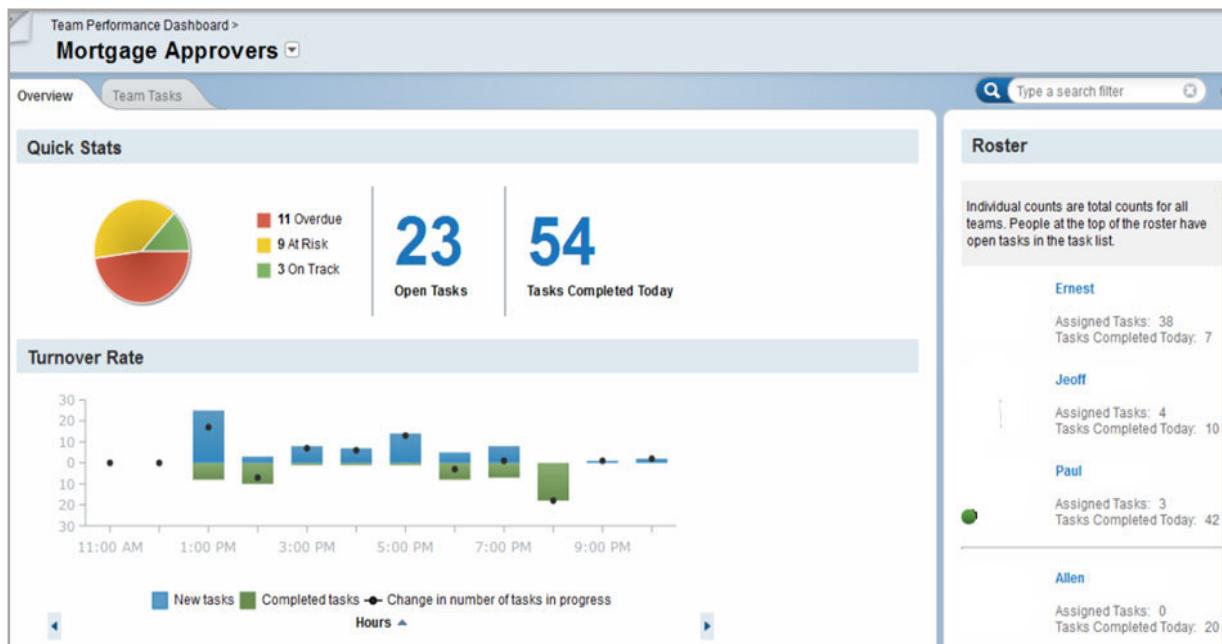
A dashboard uses charts and graphs to help you visualize status data for one or more business processes. To analyze and manage the work on your business processes, you can use the ready-to-use dashboards that Process Portal includes or the company-specific dashboards that your installation might provide.

Team Performance shows the status of the tasks for teams for which you are the designated team manager. You can manage the workload for the team and individual.

To see the Team Performance dashboard, you must be a member of the Managers team. To manage a team's tasks, you must be a member of a team of managers.



Team Performance: Overview



Overview of Process Portal

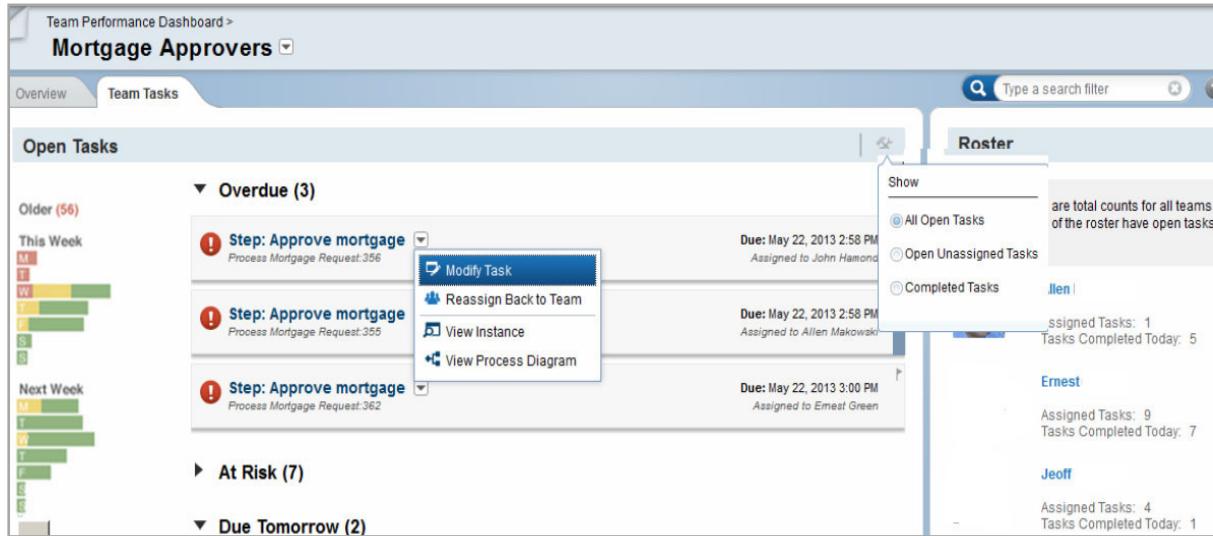
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Figure 7-15. Team Performance: Overview

- **Quick Stats:** Provides an overview of the tasks that are assigned to the team. This section includes counts for the open tasks and today's completed tasks. The open tasks are categorized as overdue, at risk, and on track. The average time to complete a particular task determines whether it is an *at risk* task. For example, if a task is due today but people need three days on average to complete this type of task, then the task is considered to be at risk.
- **Turnover Rate:** Provides an overview of the rate at which tasks are started and completed over time. The trend line indicates whether the team is catching up or falling behind with its work based on the difference between the task arrival and completion rates.
- **Roster:** The list of team members. For each team member, the list includes counts for the assigned tasks and today's completed tasks for all the teams to which the person belongs.

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Team Performance: Team Tasks



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Figure 7-16. Team Performance: Team Tasks

This page gives you a breakdown of the work in progress for the team. The information can help you to understand the status of your team's work and whether reallocating tasks to balance workloads is necessary. Use the search filter to display tasks in the list that meet certain filter criteria. All days and times are based on your time zone.

The Team Tasks page has the following sections:

- **Time period histogram:** Histogram of the task due date and status over time. The histogram is not available for completed tasks.
- **Tasks list:** The list of all the tasks that are assigned to the team. By default, the list of tasks contains both assigned and unassigned open tasks. You can change the view to show completed tasks or just the open, unassigned tasks.
- **Roster:** The list of team members. For each team member, the list includes the counts for the assigned tasks and today's completed tasks for all the teams to which the person belongs.



Team Performance: Reassign tasks

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Figure 7-17. Team Performance: Reassign tasks

You can take include the following actions:

- See the tasks for a specific due date and whom they are assigned to by clicking a bar in the histogram. The tasks list shows the associated tasks. The people at the top of the roster own the tasks in the filtered list.
- Filter the tasks in the list by entering a search filter. The histogram is also filtered to show only the tasks that apply to the search filter. Clear the filter by clicking the X icon at the end of the search filter field.
- Assign or reassign tasks in the list by hovering over an assigned name.
- See the dashboard for an individual team member by selecting the person's name in the roster.
- See the business data for the task by clicking the shaded area of the task.
- Act on the task by clicking the arrow to the right of the task name and selecting an action from the list.



Search functions

The screenshot shows the 'Team Tasks' dashboard in the IBM Process Portal. On the left, there's a calendar view for the current week, with Friday highlighted in green. The main area displays 'Open Tasks' categorized by due date: 'Overdue (1)', 'At Risk (1)', and 'Due This Week (4)'. Each task item includes a subject line, due date, and an 'Assign' button. To the right, a search bar is active, showing a dropdown menu of various filter options like 'Assigned', 'At Risk Date', etc. Below the search bar is the 'Roster' section, which lists users with their assigned tasks and completion status.

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Figure 7-18. Search functions

While you are working with process instances or tasks in the Process Portal dashboards, you can filter the processes or tasks that are shown.

On dashboard pages, a filter can consist of a field, such as Task ID or Instance ID, and a term, or just an individual free-text search term. As you type your filter, a list of the available fields is shown. Choose a field, or press Esc to continue typing your search term. Searches can include several filters.

Exit the filter by pressing the Spacebar twice, or by pressing the right arrow key.

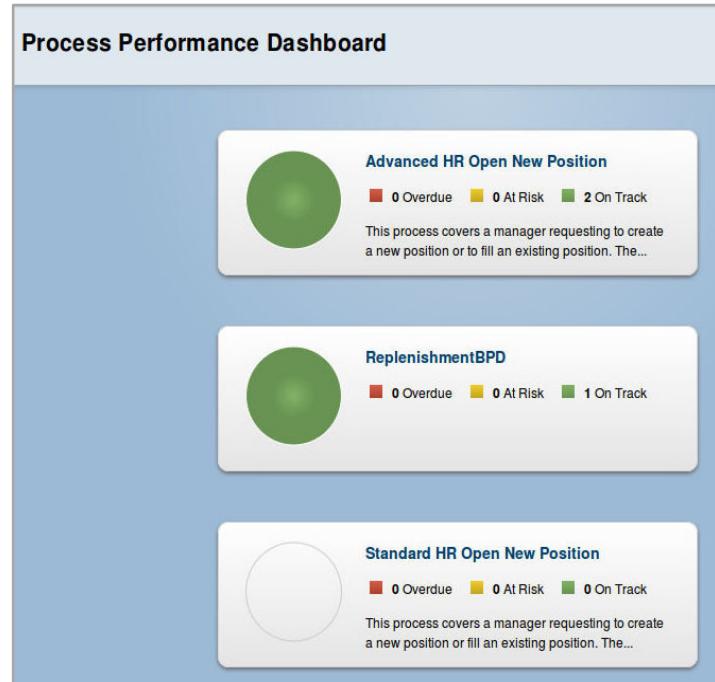
Apply your filters to the dashboard page by pressing Enter.

Clear the filters by clicking the X icon at the end of the search filter.

The default fields that are listed on the page are available for search filters on dashboard pages. You might see more business data fields that are specific to your environment. To see a list of all the available fields, enter an asterisk (*) as the search filter.

Process Performance Dashboard

- Access is given to team members of teams that are set in “Expose Performance Metrics” in Process Designer
- Shows quick overview of process status (At Risk, Overdue, On Track)
- Has a link to explore the process performance at a deeper level



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Figure 7-19. Process Performance Dashboard

Process Performance shows the status of the active instances of particular processes in your organization. You can act on individual process instances to resolve issues, such as bottlenecks.

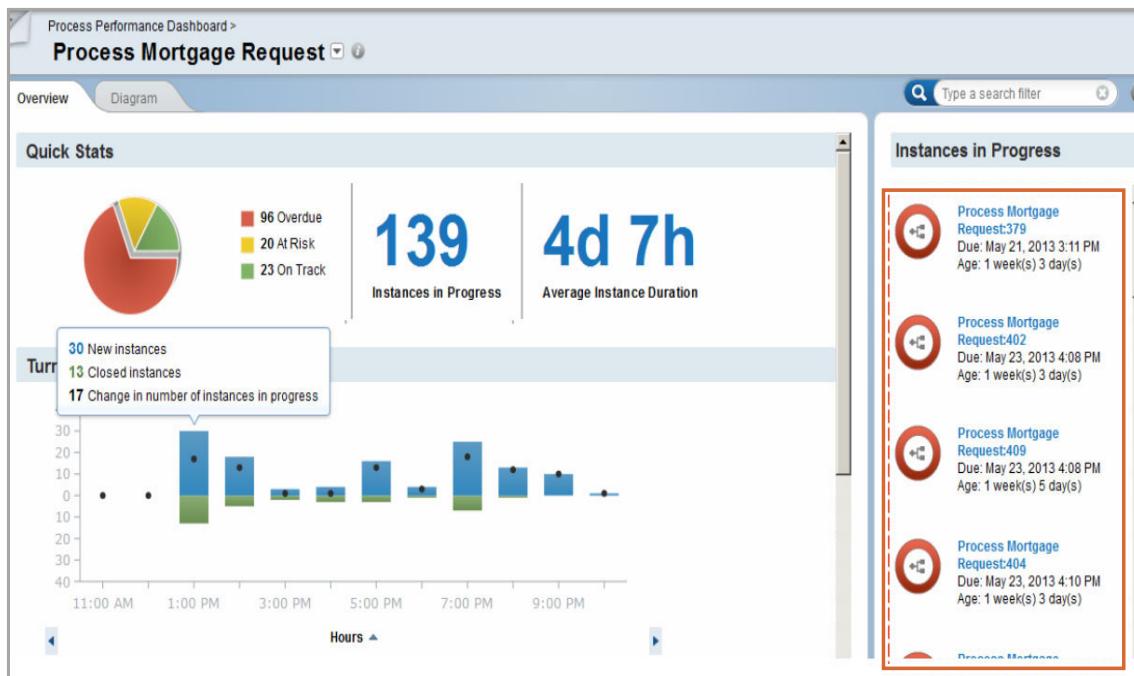
To see the Process Performance dashboard, you must be a member of the Process Owner team.

To see a specific process in the dashboard, you must be a member of the team that is assigned to the Expose Performance Metrics setting for the business process definition.

Other users can view the process instance that is associated with the task that they are working on.



Process Performance: Overview



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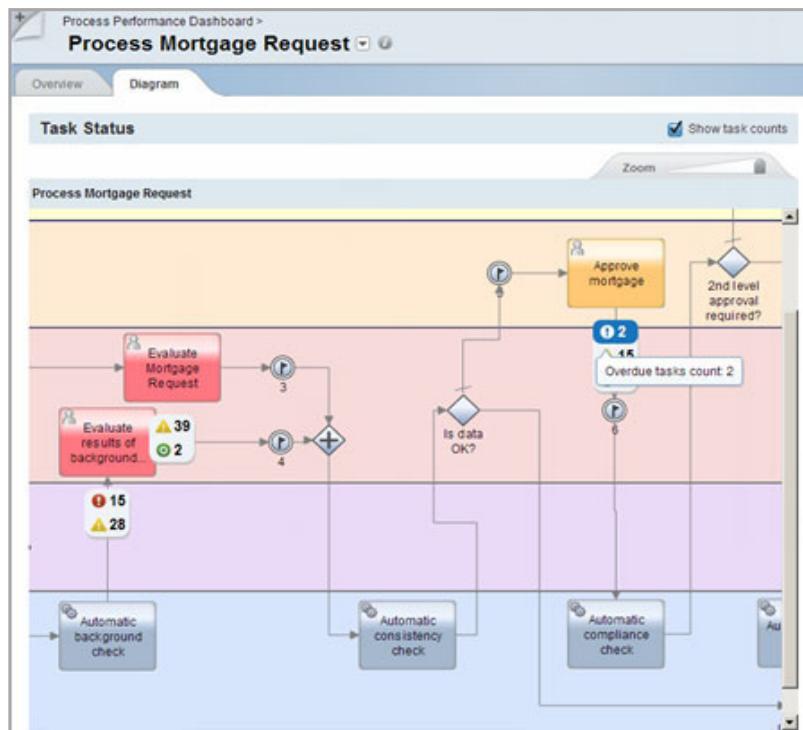
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Figure 7-20. Process Performance: Overview

Click the red area under the Quick Stats to view list of overdue tasks on the right under Instances in Progress.

Process Performance: Diagram

- Shows a graphical view of the process aggregated over all instances in progress
- Counters that are below the tasks show
 - How many inflight tasks
 - Broken down by status (at risk, overdue, or on track)
- Instances in progress pane
 - Shows what is selected in the Tasks Status pane



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Figure 7-21. Process Performance: Diagram

Click the **Diagram** tab. The dashboard shows the process diagram and consolidated information about its tasks. Keep in mind, that here you are not looking at a specific instance; you are looking at the behavior of the process overall, in statistical terms.

Unit summary

- Explain the use of Process Portal
- Work with assigned tasks
- Use the Team Performance dashboard
- Use the Process Performance dashboard

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Figure 7-22. Unit summary

Review questions

1. Which dashboard would you use to manage the work of the team members that you are responsible for?
 - A. Team Performance
 - B. Process Performance

2. Which dashboard would you use to identify processes that need attention, go to individual instances, and act to bring them back on track?
 - A. Team Performance
 - B. Process Performance



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Figure 7-23. Review questions

Write your answers here:

- 1.

- 2.

Review answers

1. Which dashboard would you use to manage the work of the team members that you are responsible for?
A. Team Performance
B. Process Performance
The answer is A.

2. Which dashboard would you use to identify processes that need attention, go to individual instances, and act to bring them back on track?
A. Team Performance
B. Process Performance
The answer is B.



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Figure 7-24. Review answers

Exercise: Administering Process Portal

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Figure 7-25. Exercise: Administering Process Portal

Exercise objectives

- Explore Process Portal capabilities
- Use Process Portal to claim a task
- Work with tasks
- Explore the Process Performance dashboard
- Explore the Team Performance dashboard



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Figure 7-26. Exercise objectives

Exercise: Purging content in Process Center

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Figure 7-27. Exercise: Purging content in Process Center

Exercise objectives

- Archive and delete process applications
- Manage and delete snapshots both named and unnamed
- Configure an automated method for deleting unnamed snapshots
- Use the Process Admin Console to monitor the environment
- Use Process Portal to monitor process applications
- Purge data in the Process Center environment



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Figure 7-28. Exercise objectives

Unit 8. Introduction to IBM Process Server

Estimated time

01:00

Overview

This unit provides an overview of Process Server and defines its three basic areas.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Explain the role of Process Server and WebSphere Enterprise Service Bus in the SOA development cycle
- Explain the purpose and business value of using the Process Server and WebSphere Enterprise Service Bus functional components:
 - SOA core components
 - Supporting service components
 - Service components
- Describe the role of mediation services in Process Server and WebSphere Enterprise Service Bus
- Define the concept of mediation modules

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Figure 8-1. Unit objectives

This unit provides an overview of WebSphere enterprise technologies. There is a brief introduction to Process Server, including a definition of its basic areas. Next, both tools and runtime are examined as they pertain to the course. Finally, process choreography is briefly examined.

Topics

- Process Server overview
- WebSphere Enterprise Service Bus overview
- Service-oriented architecture: Core components
- Service-oriented architecture: Supporting services
- Service-oriented architecture: Service components
- Process Server components

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Figure 8-2. Topics

8.1. Process Server overview

Process Server overview

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Figure 8-3. Process Server overview

Process Server: The heart of SOA

- Provides execution of standards-based business process management solutions in SOA
- Implements a WS-BPEL compliant process engine that runs complex business process automation
- Provides building of composite integration applications
- Provides high performance and qualities of service with fault tolerance and error-detection capability
- Includes a prebuilt Web 2.0 business user client (Business Space)
- Completes the lifecycle of business process management as the runtime engine for deployed applications

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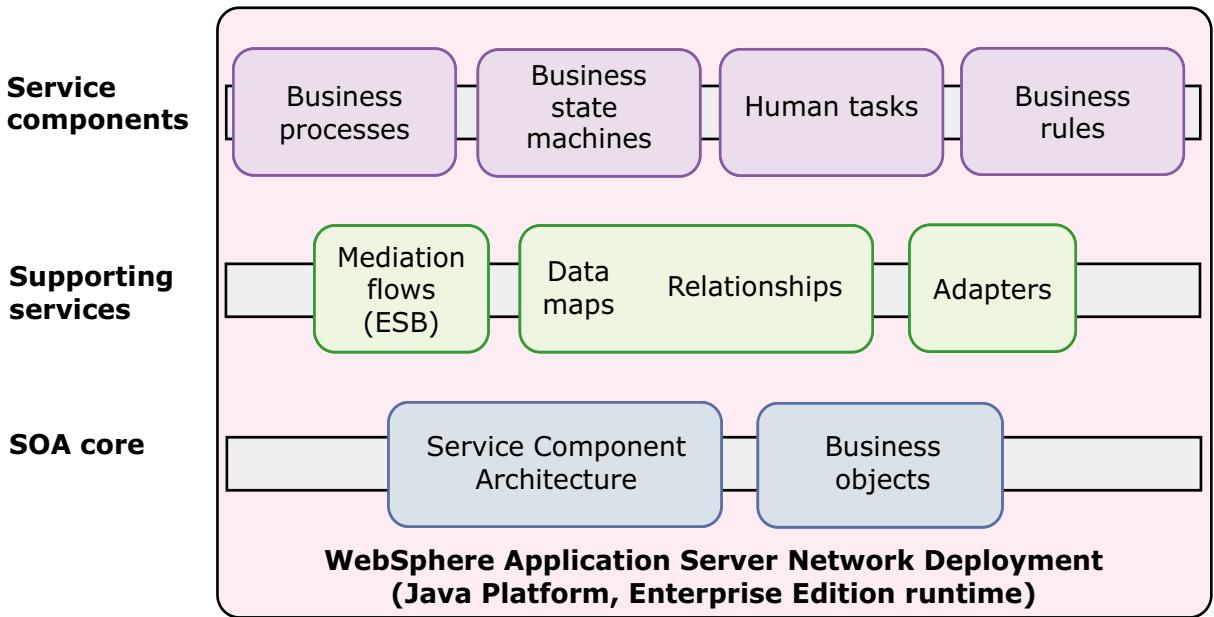
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Figure 8-4. *Process Server: The heart of SOA*

Process Server implements a Web Services Business Process Execution Language (WS-BPEL) compliant process engine. This process engine runs complex business process automation securely, consistently, and with transactional integrity by using advanced human workflow, business rules, system-to-system, and B2B capabilities.

Process Server component architecture

- Process Server adds process integration components to the WebSphere platform and includes WebSphere Enterprise Service Bus mediation capability



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Figure 8-5. Process Server component architecture

Service Component Architecture separates business logic from implementation so that you can focus on assembling an integrated application without knowing implementation details. The implementation of business processes is contained in service components. The result is an architecture that is composed of the following three layers as shown in the diagram:

- Service components
- Supporting services
- SOA core

8.2. WebSphere Enterprise Service Bus overview

WebSphere Enterprise Service Bus overview

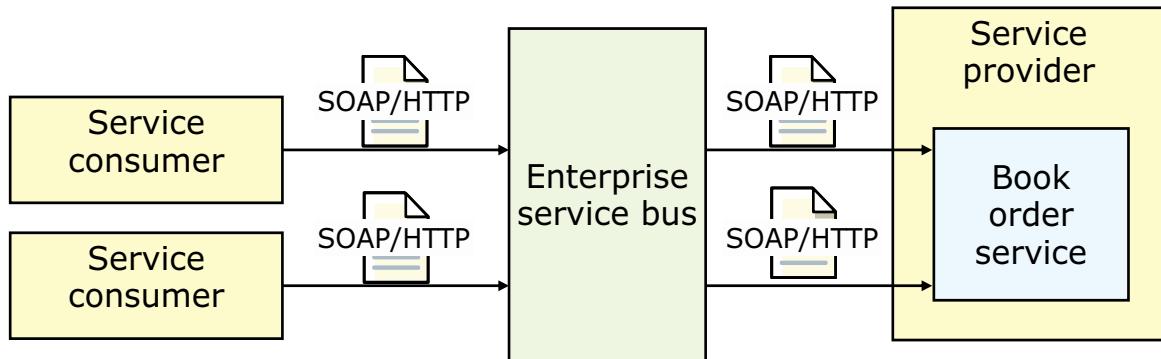
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Figure 8-6. WebSphere Enterprise Service Bus overview

What is an enterprise service bus?

- Middle-tier architecture that sits between service consumers and service providers
- Mediates messages between service consumers and providers
 - Service consumers send request messages for services to an enterprise service bus
 - The enterprise service bus passes the request to the relevant service hosted in the relevant service provider
- Reduces coupling between service consumers and providers



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Figure 8-7. What is an enterprise service bus?

The service consumer uses the Web Services Description Language (WSDL) describing the service to determine how to format the message to send to the service provider.

Purpose of an enterprise service bus (ESB)

- An ESB (as an architectural construct) reduces the number, size, and complexity of interfaces
- An ESB separates business logic concern from integration logic
 - Business logic: Targeted at achieving specific business goals
 - Integration logic: Targeted at achieving interconnectivity between application service requesters and providers
- An ESB does the following functions:
 - **ROUTING** messages between services
 - **CONVERTING** transport protocols between requester and service
 - **TRANSFORMING** message formats between requester and service
 - **HANDLING** business events from disparate sources

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Figure 8-8. Purpose of an enterprise service bus (ESB)

An enterprise service bus (ESB) can help you to achieve the goal of an SOA. It is a flexible connectivity infrastructure for integrating applications and services. It is at the heart of a SOA, powering the SOA by reducing the number, size, and complexity of interfaces.

8.3. Service-oriented architecture: Core components

Service-oriented architecture: Core components

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Figure 8-9. Service-oriented architecture: Core components

Service Component Architecture

- SCA is a programming model for declaring relationships between services in SOA applications
 - Provides a single abstraction for service types that are implemented as web services, BPEL, and others
 - Creates reusable platform and implementation-neutral service components
- SCA core concepts:
 - Services (implemented in various ways) called components
 - Each component has interfaces
 - Caller of a component has a reference to that component
- Components are wired together in an assembly diagram
 - Wiring describes relationships between components
 - Code needed to realize relationships that are generated automatically

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Figure 8-10. Service Component Architecture

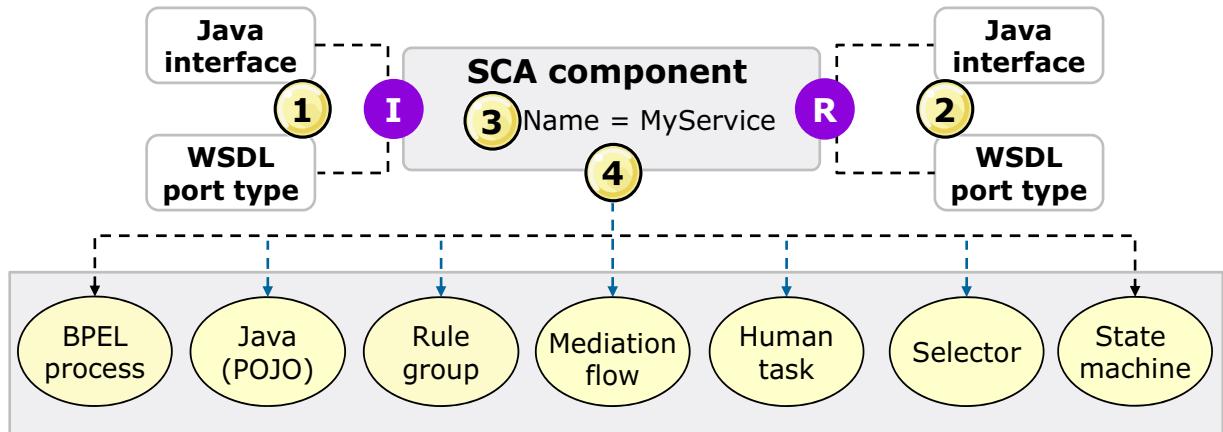
SCA is a service-oriented component model for defining and starting business services that publish or operate on business data. SCA is aimed at providing a simplified programming model for writing applications that run on a Java Platform, Enterprise Edition runtime environment. It is based on concepts and techniques that are refinements of existing Java Platform, Enterprise Edition technology. One of the important aspects of SCA is to provide a separation between application business logic and the implementation details. To accomplish this aspect, SCA provides a single abstraction for service types that might already be expressed as session beans, web services, Java classes, or BPEL. The ability to separate business logic from infrastructure logic helps reduce the IT resources that are needed to build an enterprise application. It gives developers more time to work on solving a particular business problem rather than focusing on the details of which implementation technology to use.

Service Component Definition Language (SCDL) is the basis of SCA. SCDL is an XML-based definition language, and it is used to define all SCA artifacts in a project. Integration Designer supports SCA by generating the appropriate SCDL definitions when building an SCA-based application. However, a basic familiarity with SCDL can certainly help you to understand the overall architecture and how to debug applications. A component file that is created with SCDL is roughly analogous to an EJB deployment descriptor in that it defines the interface, implementation, and several qualities of service requirements of an SCA component.

It is also important to understand the different types of artifacts that can be defined by using SCDL. The various artifact types that exist in SCA were designed to support some of the basic requirements of SOA. First, SCA needs a mechanism for defining a basic service component. After there is a mechanism for defining service components, it is important to make these services available to clients that are either inside or outside of the current SCA module. In addition, a construct is designed to import and reference services that are external to the current SCA module. Finally, SCA provides constructs for composing services and modules into larger applications. In the remaining slides of this section, you learn about each of these SCA artifacts and how they can be composed into larger applications.

SCA components

- SCA components are discrete units of business logic that contain:
 - 1. Interfaces:** Are used to call the component
 - 2. References:** Are used to call other components
 - 3. Name:** Unique in the SCA module
 - 4. Implementation:** A representation of the service type (the physical implementation is separate from the SCA component)



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Figure 8-11. SCA components

Each service component must have a unique name within the SCA module, and it must match the file path relative to the module root. In Windows environments, keep component names as short as possible to avoid path limits. Component names also must follow a standard naming convention to allow reuse.

The service component definition is included in a file that is called `<SERVICE_NAME>.component`. Each service component can have zero or more interfaces that are associated with it; these interfaces can either be Java or WSDL `portType` interface definitions. The interfaces that are associated with a service component can support either a synchronous or an asynchronous interaction style with clients that call the service.

Each service component can be implemented in various ways, which the implementation definition specifies. Service components can invoke other service components or imports that are defined in the current service module. When a component invokes another component or import, the appropriate reference must be defined to indicate which service is used. Often this type of reference is “inline” in the service component definition (although it might alternatively be placed in a stand-alone reference file). Each service component definition might have zero or more references to other services called by the service component that is being defined.

- **SCA** is a universal model for business services that publish or operate on business objects.
- **SCA services** are represented as an **SCA component**.

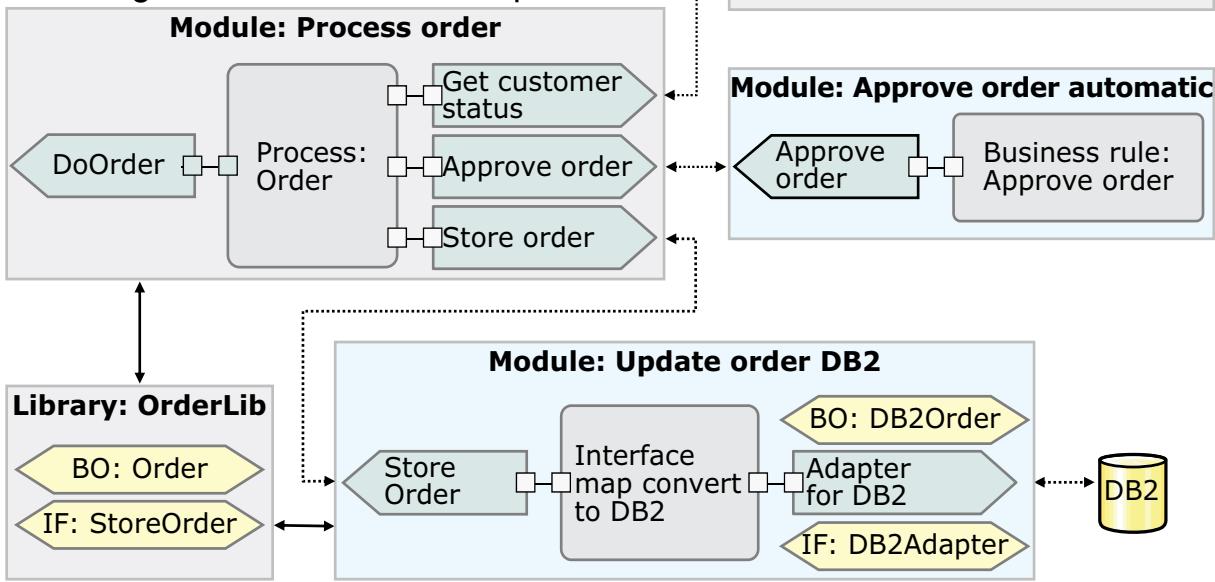
- A **service** can have many different implementations, for example: Java, BPEL, and state machines.
- Services focus on the business purpose, rather than on the infrastructure technology.
- The same implementation artifact can be reused many times:
 - The **implementation** is the *template*.
 - The **component** is the *configuration*.
- A **service interface** is defined by either a *Java interface* or a *WSDL portType*.
 - Parameters and return values are described by using **Java classes**, **simple Java types**, or **XML schema**.
 - Parameters that are described in **XML schema** are exposed as **business objects**.
- **Services** can be *composed* of other services and components, allowing for structured reuse.
 - Services reference other services through symbolic links that are called **service references**.
- **Service references** are resolved by **wires**; you use SCA wiring to combine SCA modules in the component assembly editor. Using the assembly editor, the interaction between services can be visually defined.

For more information about the current progress of the SCA specification and proposals for other implementation types, see the Apache Tuscany specification at:

<http://incubator.apache.org/tuscany>

SCA: Using modules for building applications

- SCA is the component model
- Components can be wired together
- Business objects are the data that is flowing on wires between components



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Figure 8-12. SCA: Using modules for building applications

Services are packaged in a service module, which is the basic unit of deployment and administration in an SCA runtime. The granularity of a module might be based on business functions and version requirements; that is, components whose versions are created independently might be placed in separate modules.

Here is an example in which a business integration application comprises four modules, each covering a specific business function. The implementation team wanted to change the human task Approve order to a business rule implementation and substitute the SAP with a DB2 system.

Here is what happened. The team changed the component implementation from human task to business rule, leaving the component interface untouched. They substituted the SAP with a DB2 system, so they must change the update module to reflect that change. They needed to change the existing interface map, add a different adapter, and add new business objects that reflected the data structure of the data object in DB2. But that is all they needed to do. The main point is that it was not necessary to change the process itself. The process module remained untouched. Thus, if you implement the application with the right granularity, you can change it quickly and flexibly.

The business value of modules can:

- Provide module granularity according to business needs
- Leave process logic untouched

- React to change quickly without affecting common objects or consumers

An **export** processes incoming requests from outside the SCA module:

- Its reference is associated with a specific interface type
- It is the source of a connection to an SCA component by using a wire

An **import** processes outgoing requests to components outside the SCA module:

- It contains a specific interface type
- The interface is the target of a reference by using a wire

Business objects: Common data model

- Business objects are collections of elements with names and data types
- Access to data is independent of the physical representation
- Data manipulation does not require connection to data source
- Business objects represent the data that is flowing between SCA components in a service-oriented architecture
- Component interfaces use business objects as inputs and outputs

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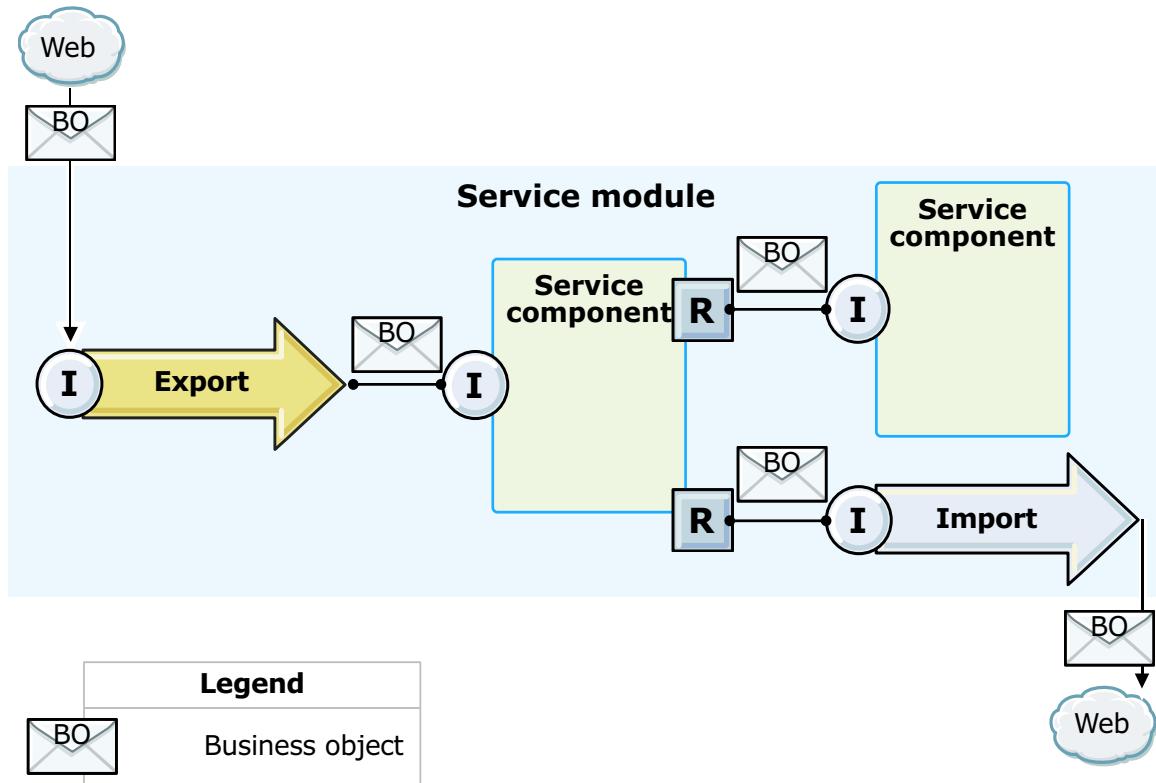
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Figure 8-13. Business objects: Common data model

Within IBM Process Server, IBM provides a logical abstraction of information, which is called the business object. The business object is a description of information that is a named collection of attributes or fields. Each attribute consists of a name and a data type. After it is created, the business object defines a template for an instance of data. A core concept of the business object is that its underlying representation is not disclosed. The business object is the set of fields and their logical data types. Nothing is said about their physical representation. By using this abstraction, you can treat data in the loosest possible manner, so that you can concentrate on what the data means as opposed to any notion of how the data is represented.

The value of business objects comes with the realization that you no longer are required to work with various different representations of data. Instead, you can focus on the use of the information as opposed to the individual challenges of specific data representations. Within IBM Process Server, you can use a business object at any location where you can use data.

Business objects: Data abstraction for SCA



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Figure 8-14. Business objects: Data abstraction for SCA

Business objects (SDOs) are the primary data abstraction for the Service Component Architecture (SCA).

This diagram illustrates how SCA provides the framework to define service components and compose these services into integrated applications. It further shows that business objects represent the data that flows between services. Whether the interface that is associated with a particular service component is defined as a Java interface or a WSDL portType, the input and output parameters are represented by using business objects. The data abstraction for SCA is achieved through business objects (SDO), and the SCA programming model is used to manage invocation.

8.4. Service-oriented architecture: Supporting services

Service-oriented architecture: Supporting services

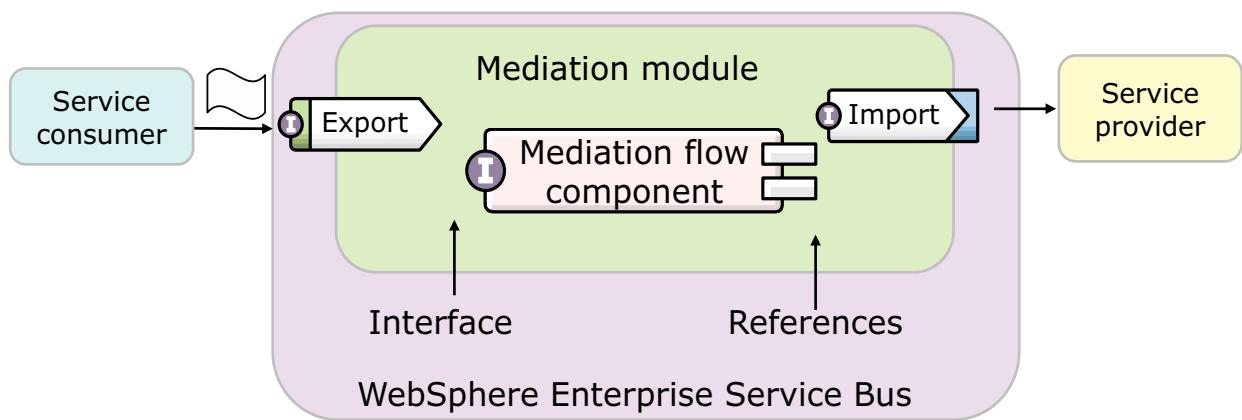
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Figure 8-15. Service-oriented architecture: Supporting services

Mediation flows in WebSphere Enterprise Service Bus

- Mediations intercept messages between the service consumer and provider
 - Mediations centralize logic to handle events, route, transform, and convert data
 - Imports and exports define the interactions with external service consumers and service providers
- Mediation components are concerned with the flow of messages in the infrastructure



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Figure 8-16. Mediation flows in WebSphere Enterprise Service Bus

From an external view, mediations in WebSphere Enterprise Service Bus are displayed as WSDL endpoints. The service consumers have the view that they are using a service that is described in the WSDL with an endpoint that terminates on the bus.

WebSphere Enterprise Service Bus provides prebuilt components that are called mediation primitives that can be used in mediation flows for Extensible Stylesheet Language Transformations (XSLT), logging, routing, and database lookup (also custom mediation primitives).

The mediation module can process, or mediate, service interactions. Mediation means that the service request can be intercepted before receipt by the service provider, and an appropriate enterprise service bus behavior can be triggered upon receipt of that service interaction. The primary characteristic of an enterprise service bus is to configure routing, transformation, logging, and to enable event-driven processing. The mediation module uses the specified subset of supplied, or built-in, mediation primitives, which provide basic enterprise service bus behaviors. Custom mediation primitives might be developed in Java, which extends or tailors the ESB capability to meet specific requirements.

The mediation module is externalized or made available through an export that specifies the interfaces it exposes, which is defined in a WSDL document. The mediation module typically starts other service providers, which are represented as a *reference* to an import that is an external service that can be started.

Integration developers create particular SCA components that are called mediation flow components. A mediation flow component provides a mediation service that is implemented by using mediation flows. A mediation flow component that is created in the assembly editor of IBM Integration Designer has the following parts:

- One or more interfaces that describe how to start the mediation flow. These interfaces must match the interfaces of the exports that are wired to this mediation flow.
- Zero or more named references that specify the interfaces of partners that this flow wants to start. The actual partners are not known to the flow, only their interfaces. These references are wired to actual partners that are imports or Java components, with matching interfaces.
- Mediation flows, which define the implementation of the component.

WebSphere Enterprise Service Bus: Key concepts

- Mediation module
 - Special type of SCA module
 - Mediate messages that flow between service requesters and providers
- Mediation flow component
 - Contains the mediation flow logic
 - Unique flow logic for every interface operation
 - Modules can contain zero or multiple mediation flow components
- Mediation primitives
 - Are used to construct the logic of a mediation flow
 - Each primitive does a specific part of the flow logic
 - An encapsulated unit of logic that manipulates the message as it passes through the enterprise service bus
- Service message object (SMO)
 - Internal representation of message body and headers
 - Mediation primitives act upon the SMO within the mediation flow

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Figure 8-17. WebSphere Enterprise Service Bus: Key concepts

The service message object (SMO) provides an abstraction layer for processing and manipulating messages that are exchanged between services.

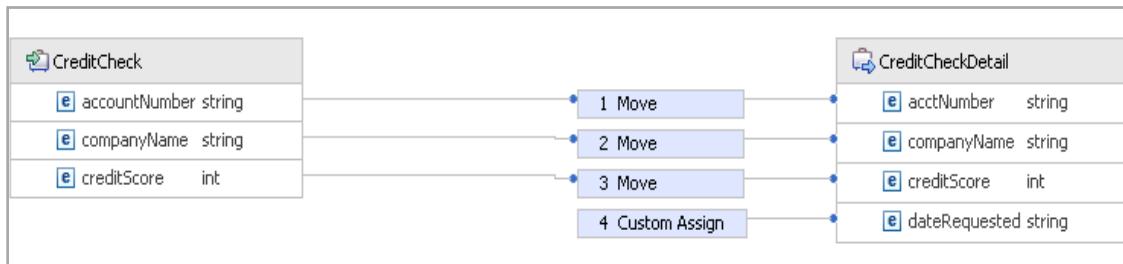
Data passing through mediation flows is represented as the SMO. The SMO is considered to be an envelope that contains the following groups of data:

- Context information (data other than the message payload and headers).
- Header information that is associated with the message. An example would be Java Message Service (JMS) headers if a message was conveyed by using the JMS API, or MQ headers if the message came from WebSphere MQ.
- The body of the message, which is the message payload, is the application data that is exchanged between service endpoints.
- Message attachments.

The SMO is a DataObject and its content can be accessed with the Service Data Object API (SDO API). SDO is a standard for representing structured business data. The body of the SMO contains a business object that represents the application payload.

Transformation components: Business object maps

- Interfaces between components can accept business objects as inputs or outputs, but the attributes might be different
- Business object maps then map attributes in one business object to another
- Various supplied transformation rules cover most needs



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Figure 8-18. Transformation components: Business object maps

Business object maps are only necessary for relationships in Process Server.

The business object provides a consistent way of representing data, and even then a challenge must be addressed. Although passing data from one application to another is not a challenge, the data content that the receiver expects might not be what is sent. For example, you might want to know the current temperature at the beach. Suppose that you expect that value in Fahrenheit, but it is sent to you in Celsius.

What is needed is the ability to transform a business object that has meaning to others into a business object that is meaningful to you. If this statement sounds like just another face of an old problem of application integration, that is partially true. However, with the existence of the business object abstraction, you have a much simpler challenge because the only data structures you work with are at the highest possible abstraction layer.

Process Server can map from one business object representation to another. Integration Designer provides a graphical tool to map from one business object to another. The resulting map is then available for execution through the services of the IBM Process Server runtime.

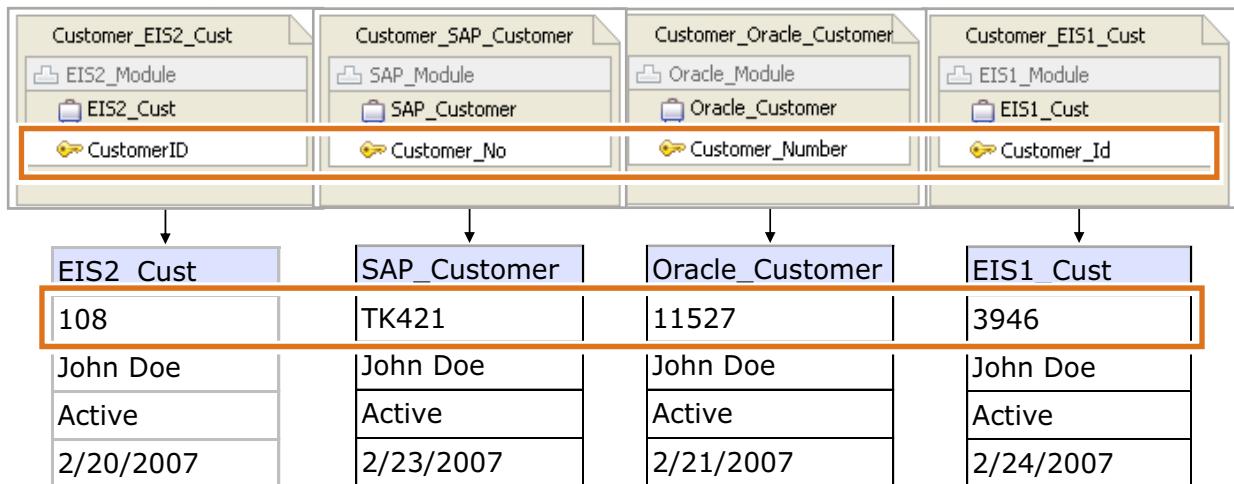
Business object mapping:

- Transforms business objects from one type to another as they flow through the IBM Process Server system

- Defines the transformation rules between the source and destination data
- Is required when argument types in the source and target interface operations are incompatible

Transformation components: Relationships

- A relationship establishes associations between semantically equivalent business entities
 - For example, customer business objects in different EIS applications with different keys
- IBM Process Server manages the relationship data, not the application, simplifying the task for the developer



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Figure 8-19. Transformation components: Relationships

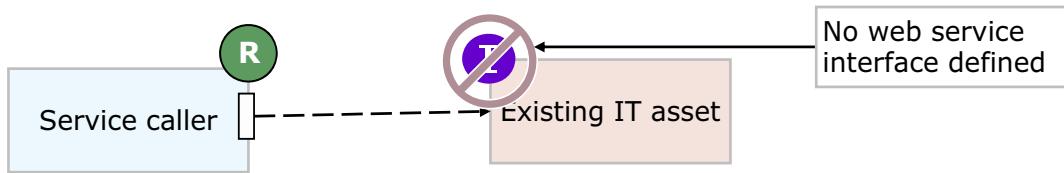
Relationships are used to establish associations between attributes of multiple related business entities. These attributes cannot be mapped because:

- The enterprise information system (EIS) applications maintain their own mechanisms for generating unique values for those attributes, so they cannot be copied across the integration environment.
- An attempt to implement transformations without relationships would be complicated, especially if a cross-reference is needed for subsequent processing.

Different applications might have different ways of uniquely identifying the same dynamic data. In EIS2, the customer number is a numeric value, for example, 108 in the slide graphic. In SAP, an alphanumeric value is used. You cannot map these values from the source to the target. You can use a dynamic relationship to correlate the key value in one system with the key value in another. Dynamic relationships can be used in a business object map mediation primitive and also in a business object map.

Adapters

- Adapters provide integration with enterprise information systems (EIS) that do not provide service interfaces
 - Adapters provide a layer of abstraction
 - This layer of abstraction isolates the developer from the complexities of the EIS system
 - Simplifies integration
 - Adapters use existing IT assets in your SOA
- The adapter presents a service interface to your SOA components, while the adapter communicates directly with the asset by using whatever technology is appropriate



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Figure 8-20. Adapters

As you design and assemble your SOA solutions, there are many occasions when you might want to integrate your new SOA with an existing IT asset. Ideally, you might be able to access that asset as a service just as you access all other components. If the asset does not have a service interface, you might examine the environment to see whether the service interface can be added easily. On some occasions, either the environment cannot directly support a service interface, or the services that are exposed would be so complex that it would have a useless interface. How can you access and include such assets in your SOA solutions?

An adapter acts as a mediator between your SOA environment and the asset. Access to the asset is not achieved directly. Instead, a component that is called an adapter presents a service interface to the SOA components that provide the service that the asset might expose.

8.5. Service-oriented architecture: Service components

Service-oriented architecture: Service components

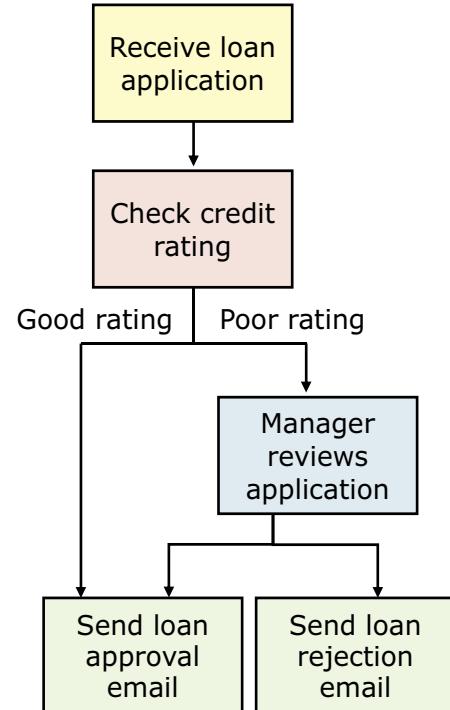
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Figure 8-21. Service-oriented architecture: Service components

Business processes

- A business process defines the execution order of services that are used to fulfill a business task
 - Defines execution paths and runtime conditions for each path
 - Coordinates interactions between instances of business processes and their partners
 - Maintains data between service invocations in the process
 - Activities are the individual business tasks that implement the larger business goal that the process represents
- The arrangement of service invocations and interactions is known as ***process choreography***



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Figure 8-22. Business processes

The diagram on the right illustrates a typical business process in a flowchart. A bank receives a loan application that a customer submits. During the preapproval stage, the bank does a credit rating check on the customer. If the customer has a good credit rating, the bank informs the customer about the loan approval through an email message. If the customer has a poor credit rating, the bank manager reviews the loan application. The bank manager can override the business process decision and approve the loan. Otherwise, the customer receives a loan application rejection email.

In this simple scenario, the business process fulfills the business task of processing a loan application through a series of steps. The process initiates a credit check service that an external business partner provides. It maintains the result from the credit check service and decides whether to approve the loan. It manages a conversation with the bank manager as the manager reviews the loan application.

Not shown in the diagram are the error handling capabilities of the loan application. In the same scenario, if the manager does not complete the loan application review within a specified amount of time, the process can escalate the task to a second-line manager.

Business state machines (1 of 2)

- A business state machine is a way to describe a non-sequential business process by focusing on the real-time events that cause a transition from one state to another
- State machines use states and events, as opposed to the graph-oriented approach of business processes
- State machines simplify process design by allowing events to determine process flow
- State machines are also currently rendered in WS-BPEL

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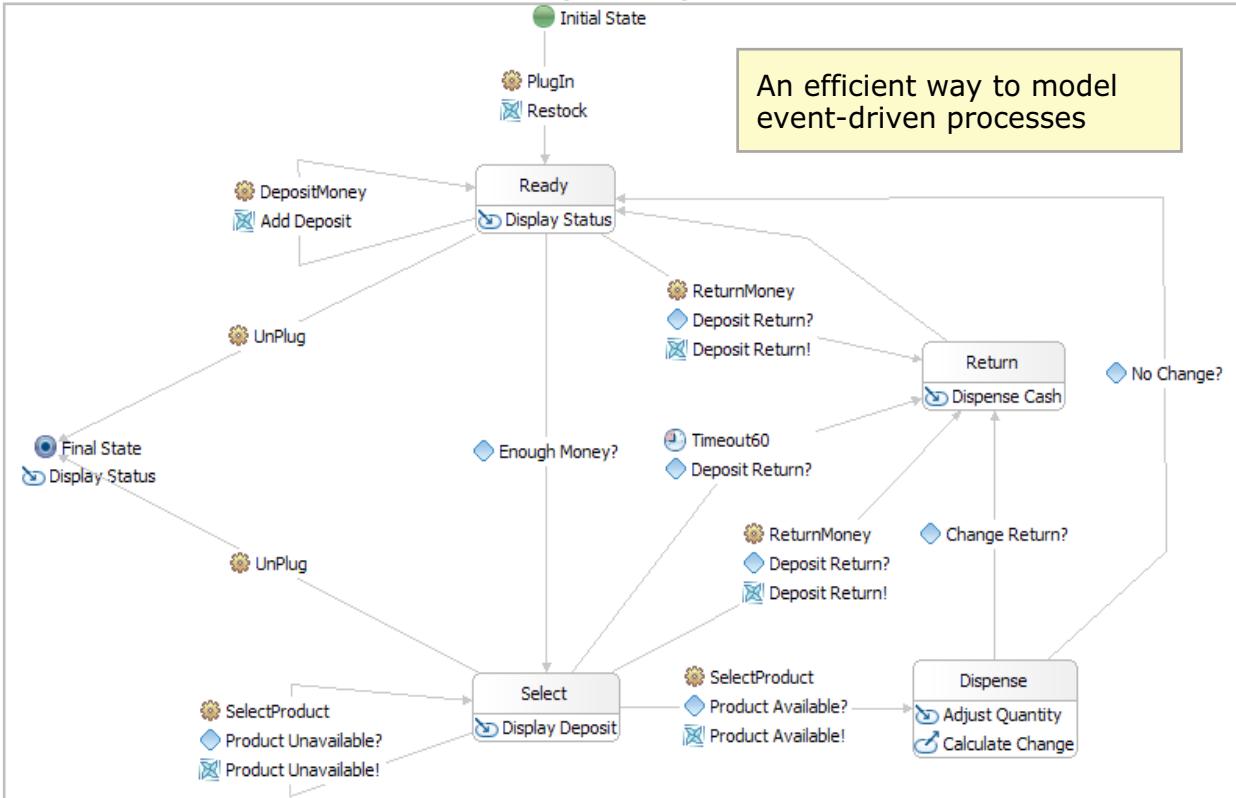
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Figure 8-23. Business state machines (1 of 2)

Describing a business process as a sequence of steps that is executed one after another is sufficient and logical for some real-world scenarios. However, some classes of processes are not so easy to describe. A business process that responds to a series of events that can occur in an arbitrary order is an example of such a process.

For example, consider the process of ordering books at an online retailer. If the order was not shipped yet, the order can be modified by adding or removing books, or it can even be canceled. After the order ships, these events are no longer allowed on that particular order. The ability to accommodate event requests at different stages in a process that results in different outcomes is called a state machine. This concept is more subtle than a classic business process, but when a solution lends itself to a state machine, the advantage becomes immediate.

Business state machines (2 of 2)



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Figure 8-24. Business state machines (2 of 2)

Business state machines versus business processes

Business processes and state machines have different attributes.

	Business process	Business state machine
Event handling	Some capability to handle events that the handler provides	Most transitions depend on events
Sequential processing	Most steps tend to occur in sequential order	Automatic transitions can provide sequential processing
Looping	Process steps cannot form a loop, except in a <i>while</i> , <i>repeat until</i> , <i>for each</i> , <i>generalized flow</i> , or <i>collaboration scope</i> activity	Process steps can lead back to a previous state
Process state	Process state can influence transitions in a parallel activity (flow)	Reaction to events depends on process state
Handlers	Support for fault and compensation handlers	State machines do not support fault or compensation handlers

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Figure 8-25. Business state machines versus business processes

Human tasks

- Human task components provide human workflow support for business processes
- Human interaction is exposed as a service by using SCA
 - Allows human tasks to be replaced with technology, and also allows the reverse
- Roles are used to assign task permissions to users or groups
 - For example, potential owner or administrator
- Users and groups are identified by using queries against supported organizational directories
- Task escalation and notifications are supported

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Figure 8-26. Human tasks

Process Server allows a process application to interact with people as easily as it interacts with services. The component within Process Server that provides this function is called the Human Task Manager. A process can ask that a human participates as a service in the same way that a process can start a technology service. The Human Task Manager tracks which requests for human interactions are outstanding, manages the state of each human task, and includes other advanced functions, such as presenting information to users.

To explore further, ask what would be necessary to include humans in your processes. To start, you need a mechanism that allows humans to obtain tasks that they are being requested to do. There must be a way to supply information to them from within the IT implementations of processes. In many cases, you want some response from the people on the outcome of their tasks. This response might be as simple as a notification that the task was completed. It might include more sophisticated activities such as including return information that describes the nature of the conclusion of the task such as “Loan approved” or “Customer’s address is <xxx>.”

Since you are building an SOA-based solution, the human task component would ideally fit within this service-oriented paradigm as well.

Business rules

- A business rule is an if-then decision that:
 - Evaluates an input condition (if)
 - Evaluation of the condition is either true or false
 - An action is then performed (then)
 - For example, If OrderTotal is <=500 then AutomaticApproval = "Yes"
- Business rules are organized into rule groups, which are exposed as services by using SCA
 - Abstracts and decouples the rules from the implementation
- Business rule parameters can be exposed at run time, allowing business analysts to change rules without redeploying or stopping the application
 - Provides agility, responsiveness, and competitive advantage

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Figure 8-27. Business rules

Business rules are a means of implementing and enforcing business policy through the externalization of business functions. Externalization enables the business rules to be managed independently from other aspects of an application. This independence allows for dynamic updating capabilities of the business rules, which, in turn, provides for a more agile business.

A business analyst focuses on business policy. Business policy describes the guidelines that drive a business. Business policy can include marketing heuristics, accounting principles, government regulations, manufacturing standards, supply management quality of service levels, or any other aspect of the business that relies on specific conventions. Business rules represent a common way of implementing and enforcing these business policies.

There are two styles of business rules:

- If-then rule set
- Decision table

Both styles of rules cover typically 80% of customer needs. Advanced concepts, like inferencing, or knowledge-based recommendations, are not covered in IBM Process Server.

Business rules are started through a business rule group component. A business rule group component provides the interface for the business rule. Each operation defines a business need, not a specific rule implementation.

Business rules change over time to support changing business policy or changing government regulations. For example, the ability to schedule rules to be in effect during specific time periods provides an organization with the flexibility to respond to changes. Using integrated effective dates, the operation might be implemented with more than one business rule for each implementation, which is effective for a specified time. Effective dates allow a client application to start the business rule group component as if it were a time in the past, present, or future.

Business rule authoring is supported by using Integration Designer for the developer and a web-based tool to support rule management for the business analyst. The business rule runtime includes support for deploying, installing, dynamic authoring, and executing the business rules.

8.6. Process Server components

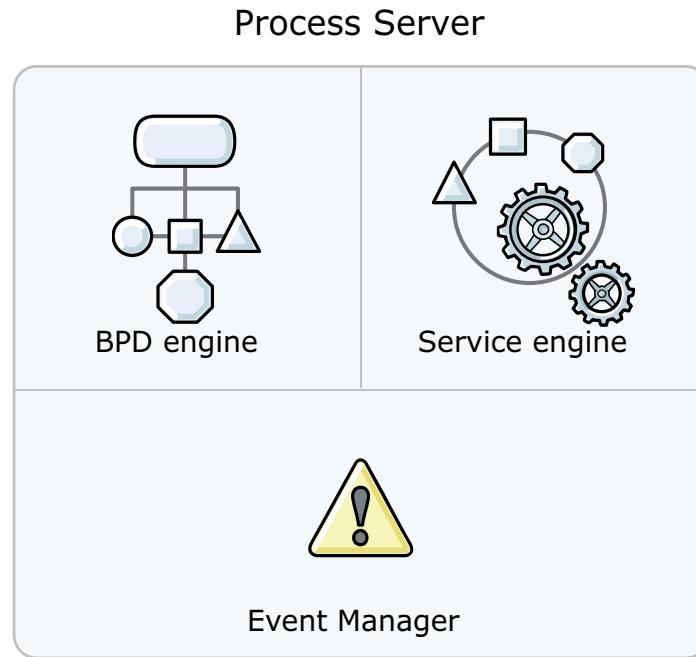
Process Server components

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Figure 8-28. Process Server components

The Process Server components



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Figure 8-29. The Process Server components

The Process Server also provides the workflow facilities, such as task management, routing, and simulation. It is made up of a BPD engine, service engine, and Event Manager.

IBM BPM engines

- The two main work “engines” allow IBM BPM to work together to move items forward
 - The BPD (business process definition) engine and the service engine
- These two engines drive the processes and services while scheduling through the *Event Manager*, which ensures no conflicts
- The BPD engine
 - Progresses BPDs
 - Moves BPDs to the next activity (user task, system lane task, join, and other activities)
- The service engine
 - Runs a service to completion or to a coach (which requires human interaction)
 - Runs a task directly, or from the Event Manager, starts the service engine

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Figure 8-30. IBM BPM engines

The BPD engine:

- Progresses BPDs.
- Moves BPDs to the next activity (user task, system lane task, join, and other activities).
- BPDs can run in parallel but can run *one token per instance at a time only*.
- BPDs can have multiple paths and “look” like they are parallel, but they are not. Two branches of one BPD instance cannot be run at the same time.

The service engine:

- Runs items in parallel.
- Runs a service to completion or to a coach (which requires human interaction).
- Starts the service engine by running a task directly or from the Event Manager.

Event Manager overview

- The Event Manager schedules execution of code
 - It does not run the code, just schedules it with a corresponding Process Center or Process Server
 - For example, UCAs, BPD token movement, system lane activities, and others
 - Work that is scheduled by a specific Event Manager runs on the local server
- The Event Manager
 - Uses queues to manage events and when asked to do work, the Event Manager reloads its queues from the database
 - Can be running or paused
 - Has a heartbeat, which is a separate thread that constantly updates a database table to tell other schedulers that it is alive
- The Event Manager queues include
 - Asynchronous queues, which are run as soon as possible with no guaranteed order
 - BPD asynchronous queues for BPD-related tasks such as system lane activities, BPD notifications, and timer events
 - Synchronous queues, which are run serially

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Figure 8-31. Event Manager overview

All Schedulers whose heartbeat ever ran are listed in `lsw_em_instance`, and are shown on the Event Manager Monitor page.

To prevent problems in a cluster, an Event Manager claims ownership of one or more sync queues when it starts.



Event Manager view

- All schedulers (Event Managers) whose heartbeat ever ran are listed in LSW_EM_INSTANCE table, and are shown on the Event Manager Monitor page in the Process Admin Console

Event Manager > Monitor

Scheduler ID	Status	Connect expiration	# Jobs Executing
<input checked="" type="checkbox"/> Node1_SingleClusterMember1		May 26, 2014 11:41:54 PM	0

Total Jobs Executing: 0 Total Jobs: 0

Scheduler	Process App / Toolkit	Snapshot	Job Name	Job Queue	Scheduled Time	Last Scheduled Time	Last Execution Time	Next Scheduled Time	Job Status
-----------	-----------------------	----------	----------	-----------	----------------	---------------------	---------------------	---------------------	------------

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Figure 8-32. Event Manager view

When you access the Event Manager Monitor, you can see the status for each scheduled job. In a clustered environment, the monitor displays all Schedulers in the cluster and the jobs for all Schedulers in the cluster.

Click **Pause** or **Pause All** to pause a selected Scheduler or all Schedulers. If you pause a Scheduler, any executing jobs are completed before processing is halted. Click **Resume** or **Resume All** to resume processing of the selected Scheduler or all Schedulers.

Understanding Event Manager queues

- Two types of queues
 - Asynchronous
 - Synchronous
- Asynchronous (async) are executed as soon as possible with no guaranteed order
- Synchronous (sync) are executed serially
 - If you have multiple tasks set to run on one sync queue, they execute one after the other in the order that they are put into the sync queue
- The Event Manager treats sync and async queues differently

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Figure 8-33. Understanding Event Manager queues

- **Async queue:** Async queues are executed as soon as possible with no guaranteed order. Sync queues are executed serially. If you have multiple tasks set to run on one sync queue, they will execute one after the other in the order in which they were put into the sync queue. The Event Manager (EM) treats sync and async queues differently.
- **Sync queue:** Each task in a sync queue must be executed in serial. To prevent problems in a cluster, an EM claims ownership of one or more sync queues when it starts. The ownership is stored in the LSW_UCA_SYNC_QUEUE where QUEUE_OWNER is linked to OWNER_ID in LSW_EM_INSTANCE. This assignment is not permanent. The LSW_EM_INSTANCE table tracks status of all of the Event Managers. The status is checked every 15 seconds. If the owner of a sync queue is no longer available, another EM takes ownership of that sync queue.
- **Async Queue:** Each EM picks up async tasks when there is room in its async queue for more tasks. Each process server has its own running EM.

Event Manager tips

- The Event Manager is quick and efficient
 - Usually it is the tasks that are executing that slow it down, not the Event Manager itself
- If you want to throttle the Event Manager, do not decrease the thread pool; instead, decrease the queue capacity
- A sync queue can get stuck since it does not advance until the task completes
 - To make it less of a problem, create multiple sync queues
 - You can manage sync queues in the IBM BPM console
- Keeping system clocks in sync is always a good idea
 - All the time stamps that the Event Manager scheduler uses – the heartbeat's expirations and the task's scheduled times – are interpreted relative to the system clock of the database computer

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Figure 8-34. Event Manager tips

Tokens

- Think of a token as a marker of where you are in the BPD or service
- Processes and services use tokens to mark where the current running instance is taking place
 - Each BPD token progression is a BPD task in the Event Manager
- Tokens can be passed from BPD to an activity
 - Process Inspector shows you the movement of the tokens between activities
- When tokens encounter an endpoint, the token returns to the parent or calling item, or ends the instance
- Tokens can become orphaned tokens when a pointer that is associated with an activity is removed from a BPD
 - The easiest way to identify and manage orphaned tokens is to generate a policy file

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Figure 8-35. *Tokens*

Endless loop

- One of the most common pitfalls in development
- Hanging BPD: This BPD is looping while inside the BPD engine
 - No activities are implemented as a service in this BPD
- Thrashing BPD: This BPD calls a service with an error
 - There is an error handler on the activity that loops back to the same failing service
 - It is difficult to stop with the process monitor as the work is quickly hopping between the BPD and the service engine
- Looping error handler: This service has a global error handler
 - Global error handlers are *very* risky
 - If the step that detects the error has an error itself, you go into a tight infinite loop



Instrumentation Monitor

Monitoring > Instrumentation

Automatically refresh every

Name	Count/Value	In Process	Average Duration (ms)	Moving Average Duration (ms)	Total (ms)
BPD					
Instances					
BPD Instances Completed	4				
BPD name is Move the Token	4				
BPD Instances Failed	16				
BPD Instances Resumed	8				
BPD Instances Started	12				
BPD name is Move the Token	12				
BPD Instances Terminated	5				
BPD name is Move the Token	5				
Cache					
Connectors					
Webservices					
Inbound					
WebService Call	0	0	0.00	0.00	0.00
Outbound					
WebService Call	0	0	0.00	0.00	0.00
EJB Services					
deploySnapshot	0	0	0.00	0.00	0.00

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Figure 8-37. Instrumentation Monitor

The Process Admin Console includes an instrumentation monitor to help identify performance bottlenecks in Process Server and to capture instrumentation data that you can use to further analyze any performance issues.

Event Manager Monitor (1 of 2)

- The Event Manager Monitor displays information about the scheduler for the Event Manager on your Process Center server or Process Server
 - Accessed by using the Process Admin Console
- When you access the Event Manager Monitor
 - You can see the status for each scheduled job
 - The monitor displays all schedulers in the cluster and the jobs for all schedulers in the cluster
- The Event Manager Monitor does not show historical information about undercover agents (UCAs) that are successfully run
 - You can capture this type of information in the `SystemOut.log` file
 - Set the log details level for the `WLE.wle_ucaexception` component to `*=info`

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Figure 8-38. Event Manager Monitor (1 of 2)

The Event Manager Monitor, included in the Process Admin Console, is useful for troubleshooting processes that are supposed to run automatically (through an undercover agent, for example) but fail to start. You can use the Event Manager Monitor to identify underlying problems and also to control various aspects of Event Manager processing.

The Event Manager is the part of the Process Server that handles event scheduling and queuing. For example, Process Server receives an event, and that event becomes a job in the Event Manager. Each job in the Event Manager is routed through a Scheduler, which schedules and tracks the execution of its assigned jobs.



Event Manager Monitor (2 of 2)

▶ IBM BPM Admin
▶ User Management
▶ Monitoring
▼ Event Manager
 Monitor
 Blackout Periods
 Synchronous Queues
 EM JMS Error Queue
▶ Admin Tools

Displays information about:

- The scheduler for the Event Manager on your Process Center server or Process Server
- The various jobs that are being tracked by that scheduler

Event Manager > Monitor

Scheduler ID	Status	Connect expiration	# Jobs Executing
<input checked="" type="checkbox"/> PCenterNode01_AppClusterMember1	●	Jun 19, 2014 4:05:18 PM	0

Total Jobs Executing: 0 Total Jobs: 2

[Refresh](#)
[Pause](#)
[Resume](#)
[Pause All](#)
[Resume All](#)

Scheduler	Process App / Toolkit	Snapshot	Job Name	Job Queue	Scheduled Time	Last Scheduled Time	Last Execution Time	Next Scheduled Time	Job Status
PCenterNode01_AppClusterMember1			BPD timer execution	BPD async queue	6/19/14 4:02:09 PM				Acquired
			BPD timer execution	BPD async queue	6/19/14 4:03:09 PM				Scheduled

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Figure 8-39. Event Manager Monitor (2 of 2)

Administrators should establish blackout periods to specify times when events cannot be scheduled, for example, due to a holiday or when regular system maintenance is scheduled. The Event Manager takes blackout periods into account when scheduling and queuing events, event subscriptions, and undercover agents (UCAs).

Event Manager jobs are scheduled to be processed in an execution queue. (If you look at the job listing in the Event Manager Monitor, you can see that each job is assigned to a job queue.)

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8-52

The screenshot shows the IBM Process Monitor interface. At the top, there are tabs for 'Summary' (selected), 'Processes', and 'Services'. A 'Refresh' button is located in the top right corner. Below the tabs, two summary boxes are displayed:

Active Processes Currently Executing	0
Active Services Currently Executing	1

Below these summary boxes is a section titled 'Most Expensive Services' containing a table:

Process App	Service Name	Total Time	Total Steps
BPM Troubleshooting V1 (RC1)	Infinite Loop - Verbose	3:30:05.735	247,776,905
BPM Troubleshooting V1 (tip)	Fail the Instance	0:00:18.171	4
BPM Troubleshooting V1 (tip)	Move Token	0:00:06.187	22
Coaches (8.5.0.1)	Coaches Localized Messages Loader	0:00:01.985	2

Below this is a section titled 'Most Expensive Processes' containing a table:

Process App	Process Name	Total Time	Total Steps
BPM Troubleshooting V1 (tip)	Move the Token	0:00:01.078	5

Finally, there is a section titled 'Most Expensive Service Steps' containing a table:

Process App	Service Name	Sub-Service Name	Step Name	Total Time	Total Instances
BPM Troubleshooting V1 (RC1)	Infinite Loop - Verbose		Counting	1:32:45.436	123,888,451

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Figure 8-40. Process Monitor

The Process Admin Console includes a Process Monitor that enables administrators to view the processes and services that are running on Process Server and also to stop any problematic processes or services. For example, you might need to stop a service that causes an exception or a service that is stuck in a repeating loop.

Unit summary

- Explain the role of Process Server and WebSphere Enterprise Service Bus in the SOA development cycle
- Explain the purpose and business value of using the Process Server and WebSphere Enterprise Service Bus functional components:
 - SOA core components
 - Supporting service components
 - Service components
- Describe the role of mediation services in Process Server and WebSphere Enterprise Service Bus
- Define the concept of mediation modules

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Figure 8-41. Unit summary

Review questions

1. Which of the following items is considered part of the component architecture?
 - A. Integration Designer
 - B. Service components
 - C. WebSphere Message Broker
 - D. Process Designer
2. A business object:
 - A. Converts data representations by using predefined mapper rules
 - B. Models the data that the business rules selector component uses
 - C. Defines the data that is flowing between components in an SOA
3. True or False: An enterprise service bus can route, convert, and transform messages, but it does not handle business events from disparate sources.



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Figure 8-42. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. Which of the following items is considered part of the component architecture?
 - A. Integration Designer
 - B. Service components
 - C. WebSphere Message Broker
 - D. Process Designer

The answer is B.
2. A business object:
 - A. Converts data representations by using predefined mapper rules
 - B. Models the data that the business rules selector component uses
 - C. Defines the data that is flowing between components in an SOA

The answer is C.
3. True or False: An enterprise service bus can route, convert, and transform messages, but it does not handle business events from disparate sources.
The answer is False. An enterprise service bus routes, converts, and transforms messages, and it handles business events from disparate sources.

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Figure 8-43. Review answers



Exercise: Configuring the Process Server environment

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Figure 8-44. Exercise: Configuring the Process Server environment

Exercise objectives

- Use the IBM BPM Configuration editor to create a deployment environment
- Customize a sample deployment environment properties file
- Generate a deployment environment by using the BPMConfig utility
- Start the deployment environment by using the BPMConfig utility
- Use the Health Center to verify the deployment environment
- Explore the deployment environment



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Figure 8-45. Exercise objectives

Unit 9. Business process choreography

Estimated time

01:00

Overview

This unit describes the concepts and use of business process choreography, the architecture of the business process container and human task container, and installation and configuration.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe basic workflow concepts
- Explain the need for business process choreography
- Describe the difference between long-running and microflow (short-running) business processes
- Explain business process choreography architecture
- Describe various features of the Business Process Choreographer Explorer
- Describe the clients that are available for human tasks
- Describe the people directory support that is available for human tasks in Process Server

Business process choreography

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Figure 9-1. Unit objectives

Topics

- Business processes
- Process choreography
- Process choreography engine
- Business process choreography administration
- Business Process Choreographer Explorer
- Human task clients
- People directory support

Business process choreography

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Figure 9-2. Topics

9.1. Business processes

Business processes

Business process choreography

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Figure 9-3. Business processes

What is a business process?

- A business process defines the execution order of services that are used to fulfill a business task
 - Defines execution paths and runtime conditions for each path
 - Coordinates interactions between instances of business processes and their partners
 - Maintains data between service invocations in the process
 - Activities are the individual business tasks that implement the larger business goal that the process represents
- The arrangement of service invocations and interactions is known as *process choreography*

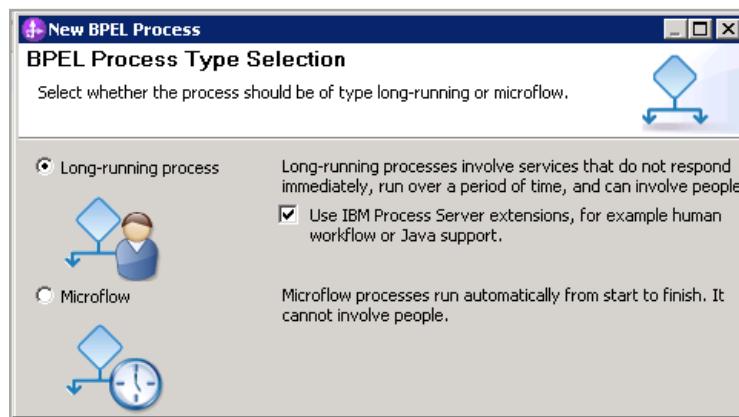
Business process choreography

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Figure 9-4. What is a business process?

Microflows versus long-running processes

- Process Server runs business processes as either microflows (short-running) or long-running processes
 - Known as non-interruptible and interruptible processes
- A microflow process is used for running short business processes or small units of work within a larger business process (subprocesses)
 - Microflow completes or fails and is not persisted
- A long-running process might run for hours, days, or weeks
 - Frequently involves components with lengthy response times, such as human tasks
 - State of the process must be persisted



Business process choreography

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Figure 9-5. Microflows versus long-running processes

The first type of business process is a non-interruptible process, which is used for running short business processes or a small unit of work within a larger business process (that is, a subprocess). A microflow business process either completes or fails. No intermediate state can be maintained.

Consider a credit card verification process. This business process is short and simple: it accepts information about an individual and returns a result that indicates whether the credit card was valid for the individual. In this business process, it might start with a number of lookups that check information about the individual before returning the results. These lookups either succeed and return a result, or they fail and the entire credit card validation fails. The client can monitor the failure, and might call the business process again. In any case, no state information is being maintained in the different lookup steps.

The second type of business process is long-running (interruptible). These business processes might take hours, days, or weeks to complete, and because of the possible random completion time, the state must be maintained during execution. If the state is not maintained and the current execution thread that is running the business process ends (for example, if the server is restarted), the work that is accomplished is lost.

An example of a long-running business process is a loan approval process. A loan approval process gathers financial information about an individual and evaluates it. If the individual seems to be financially sound, a loan can be offered, and the funds can be reserved. Since the evaluation of

the financial information might take a number of days, the state of this business process must be maintained. After each activity in the process is completed, the results can be recorded to track information that was processed and how much work was completed.

Human interactions

- Human interaction is key to many business integration applications
 - Human input or review is often required
 - Automation is not possible for some tasks
 - Error or exception situations might require handling by person
- Work must be assigned to an individual or a group of individuals
- Business processes must halt execution and wait for work to be completed
- Administrators or supervisors must be able to override, transfer, and manage tasks

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Figure 9-6. Human interactions

Although a business process can automate many steps, it might still be necessary for a human to be part of the business process. For most business processes, an individual views information that the business process generates, and acts upon that information. The actions of the individual might then be used within the business process and affect the execution path of the business process.

To have a certain individual do a specific task in a business process, a work item with certain permissions and capabilities is generated for the individual by the runtime environment. It is up to the individual to then check and retrieve any work items that might be created. Based on the permission level, the individual might be able to input information and complete the activity, or read the activity.

Administrators of the business process can override tasks (work items), which are assigned to an individual, by completing the activity.

Business processes in IBM Business Process Manager

- Business processes can be captured in Process Designer or in Integration Designer
- Process Designer:
 - Captured as business process
 - Represented as Business Process Diagram (BPD)
 - Implementations are captured in only one process application or toolkit
 - Limited implementation options
 - One human task client
- Integration Designer
 - Captured as BPEL process
 - Represented with Business Process Execution Language (BPEL)
 - Implementation can span several modules
 - Can be shared in libraries
 - Several implementations options
 - Several human task clients

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Figure 9-7. Business processes in IBM Business Process Manager

Business processes might be captured in either Process Designer, in Integration Designer, or both.

Process Designer:

- Business processes are captured as business process artifacts based on Business Process Model and Notation (BPMN). They must be built in either a process application or a toolkit.
- Business processes do not use a standard language, such as BPEL.
- The only way to share a process is to place it in a toolkit.
- Implementation options are limited (human tasks, JavaScript services, simple business rules, and others).

Integration Designer:

- Business processes are captured as BPEL artifacts. They can be built in either a module or library.
- They use the standard BPEL with IBM extensions (WS-BPEL).
- They are loosely based on BPMN.
- Business processes might rely on services in other modules through imports and exports, or through libraries.

- BPEL processes in modules might be exposed as other types of services through their bindings (such as web services, WebSphere MQ bindings, and other services).
- There are several types of implementations for a BPEL process, including the full power of Java, integration with JRules, and integration with external services.
- There are several types of human task clients available, including HTML-Dojo in Business Space, JavaServer Faces, and the Business Process Choreographer Explorer.

9.2. Process choreography

Process choreography

Business process choreography

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Figure 9-8. Process choreography

Overview of process choreography

- Brings individual web services together and coordinates their interaction in the form of a business process
- Uses a model to describe the business process and the flow of information and control between operations
- Execution of a business process involves carrying out the steps that make up the model, and manages the interaction of the different steps
- There is a clear separation between the model and the runtime, which runs business processes

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Figure 9-9. Overview of process choreography

Process choreography brings the individual services, each of which completes a small amount of work, together to accomplish a much larger amount of work. Process choreography involves two independent but closely related items:

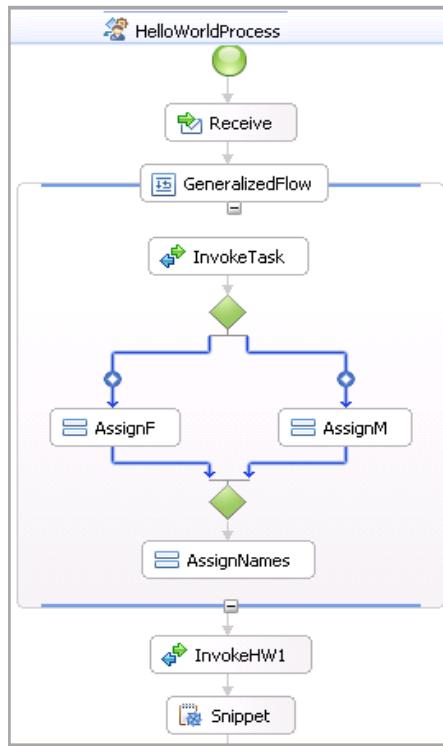
- A model
- Execution of the model

The model is the description of the business process with the different steps and logic that are required to complete the business process. The information in the model might focus on the business details about running the business process and not on information specific to the runtime implementation. It is better to wrap any runtime problems in a business process exception, even for those situations in which you might face runtime problems and would like to handle them in the business process model.

The execution of the model is the runtime implementation, and it uses the model as a roadmap for which steps can be run, and in what order. The execution is responsible for tracking what was completed and the current state of the business process, which might take hours, weeks, or months to complete.

Process choreography is also responsible for incorporating human intervention and assigning work to different individuals. It can also support defining and handling business exceptions, and routing incoming information (messages) to an appropriate running business process instance.

Model of a business process that is developed with BPEL



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Figure 9-10. Model of a business process that is developed with BPEL

This figure shows a business process as seen with the BPEL process editor of Integration Designer.

Business process templates and instances

- *Process templates* describe the business process model
 - The Business Flow Manager uses the template to create instances of the business process at run time
 - Process templates are deployed and installed on the business process container in IBM Process Server
 - Start, stop, and manage process templates by using the administrative console
- *Process instances* are entities that exist at run time
 - Business instances represent one running business process
 - Each instance has specific data and status that is associated with it
 - The Business Flow Manager can run multiple process instances at the same time
 - Manage business process instances and human tasks in the Business Process Choreographer Explorer

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Figure 9-11. Business process templates and instances

A BPEL process template is a process definition that is deployed and installed in the runtime environment.

Process properties are specified when the process is defined. In the runtime environment, properties for process templates are stored in the runtime database. They can be accessed by using the Business Process Choreographer database views, such as the PROCESS_TEMPLATE view, or by using query tables.

9.3. Process choreography engine

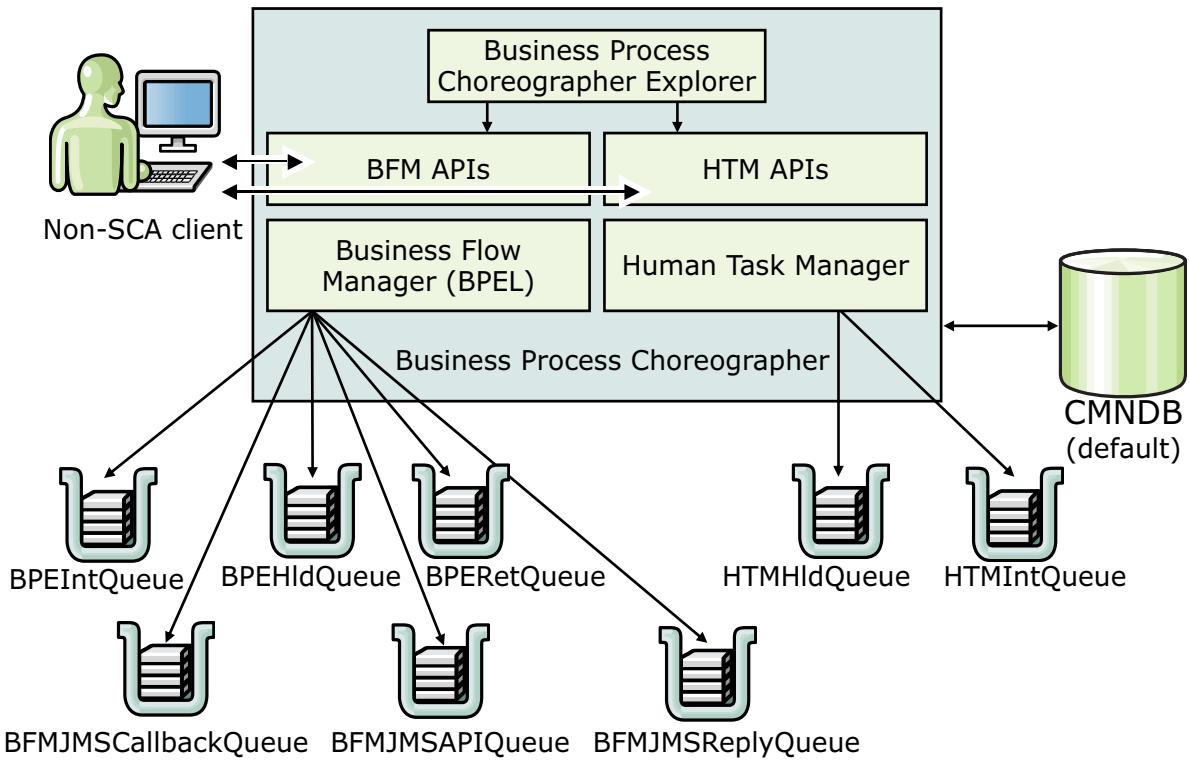
Process choreography engine

Business process choreography

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Figure 9-12. Process choreography engine

Business Process Choreographer architecture



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Figure 9-13. Business Process Choreographer architecture

The business process container is the resource that is responsible for running the business processes. It is a Java Platform, Enterprise Edition application front end that provides the APIs you can use to create robust clients. The business process container can be installed by default when you install Process Server. It is automatically installed with Integration Designer as part of the test environment. If you did not install the container when you installed Process Server, you can configure it later using the Process Server administrative console. The administrative console includes a wizard that guides you through the container configuration options such as the database type, messaging resources, and user IDs.

The Business Process Choreographer in Process Server depends on Java Platform, Enterprise Edition and enterprise services. The Business Process Choreographer engine uses Service Component Architecture (SCA) as its invocation model, business objects for a data representation model, and the Common Event Infrastructure (CEI) for business data monitoring. The engine persists process and task information to the business process choreography database (CMNDB).

The Business Flow Manager component handles process templates and process instances. There are two interfaces available for interacting with business processes:

- An SCA interface
- A generic process API for Java Platform, Enterprise Edition clients

The process navigation component manages the process state within each business process instance. The internal messaging component is used to maintain process state.

The Human Task Manager manages the state of human tasks and work items. Two interfaces are also available for the Human Task Manager:

- An SCA interface
- A generic task API

The staff resolution component works with an LDAP user registry to determine a list of authorized users for a human task.

Container components include:

- Business Flow Manager, which coordinates the calls between different activities and calls to external plug-ins
- Human Task Manager, which creates and maintains work items for users for different activities within a business process

The Business Flow Manager (BFM) is the runtime for BPEL processes. Key resources are:

- A database to store process templates and process instance information (the default name is CMNDB, but it is possible to rename it)
- JMS queues to exchange or persist messages (such as navigation or failed events)
- Business Process Choreographer, which must be installed and configured for each application server or cluster that runs business processes and human tasks

Container message queues (1 of 2)

- **BPEIntQueue**
 - Internal queue for processing interruptible business process activities
 - Destination that is used for running the different activities of an interruptible business process
- **BPERetQueue**
 - Internal queue that contains messages that cannot be processed in the BPEIntQueue
 - Destination that is used for retry activities that fail
- **BPEHldQueue**
 - Hold queue for failed messages that are not tried again
 - Destination that is used for holding messages that fail and exceed the retry limit

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Figure 9-14. Container message queues (1 of 2)

This page lists three of the six JMS queues that the Business Flow Manager uses that were shown on the previous page. Each queue that is listed has a special function. The Business Flow Manager uses the following first three queues internally:

- BPEIntQueue
- BPERetQueue
- BPEHldQueue

Container message queues (2 of 2)

The screenshot shows the 'Queues' section of the IBM BPM interface. It displays three JMS queues:

Select	Name	JNDI name	Provider
<input type="checkbox"/>	BFMJMSAPIQueue_AppCluster	jms/BFMJMSAPIQueue	Default messaging provider
<input type="checkbox"/>	BFMJMSScallbackQueue_AppCluster	jms/BFMJMSScallbackQueue	Default messaging provider
<input type="checkbox"/>	BFMJMSReplyQueue_AppCluster	jms/BFMJMSReplyQueue	Default messaging provider

- Human Task Manager queues

- HTMIntQueue: Human task internal queue
- HTMHldQueue: Internal queue for holding any message that failed processing in the HTMIntQueue

- Business Flow Manager queues

- BFMJMSAPIQueue
- BFMJMSScallbackQueue
- BFMJMSReplyQueue

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Figure 9-15. Container message queues (2 of 2)

BFMJMSAPIQueue: A queue for accessing business process applications through the Java Message Services API. Requests from JMS clients are sent to this queue.

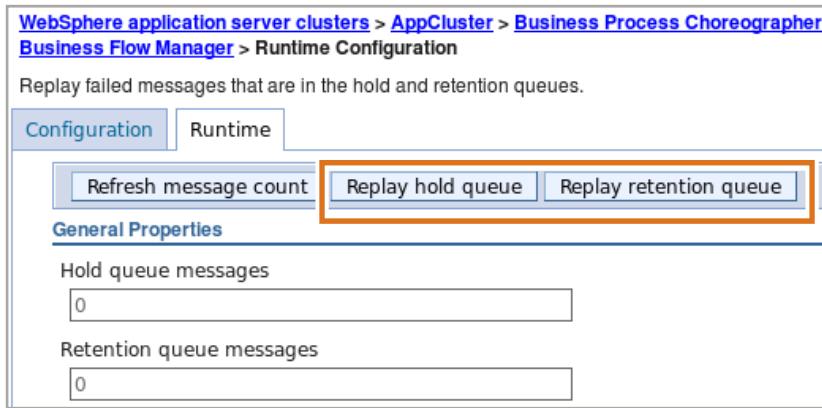
BFMJMSScallbackQueue: Another queue for the JMS API. Responses with callback to JMS clients are sent to this queue.

BFMJMSReplyQueue: The JMS API queue to which responses to JMS clients are sent.

All queues are created when you set up the business process and the human task container by using the provided wizards or wsadmin scripts. Also, connection factories for accessing those queues are created.

Replay from hold queue

- Business Flow Manager uses an internal queue for processing long-running processes
- Retention queue and hold queue are used for internal processing issues, such as transaction rollbacks and timeouts
- Messages are tried again by using a sophisticated algorithm
 - Finally, they are put onto the hold queue for manual replay by the process administrator



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Figure 9-16. Replay from hold queue

The administration of existing messages on the retention queue, the hold queue, or both, and potentially replaying these messages can be part of a recovery procedure. Checking and replaying messages can be done by using scripting from the administrative console.

9.4. Business process choreography administration

Business process choreography administration

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Figure 9-17. Business process choreography administration

Identify which containers are installed

Application	Application names
Business Flow Manager	BPEContainer_ <i>clustername</i>
Human Task Manager	TaskContainer_ <i>clustername</i>
Business Process Choreographer Explorer	BPCExplorer_ <i>clustername</i>
Business Process Choreographer Business Space predefined tasks	HTM_PredefinedTasks_Vnnnn_<i>clustername</i> and HTM_PredefinedTaskMsg_Vnnn_<i>clustername</i>
Business Process Archive Manager	BPArchiveMgr_ <i>clustername</i> and TaskArchiveMgr_ <i>clustername</i>
Business Process Archive Explorer	BPCArchiveExplorer_ <i>clustername</i>

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Figure 9-18. Identify which containers are installed

Identify which of the following Business Process Choreographer applications are installed, and their original deployment scopes.

You can look for these applications in the list of installed WebSphere Enterprise Applications from the administrative console.



Business process container modification

- Business Flow Manager and Human Task Manager are both installed as part of Business Process Choreographer setup

WebSphere application server clusters > AppCluster

General Properties

- * Cluster name: AppCluster
- Bounding node group name: DefaultNodeGroup
- Prefer local
- Enable failover of transaction log recovery

Cluster messaging

- [Messaging engines](#)

Business Process Manager

- [Business Space rest services endpoint registration](#)
- [REST services](#)
- Business Process Choreographer**
- [Business Process Choreographer Containers](#)
- [Business Flow Manager](#)
- [Human Task Manager](#)
- [Business Process Choreographer Explorer](#)

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Figure 9-19. Business process container modification

The Business Process Choreographer configuration includes a Business Process Choreographer Explorer configuration. To view or modify the Business Process Choreographer Explorer settings by using the administrative console, click **Servers > Clusters > WebSphere application server clusters > cluster_name**. Then, on the **Configuration** tab in the Business Process Manager section, expand **Business Process Choreographer**, and click **Business Process Choreographer Explorer**.

Business process container administration

- Retry limit: Maximum number of times a message is placed on the retention queue
- Retention queue message limit: Maximum number of messages that can be stored in the retention queue before the Business Flow Manager switches into quiesce mode
- Retention queue: Temporal storage of failed messages
- Hold queue: Permanent storage of failed messages

[WebSphere application server clusters](#) > [AppCluster](#) > [Business Process Choreographer Containers](#) > Business Flow Manager

The business flow manager provides services to run and manage business processes within an application server. After configuring the manager for the first time, you can only change the editable properties.

Configuration	Runtime
Retry limit	<input type="text" value="5"/>
Retention queue message limit	<input type="text" value="20"/>
Retention queue	<input type="text" value="jms/BPERetQueue"/>
Hold queue	<input type="text" value="jms/BPEHldQueue"/>

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Figure 9-20. Business process container administration

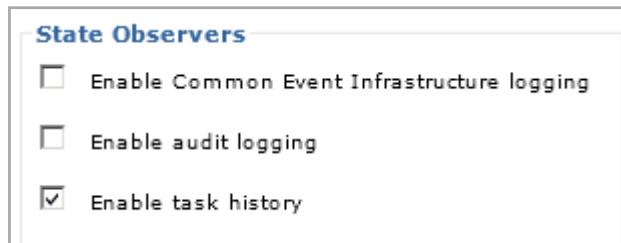
Business Flow Manager uses the following queues for coping with infrastructure failures:

- The retention queue stores failed messages that are automatically tried again.
- The hold queue stores messages that failed more times than the retry limit, and can indicate a more serious infrastructure failure or a damaged message that cannot be processed.

State observers

- Enable audit logging
 - Allows audit log information that business processes generate to be sent to the audit log and stored in the CMNDB

- Enable task history
 - Business users are able to see a simple “who did what and when” history for a task
 - Human task manager only



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Figure 9-21. State observers

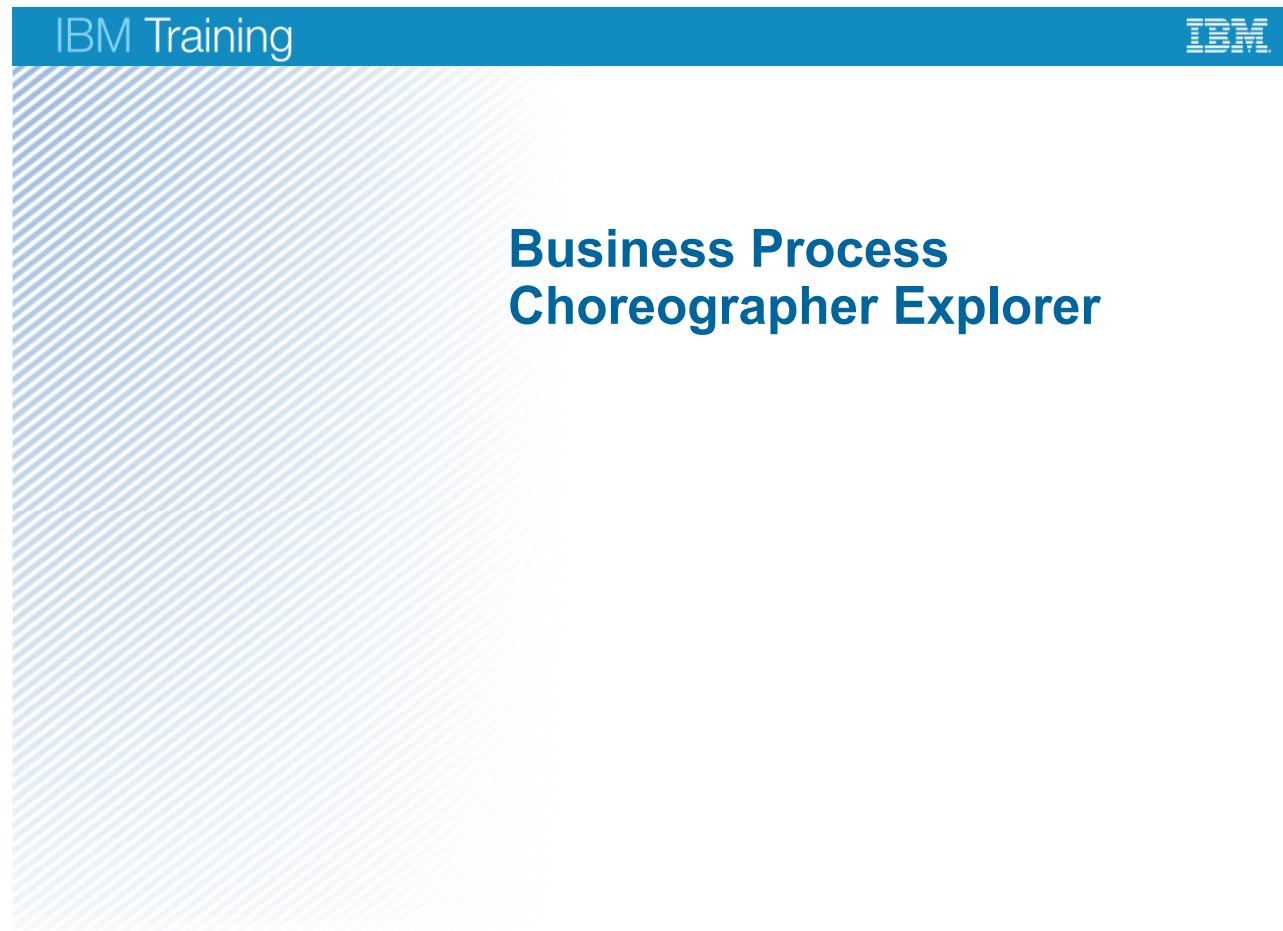
You must configure IBM Business Process Manager to support monitoring of business process and human task service components before you do any actual monitoring of those types of service component.

Audit logging tables:

- Log tables: AUDIT_LOG and TASK_AUDIT_LOG
- Tables are insert-only and constantly grow as the processes add more data to them
- Purge these tables at regular intervals.

You can also use this task to use task history data by using either Business Space or the Task Instance History Representational State Transfer (REST) interface.

9.5. Business Process Choreographer Explorer



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Figure 9-22. Business Process Choreographer Explorer

Business Process Choreographer Explorer

- With the Business Process Choreographer Explorer, you can manage business processes and human tasks
 - View installed process templates
 - View, start, terminate, delete, compensate, suspend (including “suspend until” and “suspend for”), try process instances again, transfer ownership, and similar actions
- It is automatically configured with Business Process Choreographer
 - Can change installation options for the business process container and human task container
- Security aware:
 - Only certain templates, instances, tasks, and options are visible, depending on the authorization level

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Figure 9-23. Business Process Choreographer Explorer

The Business Process Choreographer Explorer is a tool for developers and administrators.

The enhanced capabilities of the Business Process Choreographer Explorer are that you can do the following tasks:

- Handle the absence and substitution of users
- Use the “Suspend until” option for processes and tasks
- View and edit XML source data
- Combine filter criteria across processes and tasks with their definitions and instances
- Go between related tasks (subtasks and follow-on tasks), and administer and view information about specific tasks
- Use human task priorities and business categories as filter criteria and list columns
- Edit custom properties
- Improve the usability of the graphical process view

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Business Process Choreographer Explorer web application

The screenshot shows the 'Enterprise Applications' management interface. At the top, there is a header with the title 'Enterprise Applications'. Below the header, a message says 'Use this page to manage installed applications. A single application can be deployed'. There is a 'Preferences' link and a toolbar with buttons for Start, Stop, Install, Uninstall, Update, Rollout Update, Remove, and Refresh. Below the toolbar is a toolbar with icons for Select, Name, and Application. A table lists four applications: 'AccountOpeningUIEAR', 'AppScheduler', 'BPCExplorer_SupCluster' (which is highlighted with a red border), and 'BPEContainer_AppCluster'. Each row in the table has a checkbox in the first column and a green edit icon in the last column.

Select	Name	Ap
<input type="checkbox"/>	AccountOpeningUIEAR	
<input type="checkbox"/>	AppScheduler	
<input type="checkbox"/>	BPCExplorer_SupCluster	
<input type="checkbox"/>	BPEContainer_AppCluster	

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Figure 9-24. Business Process Choreographer Explorer web application

Business Process Choreographer Explorer is a web application that can be installed as part of the configuration of the process container.

Before you can work with the Business Process Choreographer Explorer from a web browser, you must install the process container, human task container, and the Business Process Choreographer Explorer application; and the application must be running.

Not shown in the figure is the `TaskContainer_AppCluster` application.

Using the Business Process Choreographer Explorer

- *Business administrator* manages the lifecycle of business processes, and repairs business processes
 - Restarts or forces the completion of single activities, or compensates the business process as a whole
 - For failed compensations, the process instances are retried, skipped, or stopped
 - Adds and updates custom properties for business processes and activities
- *Human task administrator* manages the lifecycle of human tasks, and manages work assignments
 - Assigns responsibility to users, or manages absence handling and substitutes for users
 - Changes the priority and business category for human tasks, and adds or updates custom properties
- *Business user* works with assigned tasks
 - Initiates business processes, services, and human tasks, and works on, edits, saves, completes, or releases human tasks
 - Flags your absence and defines substitutes

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Figure 9-25. Using the Business Process Choreographer Explorer

How you use Business Process Choreographer Explorer depends on your role.

You can use Business Process Choreographer Explorer to do the following tasks:

- If you are in the Business Process Choreographer system monitor role, you can browse all the BPEL process instances and human tasks, and also view their details.
- If you are in the Business Process Choreographer system administrator role, you can manage the lifecycle of BPEL processes and human tasks, repair BPEL processes, and manage work assignments.
- If your Business Process Choreographer Explorer configuration includes the reporting function, you can define your own reports, or use a drill-down approach to get more detailed information. You can get information about specific process instances, activity instances, or inline human tasks. In addition, you can export the reported results for further external processing. The Business Process Choreographer Explorer reporting function is deprecated. To monitor and report on BPEL processes, use IBM Business Monitor.
- If you are a business user, you can use Business Process Choreographer Explorer to work with your assigned tasks, flag your absence, and define substitutes.

Starting the Business Process Choreographer Explorer

[Enterprise Applications > BPCEexplorer_SupCluster > Context Root For Web Modules](#)

Context Root For Web Modules

Configure values for context roots in web modules.

Web module	URI	Context Root
BPCEexplorer	bpcexplorer.war,WEB-INF/web.xml	/bpc

- Open the Business Process Choreographer Explorer in a new web browser and type: `http://<host>:<port>/bpc/`

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Figure 9-26. Starting the Business Process Choreographer Explorer

After it is installed, the Business Process Choreographer Explorer can be accessed by opening a web browser. Enter the URI http host name, the port that is specific to where the application is installed, and the context root of bpc.

In the current version of the course, the Business Process Choreographer Explorer is installed on the SupCluster.

Check the port number from the administrative console with the option **Servers > Server Types > WebSphere application servers**.

Then, select **SupClusterMember1**. Under the Communications area, select **Ports**, and find the port that matches the **WC-defaulthost** option.



Business Process Choreographer Explorer

- The Business Process Choreographer Explorer is a web application that implements a generic web user interface for interacting with BPEL processes and human tasks
- Click **Currently Valid** under **Process Templates** to reveal all deployed business processes

The screenshot shows the 'Business Process Choreographer Explorer' interface. The header contains 'Welcome bpmadmin | Logout | Help | About'. Below it is a 'Views' tab bar with three sections: 'Process Templates' (selected), 'Process Instances', and 'Activity Instances'. The 'Process Templates' section has links for 'Currently Valid' and 'All Versions'. The 'Process Instances' section has links for 'Started By Me', 'Administered By Me', 'Critical Processes', 'Terminated Processes', and 'Failed Compensations'. The 'Activity Instances' section has a link for 'Stopped Activities'. The main work area is titled 'Currently Valid Process Templates' and contains a message: 'Use this page to view process templates on which you can work.' It features a 'Start Instance' button and a 'Refresh' button. A table lists process template names with their valid from dates: 'AccountTracking' (3/12/2008 2:14:43 AM EDT) and 'AccountVerification' (3/11/2008 3:02:33 AM EDT). Below the table, a status bar says 'Items found: 2 Items selected: 0'. Callouts identify the 'Header' (top bar), 'Command bar' (button bar), 'Work area' (main content), and 'Navigation pane' (left sidebar).

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Figure 9-27. Business Process Choreographer Explorer

Business Process Choreographer Explorer is a web application that provides a set of administration functions for managing BPEL processes and human tasks. You can also view and delete archived processes and tasks, and report on process and activity events. The interface consists of a taskbar, a navigation pane, and the workspace.

Navigation pane view types

Predefined views

- In the default navigation pane
- Views are available only if that navigation pane is not changed

Customized and predefined views

- Added to the navigation pane by system administrator
- The **Custom view** icon indicates customized views
 - System administrator can delete, edit, copy, and move these views
- The **Predefined view** icon indicates predefined views
 - System administrator can change the position of these views

Personalized view

- The **Custom view** icon indicates the personalized view
- The user that created the view can delete, edit, copy, and move

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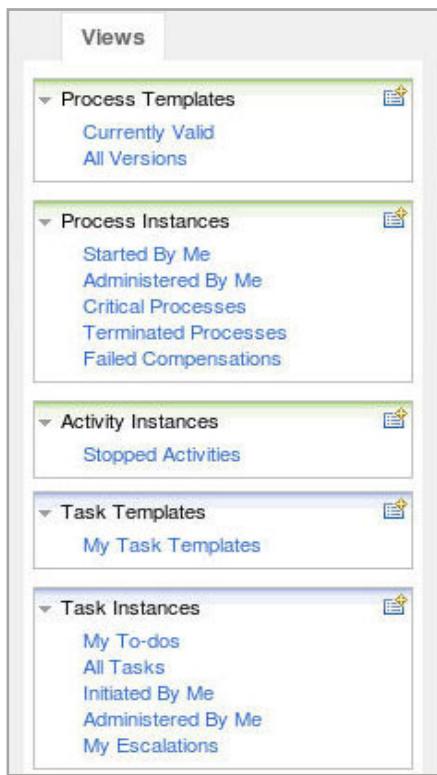
Figure 9-28. Navigation pane view types

If the **Views** tab is selected, the navigation pane contains links to views that you use to administer objects, for example, process instances that you started, or human tasks that you are authorized to administer. The default user interface contains links to predefined views for BPEL processes and tasks.

The system administrator can customize the content of the navigation pane by adding and removing predefined views from the navigation pane and defining custom views to add to the navigation pane. All users can define personalized views and add them to their navigation pane.



Navigation pane views



- Predefined views
 - In the default navigation pane
 - Views are used to administer objects that you are authorized to use

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Figure 9-29. Navigation pane views



Enhanced configuration and customization

Business Process Choreographer Explorer

Welcome psdeadmin | Logout | Manage Views | **Customize** | Help | About

Views

- Process Templates
 - Currently Valid
 - All Versions
- Process Instances
 - Started By Me
 - Administered By Me
 - Critical Processes
 - Terminated Processes
 - Failed Compensations
- Running Processes
- Activity Instances
 - Stopped Activities
- Task Templates
 - My Task Templates
- Task Instances
 - My To-dos

Customize Navigation Tree and Login View

Use this page to customize the views that are shown in the navigation tree. You can define the view that your users see when they log in. [i](#)

Save | **Cancel** | **Restore Defaults**

1. Select the views to display in the navigation tree

This list shows the system views. Select or deselect a view to display it in the navigation tree, and save your changes. Your users then see these views in the Business Process Choreographer Explorer.

Process Templates	<input checked="" type="checkbox"/> Currently Valid <input checked="" type="checkbox"/> All Versions <input type="checkbox"/> State Machine Templates
Process Instances	<input checked="" type="checkbox"/> Started By Me <input checked="" type="checkbox"/> Administered By Me <input type="checkbox"/> State Machine Instances

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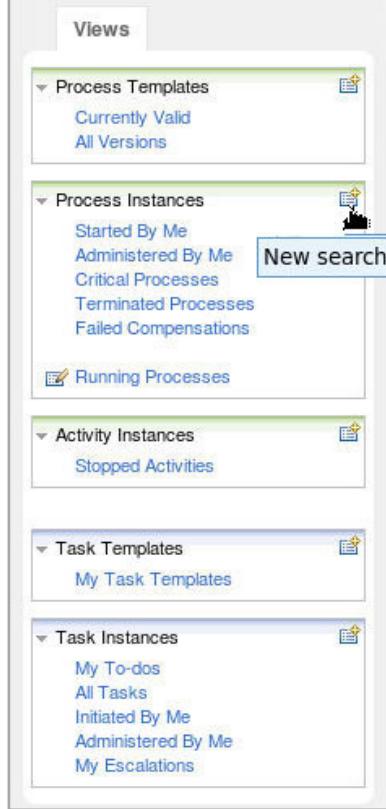
Figure 9-30. Enhanced configuration and customization

The system administrator can select the **Customize** option to add views to and remove views from the navigation pane for this instance of the client application. The administrator can also define the view that your users see when they log in.

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Business Process Choreographer Explorer customized views

- Business Process Choreographer administrator customizes the Business Process Choreographer Explorer for all users
 - Set default welcome view
 - Customize navigation area and views
- Users are able to personalize their own Business Process Choreographer Explorer
 - Administrators and users can manage custom views in their scope
- Saved views are shown in that navigation area (queries are stored)
 - Public stored queries by administrator
 - Private stored queries for each user



Business process choreography

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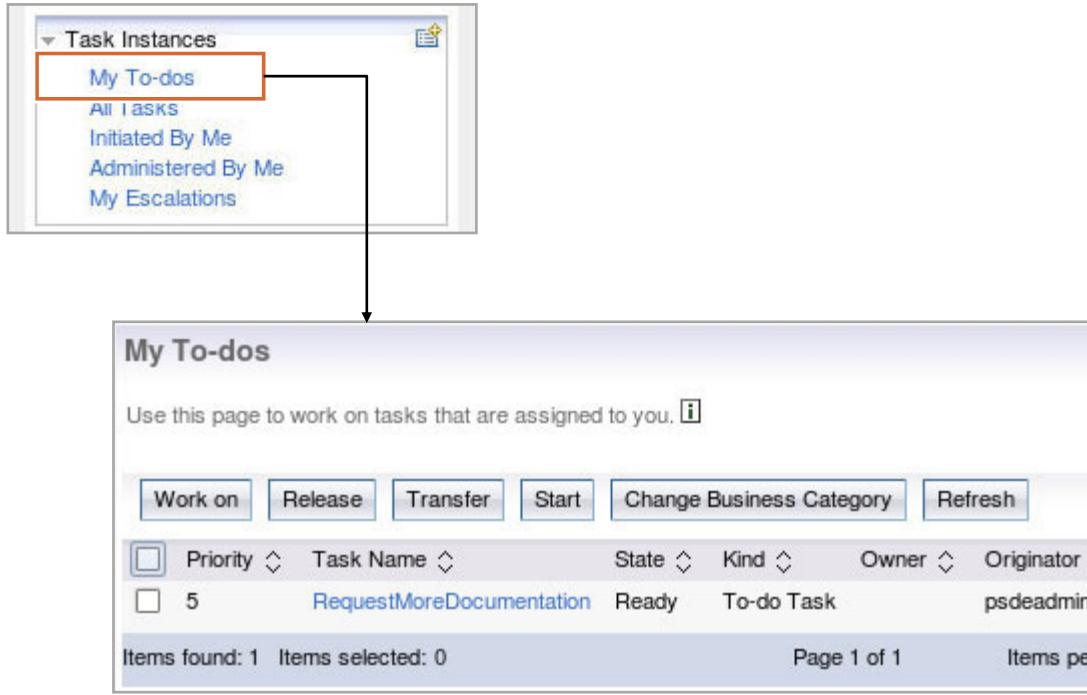
Figure 9-31. Business Process Choreographer Explorer customized views

Further actions are available from the menu and depend on the view type. The New search menu icon indicates that a menu is available.

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Work on tasks with the Business Process Choreographer Explorer



	Priority	Task Name	State	Kind	Owner	Originator
<input type="checkbox"/>	5	RequestMoreDocumentation	Ready	To-do Task	psdeadmin	

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Figure 9-32. Work on tasks with the Business Process Choreographer Explorer

By clicking **My To-dos** in the Task Instances view, you can work on tasks that are assigned to you.



Monitor the progress of a process instance

Views

- Process Templates
 - Currently Valid
 - All Versions
- Process Instances
 - Started By Me
 - Administered By Me
 - Critical Processes
 - Terminated Processes
 - Failed Compensations
- Activity Instances
 - Stopped Activities
- Task Templates
 - My Task Templates
- Task Instances
 - My To-dos
 - All Tasks
 - Initiated By Me
 - Administered By Me
 - My Escalations

Process State View

Use this page to view a graphical image of the process instance. [\[i\]](#)

[Refresh](#) [View Process Instance Details](#) [View Process Template Details](#)

Process Instance Name	_PI:90030145.baffa4b6.91afef53.fcff0002
Process Template Name	CustomerSync
State	Failed

Detail level: Zoom:

less detail more detail small

You can monitor the progress of a process instance to determine whether you need to act so that the process can run to completion

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Figure 9-33. Monitor the progress of a process instance

1. Display a list of process instances. For example, click **Administered By Me** under Process Instances on the **Views** tab navigation pane.
2. Select the check box next to the process instance and click **View Process State**. The Process State page is displayed. This page shows the activities, the links (including the transition and join conditions for the links), the fault handlers, the compensation handlers, and the event handlers that are defined for the process. Activities are color-coded in the diagram, depending on their state. All states have an associated icon. For example, completed activities have a check mark. For more information, see the online help for the page.
3. To act on an activity, click the activity, and select **Show Activity Details**. Click an activity in the process state view to open a menu. In this menu, you can view the activity details, skip the activity (mark an activity for skipping), or select it as the source for a jump to a different activity in the process. You can also repair switch activities that failed due to problems with the evaluation of a case condition.

The available actions are displayed. Select the action of your choice. The purpose of this screen capture is to give an example of a process state view in Business Process Choreographer Explorer. Though the font is small and might be difficult to read, it is not critical to the concept for you to be able to read what it says.

9.6. Human task clients

Human task clients

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Figure 9-34. Human task clients

Clients for human tasks

- Several clients are available for working with human tasks that are specified in the task template user interface settings
- Most can be generated by using the graphical client wizard
 - Business Process Choreographer Explorer: JSF-based application for basic and administrative actions on tasks
 - IBM WebSphere Portal clients: Use an existing portlet or generate a portlet by using the portlet generator
 - IBM Forms clients: Generate a human task client, which is based on electronic forms
 - Business Space client: Web 2.0 client for creating human workflow workspaces
 - HTML-Dojo pages can be created and rendered in Business Space
 - JSF and JSP clients
 - Custom clients: Generate client by using calls to task container APIs
 - Coaches: Web-based interfaces where process participants do the work that is required to complete each task

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Figure 9-35. Clients for human tasks

You can use various clients for working with human tasks. You can call the task by using SCA, JMS, and web services when the task is exposed as an SCA component. With these interfaces, you can create human tasks and retrieve results.

There is a full set of exposed APIs for the Human Task Manager so you can create your own custom clients that retrieve work items that are based on specific attributes. To create such clients, you might use APIs along with the people query capabilities. APIs provide a robust means of retrieving work items by using a tightly coupled Java implementation.

The screenshot shows two windows side-by-side. On the left is a dialog box titled 'Generate Human Task User Interface' with a tab labeled 'Portlets for IBM WebSphere Portal server'. On the right is a web-based 'Flight Book Portlet' interface. An arrow points from the 'Portlets for IBM WebSphere Portal server' tab in the dialog box to the 'Flight Book Portlet' interface.

Flight Book Portlet

Travel Request:

- Employee:** Juergen Employee
- Reason:** Conference
- Departure Date:** 5.10.2002, 9:00 am
- Origin Airport:** Frankfurt
- Destination Airport:** New York
- Airline:** Lufthansa
- Class:** Economy

Origin airport (IATA code):

Destination airport (IATA code):

Airport selection list:

- Aalesund, Norway (AES)
- Aberdeen, Scotland, United Kingdom (ABZ)
- Aberdeen, SD, USA (ABR)
- Abu Dhabi, United Arab Emirates (AUH)

Departure date: (yyyy/mm/dd)

Return date: (yyyy/mm/dd)

Departure time (hh:mm):

Return time (hh:mm):

Seat Class: Economy

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Figure 9-36. IBM WebSphere Portal portlet

A portlet is a reusable web module that runs on a portal server. In the human task editor, you can specify a portlet as a client. Before you can generate a portlet in IBM Integration Designer, you must:

- Install the Portal Toolkit. When you install IBM Integration Designer, choose to install the Portal Toolkit. Information about how to set up IBM WebSphere Portal Server to integrate business processes on Process Server can be found in the IBM WebSphere Portal IBM Knowledge Center.
- Create a Portal server connection.

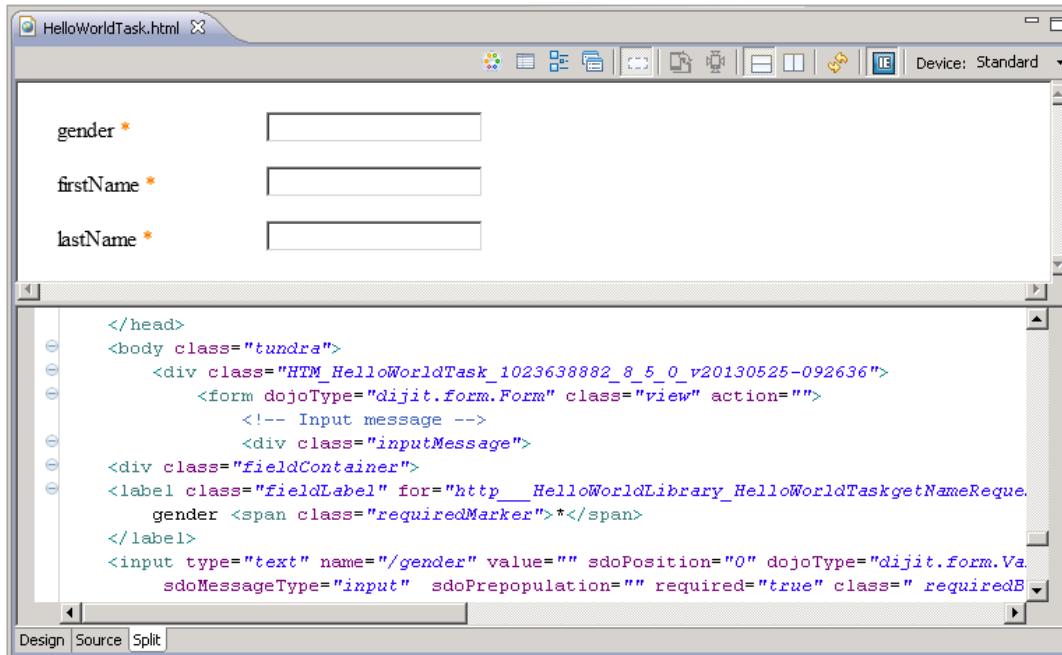
The portlet generator wizard guides you through the process of creating a portlet in Integration Designer.

Business Space for human workflow

- Business Space is a Web 2.0 IBM BPM client for business users
- Spaces: Pages that are built by using mashup technology that integrates widgets
 - Predefined space templates that contain task-related widgets support human-centric workspaces
 - Customized layouts can be defined by using available widgets
 - Includes graphical process widget, escalations, and task lists
- Widgets:
 - Use Representational State Transfer (REST) APIs to access runtimes
 - Dojo Toolkit and JavaScript used to create iWidget compliant widgets
 - iWidget editor is provided as part of the web development tools
 - Widget content can be used in IBM WebSphere Portal
- Uses Business Space Manager
 - Common framework for user interfaces in IBM products

HTML-Dojo client for Business Space (1 of 2)

- HTML-Dojo forms are developed in IBM Integration Designer and rendered in the business user's workspace



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Figure 9-38. HTML-Dojo client for Business Space (1 of 2)

Use the context root and HTML file fields to specify the location of the HTML file that contains the visualization of the user interface. Business Space uses two fields to compose the URL from which your HTML file is uploaded by using the following format:

`http://localhost/<contextroot>/<pathAndFile>`

If no HTML file exists, you can create one. In the “Select the folder where the HTML file is generated” window, click **New Web Project** to create a web project for your HTML file. You can also create folders within that project to better organize your files. To create a folder, select the web project, or one of the folders nested beneath it, and click **New folder**. You can change your HTML files by using a text or HTML editor.

HTML-Dojo client for Business Space (2 of 2)

- HTML-Dojo forms are developed in Integration Designer and rendered in the Task Information widget of Business Space

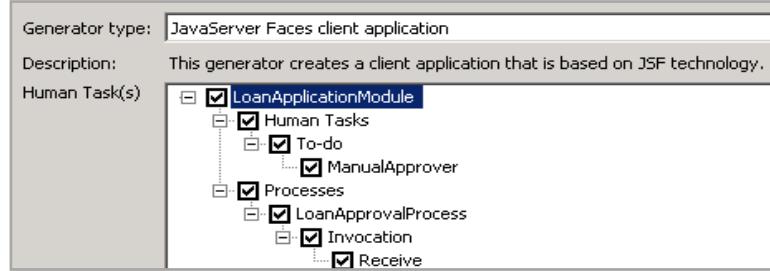
The screenshot shows the 'Task Information' dialog box from the IBM Business Space interface. The title bar says 'Task Information'. Below it, there's a section labeled 'HelloWorldTask' with a delete button. On the left, there are two buttons: 'Submit' and 'Save'. To the right, there are three input fields: 'gender *' with the value 'male', 'firstName *' with the value 'phil', and 'lastName *' with the value 'bar'. A yellow callout box with a black border and arrow points to the 'HelloWorldTask' section, containing the text: 'The form that is developed in Integration Designer is rendered in the Business Space UI'.

Figure 9-39. HTML-Dojo client for Business Space (2 of 2)

The HTML-Dojo forms that are generated in Integration Designer are rendered in the Task Information widget of Business Space.

JSF and JSP clients

- Use a graphical wizard to generate JSP or JSF-based clients for human tasks
 - Stand-alone and inline human tasks for individual module or multiple modules
 - Specify which tasks to display in the generated client
 - Web or Java EE perspective is used to further customize JSF-based web clients
 - Provides an easy way to demonstrate human task capabilities that include ad hoc tasks (subtasks only)
- The wizard also supports JSF clients for tasks that are associated with business processes



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Figure 9-40. JSF and JSP clients



Coach

The screenshot illustrates the Coach interface. On the left, a sidebar titled 'Coaches' lists three tasks: 'Create job requisition NG', 'Confirm position details NG', and 'Provide details for existing position NG'. The main area is a 'Submit job requisition' form divided into sections: 'Job requisition data' (Requester and Requested job position), 'Make your decision', and a 'Next' button.

- Create rich user interfaces easily and quickly
- Create and distribute their custom coach views

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Figure 9-41. Coach

Coaches are the user interfaces for human services.

There are two types of user interfaces for human services: dashboards and task completion. To build either type of user interface for human services, you use coaches.

When a coach is a dashboard user interface, users can run it as a stand-alone user interface at any time. The users access it through the Process Portal.

When a coach is a task completion user interface, it is part of the human service flow. When the flow enters the coach, the user sees the user interface that is defined for that coach. The user interface consists of HTML code that is displayed in a web browser. The flow leaves the coach when a boundary event occurs. A coach can have multiple exit flows with each one associated with a different boundary event.

Coaches contain one or more coach views. The coach views provide the user interface elements and layout for the coach. Each coach view can contain one or more other coach views, which creates a parent-child relationship between these coach views.

9.7. People directory support

People directory support

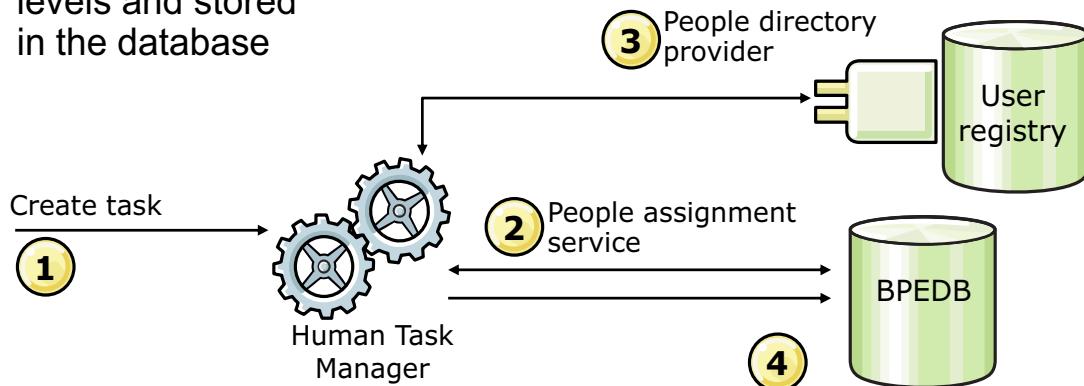
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Figure 9-42. People directory support

Human task and query creation

1. The Human Task Manager (HTM) receives a task request
2. The HTM retrieves the people query from the BPEDB database
3. The people assignment service passes the people query to the people directory provider where the query is run against the user registry to retrieve a user, a group of users, or a group
4. The query results are returned to the Human Task Manager, and tasks are created for selected users with different permission levels and stored in the database



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Figure 9-43. Human task and query creation

People query example

- In this example, the “Potential owner” role is assigned to the “Approvers” group
- Both John and Jane, as members of the approvers group, can claim the task
- A people assignment post-processor plug-in is available to further modify the query result after it is returned to the Human Task Manager

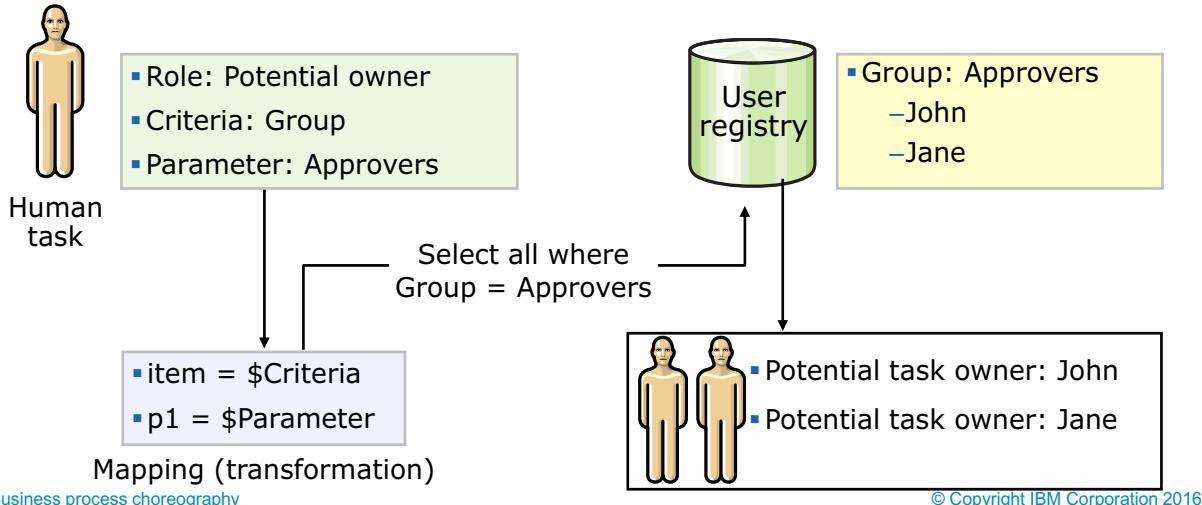


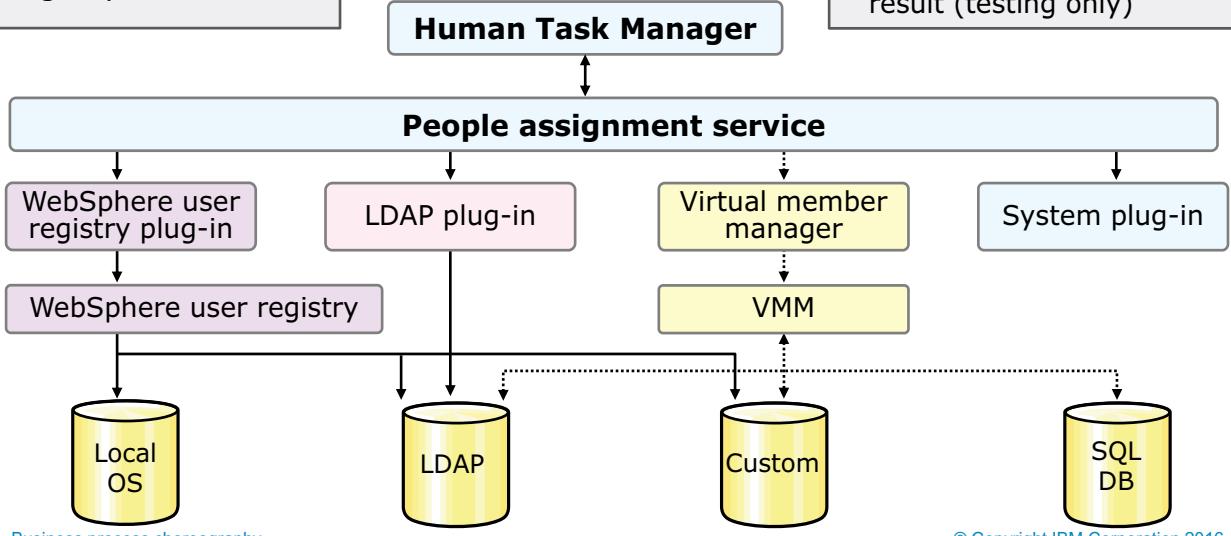
Figure 9-44. People query example

Query resolution at run time

At run time, the people assignment service provides access to one of the people directory plug-ins to query a particular user registry

- **LDAP:** Uses an LDAP registry
- **User registry:** Supports the local operating system directory, LDAP, or custom registry by using the user registry API

- **System:** Uses static group values, user values, or context variables (for testing)
- **“Everybody”:** Based on the system plug-in, but always returns “everybody” as the query result (testing only)



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Figure 9-45. Query resolution at run time

Unit summary

- Describe basic workflow concepts
- Explain the need for business process choreography
- Describe the difference between long-running and microflow (short-running) business processes
- Explain business process choreography architecture
- Describe various features of the Business Process Choreographer Explorer
- Describe the clients that are available for human tasks
- Describe the people directory support that is available for human tasks in Process Server

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Figure 9-46. Unit summary

Review questions

1. The following features are installed with Business Process Manager Advanced, except for:
 - A. Business Process Choreographer Explorer
 - B. Business Flow Manager
 - C. Business Process Archive Manager
 - D. Human Task Manager

2. What people assignment plug-in providers are available?
 - A. LDAP, user registry, system, and VMM
 - B. LDAP, federated, custom, file
 - C. User registry, federated, custom, file



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Figure 9-47. Review questions

Write your answers here:

1.

2.

Review answers

1. The following features are installed with Business Process Manager Advanced, except for:

- A. Business Process Choreographer Explorer
- B. Business Flow Manager
- C. Business Process Archive Manager
- D. Human Task Manager

The answer is C.



2. What people assignment plug-in providers are available?

- A. LDAP, user registry, system, and VMM
- B. LDAP, federated, custom, file
- C. User registry, federated, custom, file

The answer is A.

Unit 10. Application deployment concepts

Estimated time

01:15

Overview

This unit describes the process of deploying and managing business process applications.

How you will check your progress

- Checkpoint
- Lab exercises

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe the installation of a business process
- Describe the runtime behavior of business processes
- Describe the administrative options and the types of client access that are available for business processes
- Describe the uninstallation of a business process
- Define the purpose and function of the serviceDeploy tool
- Describe the process of using the Failed Event Manager to manage failed events
- Describe how to migrate process instances and generate a migration policy file
- Purge data in the Process Server environment
- Configure business process choreography cleanup

Topics

- Installing and managing business processes
- Managing business process instances
- Working with advanced content
- Working with the Failed Event Manager
- Migrating instances
- Purging data in the Process Server environment
- Business process choreography cleanup

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Figure 10-2. Topics

10.1. Installing and managing business processes

Installing and managing business processes

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Figure 10-3. Installing and managing business processes

Business process templates and instances

- Process templates describe the business process model
 - The Business Flow Manager uses the template to create instances of the business process at run time
 - Process templates are deployed and installed on IBM Process Server
- Process instances are entities that exist at run time
 - An instance represents one running business process, its specific data, and its state
 - The Business Flow Manager can run multiple process instances at the same time
- Process templates and instances are persisted to a database

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Figure 10-4. Business process templates and instances

A process template describes the business process model. It is the blueprint of your service and shows how you process requests. When a request comes in, the business flow manager reads the template to create an instance for the business process at run time. Process templates are deployed and installed in the business process container in Process Server. Through the administrative console, you can start and stop process templates.

After a request comes in, a process instance gets created by the runtime. Process instances represent the running business process. The business flow manager can run multiple process instances simultaneously.

Process templates and instances are persisted in a database, and you can manage them through the Business Process Choreographer Explorer.

Installing a business process

- Business processes are packaged in EAR files
 - Install by using the administrative console or wsadmin
 - Installed in the normal application installation process
- At installation time:
 - The business process application is installed
 - The WebSphere configuration repository is updated
 - Validates business processes (.bpel) and human tasks (.tel) for correctness
 - The business process template is deployed to the database
 - The persistent storage for each interruptible business process is stored in separate tables in the database
- Process and task templates can have the following states:
 - Started: New process instances can be started
 - Stopped: No new process instances can be created and started

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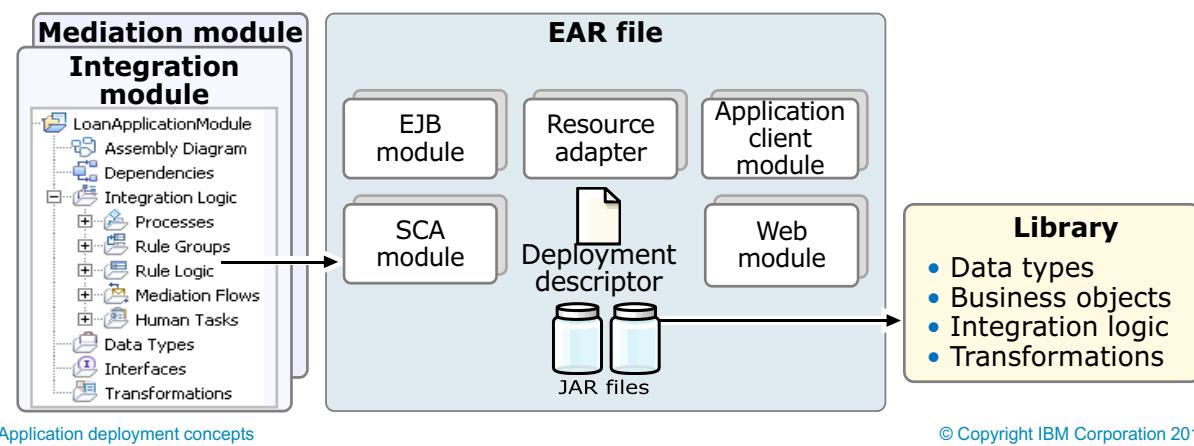
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Figure 10-5. Installing a business process

Business processes, as deployable artifacts, are contained within EAR files and are exposed as SCA components. They are installed in the normal application installation process. There are no additional steps necessary when installing an application that includes a business process.

Service Component Architecture modules

- When a module is built and packaged, it is the basic unit of deployment
 - Integration modules are packaged in EAR files as SCA modules
 - The EAR is deployed to the runtime environment
- The EAR file can contain more components:
 - Java Platform, Enterprise Edition projects (EJB modules and web modules)
 - Java projects
 - Dependent libraries
- A library might be included as a JAR file (if not deployed globally)



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Figure 10-6. Service Component Architecture modules

A service module is an SCA module that provides services in the runtime. When you deploy a service module to IBM Business Process Manager, you build an associated service application that is packaged as an EAR file.

Service modules are the basic units of deployment and can contain components, libraries, and staging modules that the associated service application uses. Service modules have exports and, optionally, imports to define the relationships between modules and service requesters and providers. IBM Process Server supports modules for business services and mediation modules. Both business services modules and mediation modules are types of SCA modules. A mediation module allows communication between applications by transforming the service invocation to a format that the target understands. It passes the request to the target and returns the result to the originator. A module for a business service implements the logic of a business process. However, a module can also include the same mediation logic that can be packaged in a mediation module.

SCA module administration

- SCA modules:
 - Can be started and stopped
 - Can be installed and uninstalled by using the administrative console
- Export and import binding configurations can be changed
- Module properties can be modified

The screenshot shows a web-based administrative interface titled "SCA modules". The page header includes a "Preferences" link and buttons for "Start", "Stop", "Install", and "Uninstall". Below this is a toolbar with icons for search, refresh, and other functions. A filter bar allows filtering by "Select", "Module", "Version", "Application", and "Status". The main content area displays a table of resources, each with a checkbox, a name, and a status icon. The resources listed are:

	Name	Status
<input type="checkbox"/>	BFMIF_AppCluster	
<input type="checkbox"/>	CreditCheckMediationService	
<input type="checkbox"/>	CustomerMediationService	
<input type="checkbox"/>	FoundationModule	
<input type="checkbox"/>	FoundationServices	
<input type="checkbox"/>	HTMIF_AppCluster	
<input type="checkbox"/>	HTM_PredefinedTaskMsg_V700 (AppCluster)	
	BPEContainer_AppCluster	
	CreditCheckMediationServiceApp	
	CustomerMediationServiceApp	
	FoundationModuleApp	
	FoundationServicesApp	
	TaskContainer_AppCluster	
	HTM_PredefinedTaskMsg_V700_AppCluster	

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Figure 10-7. SCA module administration

The service module details that you can view depend upon the SCA module. They can include the following attributes:

- SCA module name.
- SCA module description.
- Associated application name.
- SCA module version information, if the module has versions.
- SCA module imports: Import interfaces are abstract definitions that describe how an SCA module accesses a service. Import bindings are concrete definitions that specify the physical mechanism by which an SCA module accesses a service; for example, by using SOAP/HTTP.
- SCA module exports: Export interfaces are abstract definitions that describe how service requesters access an SCA module. Export bindings are concrete definitions that specify the physical mechanism by which a service requester accesses an SCA module, and indirectly, a service.
- SCA module properties.



SCA export and import binding configuration

SCA modules > HelloWorld_Module

Use this page to configure the details of an SCA module. A SCA module is connected to service requesters through exports and to service providers through imports. Both imports and exports have interfaces, which are abstract definitions defining access points.

Configuration

General Properties

- Module: HelloWorld_Module
- Application name: HelloWorld_ModuleApp
- Description:

Module components

- Imports
 - Import1
 - Interfaces
 - Polyglot
- Exports
 - Web service [PolyglotService/Polyglot]

There are no exports

Additional Properties

- [Business process](#)
- [Module properties](#)
- [Human tasks](#)

SCA modules > HelloWorld_Module > PolyglotService

The attributes of the selected Web service import binding.

Configuration

General Properties

- Service: PolyglotService
- Port: Polyglot
- * Endpoint: <http://localhost:9080/WSWeb/services/Polyglot>

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Figure 10-8. SCA export and import binding configuration

Export and import bindings can be configured at run time.

serviceDeploy overview

- Automated deployment (assemble, generate, and compile) of Service Component Architecture (SCA) applications
 - Helpful in situations where all SCA component resources are not in a single workspace for assembly and deployment
- Command line or Ant task options
 - SCA resources (module) and other application components (WAR, EJB JAR, RAR, utility JAR) passed as a single input archive
 - Deployment provides basic assembly for SCA components and generates Java Platform, Enterprise Edition application artifacts, and packages into a single EAR ready for installation

```
serviceDeploy inputArchive [<-workingDirectory temppath>
                  <-outputApplication outputpathname.ear>
                  <-freeform true|false >
                  <-cleanStagingModules true|false> <-keep true|false>
                  <-ignoreErrors true|false>
                  <-classpath jarpathname;rarpathname;warpathname;... ->
                  help]
```

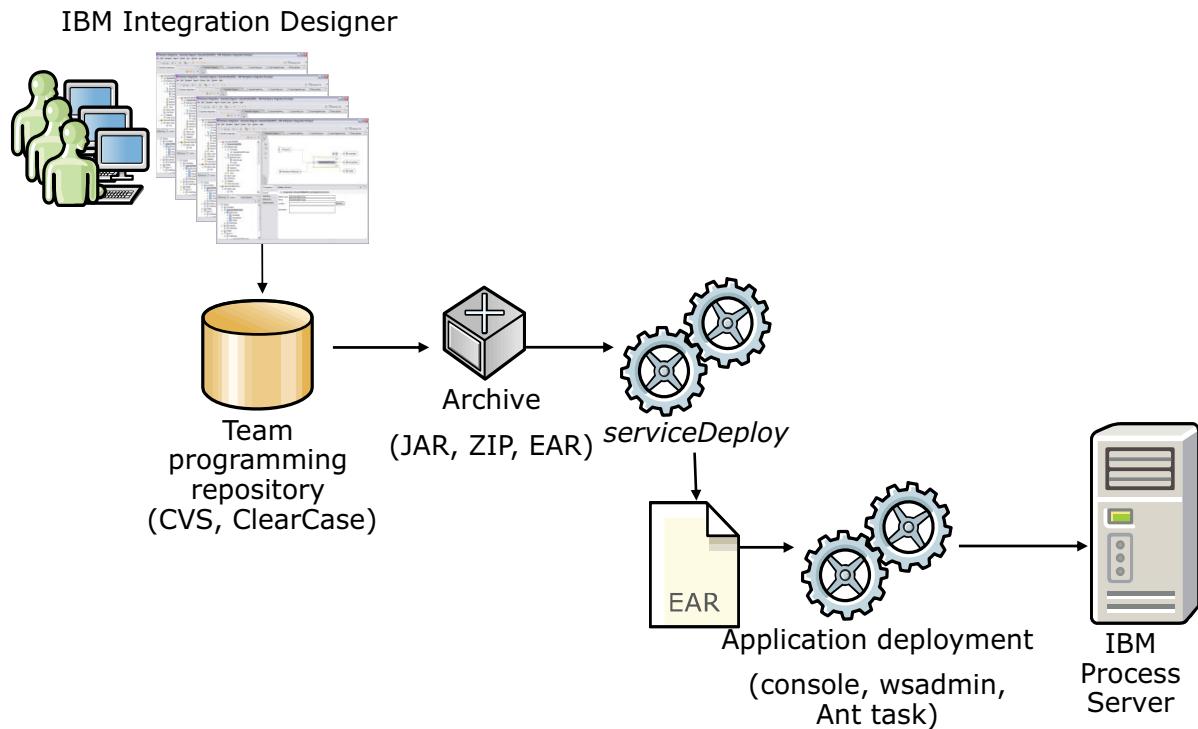
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Figure 10-9. serviceDeploy overview

You can export modules and libraries as compressed files. Then, use the serviceDeploy command of IBM Process Server or WebSphere Enterprise Service Bus (mediation modules only) to build and deploy them as EAR files.

serviceDeploy: Multiple developers



Application deployment concepts

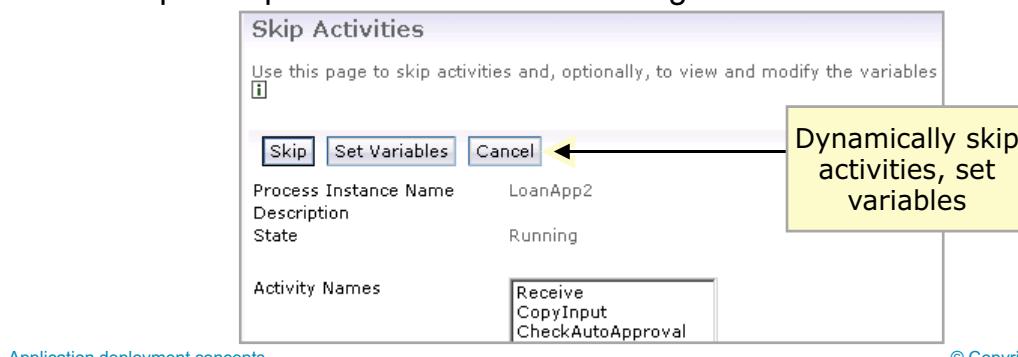
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Figure 10-10. *serviceDeploy: Multiple developers*

In this example, you have a team of developers who are developing particular resources and publishing them to a team repository. The repository might be CVS, ClearCase, or some other repository. Using the `serviceDeploy` command, the resources are assembled and an EAR file is generated. The various administrative tools can be used to install the EAR file to the runtime.

Runtime process dynamicity (1 of 3)

- Scopes and collaboration scopes support dynamic modification by using the graphical process widget in Business Space or Business Process Choreographer Explorer
 - Provides greater flexibility and allows processes to adapt to changing situations
 - Supports dynamic human workflow scenarios
- Dynamicity allows business users and solution administrators to override the navigation of a long-running process
 - Jump forward and backward between activities in a running process
 - Skip specific activities within a running process
 - Incorporate process relevant data changes at run time



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Figure 10-11. Runtime process dynamicity (1 of 3)

When a business process is stopped at an activity that is nested within a collaboration scope, an authorized individual can skip, undo, redo, jump forward, or jump backward from that activity. These options are available through an appropriate client such as the Business Process Choreographer Explorer or Business Space. The ability to dynamically modify a process that is deployed to a runtime environment is especially useful in cases where the process describes a series of steps that are not always necessary.

For example, a business process has a model of the sequence of steps in an insurance claim. There might typically be five steps in the insurance claim process that is being modeled, but what about situations where it can be settled in just three? Enabling dynamicity in your business process means that an authorized user can make edits after the process is deployed.

Dynamic modification also includes the ability to modify process data at run time. You might modify business information, such as customer name and address. CEI events can be generated during dynamic modification for auditing purposes.

Runtime process dynamicity (2 of 3)

- Jumping (forward and back) is supported between activities in a generalized flow, sequence, or single thread or section of a parallel flow
 - Source of a jump is basic activity
 - Target of a jump can be basic or structured activity
 - Jumping into nested constructs not supported
- You can skip active or future basic activities in a process
 - Can skip active activities (in non-terminal state: running or ready) immediately
 - Can mark future skipped activities
 - Can skip basic activities
 - Cannot skip structured activities (such as scope, sequence)
 - Can combine skip with jump
- Skipping an activity can be undone if it did not reach the activity

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Figure 10-12. Runtime process dynamicity (2 of 3)

For a complete list of repairable items in business processes, see the IBM Knowledge Center.

Runtime process dynamicity (3 of 3)

- Specific business users and administrators can be authorized to initiate jumps, or to skip certain activities in a scope or collaboration scope
- You can update process variables at run time
 - Can use Business Process Choreographer Explorer or Business Space to set variables for running instance
 - Useful in repair scenarios where inconsistent data must be changed

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Figure 10-13. Runtime process dynamicity (3 of 3)

For a complete list of repairable items in business processes, see the IBM Knowledge Center.

Uninstalling a business process

- The process or task template must be stopped before uninstalling an application; template is stopped automatically during uninstall
 - If uninstall fails, template is restarted
- Uninstall fails if there are running instances
 - The check is done after the template is stopped
 - All instances must be terminated and deleted
- Applications can be removed by using included Jacl script even though *instances still exist in various states* (cleans up templates and instances)
 - Use during testing

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Figure 10-14. Uninstalling a business process

If you must uninstall an application that contains a human task, you must first stop all running instances of that task. Uninstalling an application that contains a task is a three-step process.

1. Ensure that all instances are completed and removed.
2. Stop the template that represents the task.
3. Uninstall the application.

Removing applications along with running instances can be done during testing.

10.2. Managing business process instances

Managing business process instances

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Figure 10-15. Managing business process instances



Examine process template information

Business Process Choreographer Explorer

Welcome wasadmin | Logout | Define Views | Customize | Help | About

Views

- Process Templates
 - Currently Valid
 - All Versions
- Process Instances
 - Started By Me
 - Administered By Me
 - Critical Processes
 - Terminated Processes
 - Failed Compensations
- Running Processes
- Activity Instances
 - Stopped Activities
- Task Templates
 - My Task Templates
- Task Instances
 - My To-dos
 - All Tasks
 - Initiated By Me

Process Template

Use this page to view information about a process template. [i](#)

Start Instance Instances Versions View Structure

Process Template Description

Process Template Name	AccountTracking
Description	
Documentation	

Details Operations Process Instances Custom Properties Query Properties

Process Template ID	_PT:90010126.d7f3ba58.fdf80.f57d0079
Namespace	http://FoundationServices-process
Application Name	FoundationServicesApp
Administrators	Nobody
Created	2/16/2010 1:04:19 PM EST
Valid From	3/12/2008 2:14:43 AM EDT
State	Started
Delete on Completion	only if successful
Long Running	yes
Compensation Defined	no
Continue on Error	yes
Autonomy	Peer

Click a process name in the **Process Templates** list to reveal detailed information about the process template

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Figure 10-16. Examine process template information

You can use Business Process Choreographer Explorer to view information about the started templates.



Monitor business process instance and activities

- Instances can be monitored from the Process Instances view or administered from the By Me view
- Certain operations are available only to BPESystemAdministrator
 - The date, time started, or current state of completed activities or pending activities for a selected process instance is listed

Process Instances for Process Templates

Use this page to work with process instances that belong to specific process templates. [\[i\]](#)

Terminate	Delete	Suspend	Resume	Restart	Compensate	Claim Ownership	View Process State	Related Processes
<input checked="" type="checkbox"/> Process Instance Name ↓							State ↓	Started ↓
<input checked="" type="checkbox"/> _PI:9003011f.23529bf6.7fa9573f.d5ff01c9							Running	1/29/09 11:57:10 AM
<input checked="" type="checkbox"/> Sungsam							Running	1/29/09 11:57:08 AM

Items found: 2 Items selected: 2 [\[<<\]](#) Page 1 of 1 [\[>>\]](#) Items per page: [20](#) [\[▼\]](#)

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Figure 10-17. Monitor business process instance and activities

You can monitor the progress of a process instance to determine whether the process can run to completion. After a BPEL process starts, it goes through various states until it ends. As a process administrator, you can take various actions on a process throughout its lifecycle.

Managing business processes

- To uninstall an application that contains business processes or human tasks, the following prerequisites must be met:
 - If an application is installed on a cluster, the deployment manager and at least one cluster member must be running
 - The cluster member must have access to the database
 - No instances of a business process template or human task template present in any state

Process Instances for Process Templates

Use this page to work with process instances that belong to specific process templates. [\[i\]](#)

<input type="checkbox"/> Process Instance Name	Process Template Name	State	Started
<input checked="" type="checkbox"/> _PI:9003011f.23529bf6.7fa9573f.d5ff01c9	AccountTracking	Running	1/29/09 11:57:10 AM
<input checked="" type="checkbox"/> Sungsam	AccountVerification	Running	1/29/09 11:57:08 AM

Items found: 2 Items selected: 2 Page 1 of 1 Items per page: 20

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Figure 10-18. Managing business processes

You might want to end a process instance. For example:

- The work or documents it represents are no longer needed.
- Nobody is available to complete the process instance.
- You encountered problems with the process template and it must be redesigned.

Uninstalling business processes and human tasks

To uninstall by using the administrative console:

- Select **Applications > Enterprise Applications**
- Select the application that you want to uninstall
- Select **Stop**
 - If this step fails, verify that all process and task instances are deleted before repeating this step
- Select again the application you want to uninstall
- Click **Uninstall** to remove the business module

To uninstall by using scripting, use the `manageTemplates.py` script:

- First, delete the process or task instances association with template
- Can start, or stop, process and task templates that belong to a particular application and uninstall BPEL and human task applications

Figure 10-19. Uninstalling business processes and human tasks

If you uninstall an application that contains a business process, you must first stop all running instances of that business process. Stopping a process is done to prevent the loss of state from a long-running business process by accidentally removing the application. Uninstalling a business process is a three-step process.

1. Ensure that all instances are completed and are removed.
2. Stop the template that represents that business process. (Stopping the template is done automatically when the application is uninstalled by using the administrative console.)
3. Uninstall the application.

10.3. Working with advanced content

Working with advanced content

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Figure 10-20. Working with advanced content

Advanced Integration service

- An Advanced Integration service (AIS) is used to call a service that is implemented in IBM Integration Designer from one of the following methods:
 - BPD with a system task
 - Another service with a nested service
- A collaboration between a business user who works with IBM Process Designer and an integration developer who works with IBM Integration Designer
- Available only with IBM Business Process Manager Advanced
- Implementation of a user task or a system task
 - User task: Assign as specified with the assignments of the user task
 - System task: Run by the system user

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Figure 10-21. Advanced Integration service

AIS is a collaborative arrangement. If you move your Advanced Integration service to another toolkit, you need to notify the integration developer who implemented your service. Your service and its implementation by Integration Designer are decoupled. It means that even though you might move a service in Process Designer, there is no automatic corresponding movement in the implementation by Integration Designer.

IBM Business Process Manager Advanced offers two authoring environments. IBM Process Designer is used to model and execute high-level business processes, which often have human interactions. IBM Integration Designer is used to build and implement services that are automated or that invoke other services such as web services, enterprise resource applications, or CICS applications and IMS, which exist in the enterprise. These authoring environments both interact with the Process Center, which is a shared repository and runtime environment.

There are two roles and skill sets to consider when developing business process management applications with these environments:

The *business author* is responsible for authoring all business processes. Business author is able to use services, but is not interested in the implementation details or how they work. The business author uses Process Designer to create business process diagrams (BPDs), and Advanced Integration services (AISs) to collaborate with the integration programmer.

The *integration programmer* is responsible for doing all of the integration work necessary to support the processes the business author creates. For example, integration programmer implements all the AISs, and produces mappings between backend formats and the requirements of current applications. The integration programmer uses Integration Designer.

Advanced content deployment considerations (1 of 2)

- Advanced content includes process applications or toolkits that are authored in IBM Integration Designer
 - Takes much longer to deploy than standard content
 - Content is packaged as SCA modules and libraries
 - Deployed as BLAs and EARs to the runtime
- Deployments should be done the minimum number of times that is practical
 - BLAs and EARs that are deployed consume resources on the server such as memory, disk space, and CPU cycles
- Toolkits are copied by value into dependent process applications and toolkits
 - Content is duplicated on the server for every process application and toolkit that references it

Advanced content deployment considerations (2 of 2)

- For Process Server deployments
 - Install snapshots during periods of low activity
 - Installation directories for the deployment manager and cluster members should be stored on a fast disk subsystem
- For Process Center server deployments
 - Make sure that the deployment manager and cluster members are installed on servers with multiple CPU cores
 - Use a dynamic load balancer that can detect CPU consumption on cluster members
- Purge data that is no longer needed
 - Data includes snapshots, process applications, and toolkit tips
 - Make sure to deactivate and undeploy advanced content

10.4. Working with the Failed Event Manager

Working with the Failed Event Manager

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Figure 10-24. Working with the Failed Event Manager

Failed Event Manager

- The Failed Event Manager can be used to find and manage failed events on all servers in a deployment environment
 - Use the interface to view (and in some cases, edit) the data for a failed event, resubmit a failed event, or delete a failed event
- Destinations that are created on the bus are configured to route failed messages to the recovery exception destination
- When a system failure occurs, the failed message is captured in the exception destination
- Process Server recovery feature generates a failed event that represents the system error and stores it in the failed event database
 - Three database tables include FailedEvents, FailedEventBOTypes, and FailedEventMessages

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Figure 10-25. Failed Event Manager

If an event fails, it is stored in a database in the Failed Event Manager. Use the Failed Event Manager to search for and handle failed events.

Actions for handling failed events include examining the types of data that is associated with the event (business, trace, or expiration data) to determine the cause of the failure. Actions also include editing the data, resubmitting the event, or both.

Failed Event Manager event types (1 of 2)

Service Component Architecture (SCA) failed events

- Failed asynchronous request or response

Java Message Service (JMS) failed events

- Failed data binding or function selector operation

WebSphere MQ failed events

- A failed event is generated when there is a problem with the WebSphere MQ or WebSphere MQ JMS binding export or import that is used by an SCA module

Business Process Choreographer stopped, terminated, and failed events

- Generated when a long-running BPEL process fails

Failed Event Manager event types (2 of 2)

Business Flow Manager hold queue events

- A navigation message might be stored in the hold queue if:
 - An infrastructure, such as a database, is unavailable
 - The message is damaged



Failed Event Manager interface

- Click **Servers > Deployment Environments > deployment_environment_name > Failed Event Manager** to open the Failed Event Manager

The screenshot shows the 'Deployment Environments > Failed Event Manager' page. It includes sections for 'Failed events on this server' (with links to 'Get all failed events' and 'Search failed events'), 'About your failed event manager' (showing the Recovery sub-system is enabled, total failed events count 4, and system details like IBM WebSphere Application Server Network Deployment, 8.5.5.2, Build Number: cf021414.01, and Build Date: 4/8/14), and a 'Documentation' section.

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Figure 10-28. Failed Event Manager interface

You can use the Failed Event Manager to find failed events in IBM Business Process Manager. You can search for all failed events or for a specific subset of events on all the servers within the deployment environment. Click any failed event to see all of the data that is associated with it.



Failed Event Manager: Viewing failed events

Failed Event Manager

[Failed Event Manager > Search results](#)

The failed events result set shows the failed events found from the most recent query.

Use the buttons below to manage the failed events in the current result set and to query or delete all failed

Preferences

Refresh Get all Search Resubmit Resubmit with trace Delete Delete expi

Select	Message ID	Type	Src. module	Src. component	Dest. module
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress
<input type="checkbox"/>	529361861F14F944..	invokeAsyncWithC..	JCAStress	JCAStressBPEL	SubJCAStress

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Figure 10-29. Failed Event Manager: Viewing failed events

The search results page displays the failed events in table format. The table columns provide details of the failed events (such as the name of the source module, source component, or destination module) in table format.

You can manage the failed events with the following actions:

- Resubmit events
- Resubmit events with detailed trace enabled
- Delete or discard events

Using the Select column is how you process multiple failed events concurrently.

Deleting all failed events can be useful, if you fixed the problem manually and want to clear all existing failed events.



Failed Event Manager: Event actions

Failed Event Manager

[Failed Event Manager](#) > [Search results](#) > 529361861F14F944_8500006

Use this page to view details about the failed event.

[Failed event details](#)

[Edit business data](#) Resubmit [Delete](#) [Undo local changes](#)

[Browse Related Common Base Events](#)

Failed event details

Message ID	529361861F14F944_8500006
Session ID	9.146.225.135;JCASTress;;operation;1173389070859;1418346063
Interaction type	invokeAsyncWithCallback
Source module	JCASTress
Source component	JCASTressBPEL

Application deployment concepts

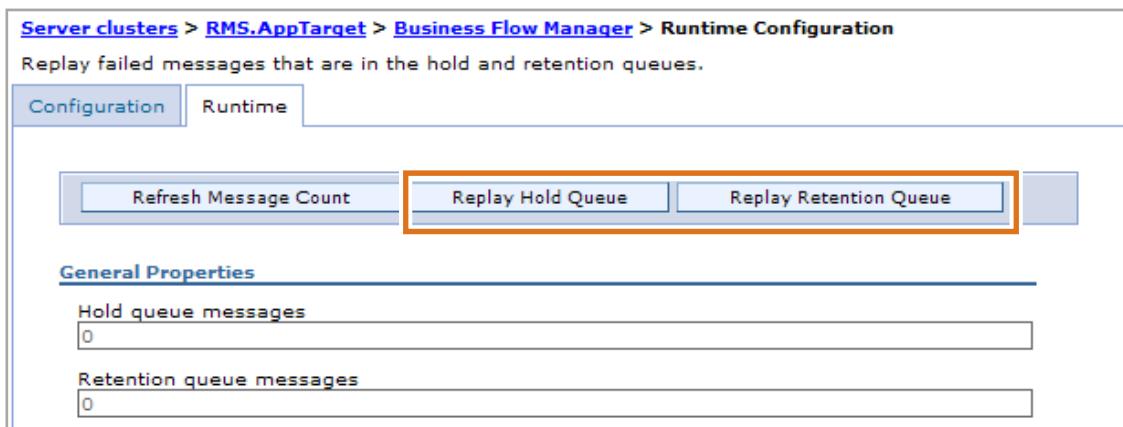
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Figure 10-30. Failed Event Manager: Event actions

The details page is used to verify the failed event content before running the appropriate management action. The action might be to resubmit or to retransfer the message after a failed component becomes available. When message content needs modification before resubmitting, use the **Edit business data** link.

Replay from hold queue

- Business Flow Manager uses an internal queue for processing long-running processes
- Retention queue and hold queue are used for internal processing issues, such as transaction rollbacks and timeouts
- Messages are tried again by using a sophisticated algorithm
 - Finally, the messages are put onto the hold queue for manual replay by the process administrator



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Figure 10-31. Replay from hold queue

You can use the Failed Event Manager to manage navigation messages that are stored in the Business Flow Manager hold queue. A navigation message might be stored in the hold queue if an infrastructure, such as a database, is unavailable or if the message is damaged.

In a long-running process, the Business Flow Manager can send itself request messages that trigger follow-on navigation. These messages trigger either a process-related action (for example, starting a fault handler) or an activity-related action (for example, continuing process navigation at the activity). A navigation message always contains its associated process instance ID (piid). If the message triggers an activity-related action, it also contains the activity template ID (arid) and the activity instance ID (arid).

You can use the Failed Event Manager to manage Business Flow Manager hold queue messages, or you can use a custom program.

You cannot delete Business Flow Manager hold queue messages in the Failed Event Manager. If the related process instance does not exist, replay the hold queue message to delete the message.

10.5. Migrating instances

Migrating instances

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Figure 10-32. Migrating instances

Snapshot installation

- When you install a snapshot, this sequence occurs on the Process Server:
 1. Necessary library items, assets, and referenced toolkits for the Process Application are installed
 2. The installation services run for each toolkit
 3. The installation service runs for the process application
 4. The data and process instances migrate if there are running business process definition instances.
 5. Tracking definitions are sent to the Business Performance Data Warehouse
 6. Any scheduled undercover agents (UCAs) are activated
 7. Any advanced content is deployed (SCA modules and libraries)
 8. An “Installation complete” message is sent to the Process Center (online servers only)
- If step 1, 2, or 3 fails, your installation stops and does not progress
- If an installation does not complete step 4 or 5, it will progress normally and you can manually correct problems after the installation is complete

If developers customize installation services, they can handle some exceptions to help with failures. Otherwise, you must manually roll back installation changes before you attempt to install a snapshot again.

Migration

- When changes are made to a snapshot of a BPD, which has been deployed to a runtime IBM BPM Process Server, there might be instances of an older snapshot that is still running
 - These instances might be left running or they might need to be migrated to the newer version of the snapshot
- For example, a process called New Hire Orientation on the production server
 - The developers designated some existing business data variables to be tracked in the newest snapshot, and they want to upgrade the production process to include tracking
 - IBM BPM prompts the person who is installing the snapshot to migrate the data from the current production process to the new snapshot
- Migration can be done by using the Process Center Console or by using the command line

Snapshot migration

- When you migrate a snapshot, this sequence occurs on the Process Server:
 1. The snapshot that originally contained the running instances is deactivated
 2. The replacement snapshot is installed on the server
 3. The migration program runs the installation service
 4. The migration program migrates global data (exposed process variables, environment variables, and teams). It uses the most recent time stamp on each exposed process variable to identify the global data to use in the replacement snapshot.
 5. The instance is migrated, the execution context is updated, and the actions are updated
 6. The migration program moves the "default" designation from the snapshot of the running instances to the newly installed snapshot. This action takes place only if the snapshot of the running instances was previously designated as the default snapshot.
 7. Instances from the source snapshot are deactivated
 8. The updated snapshot is activated

Application deployment concepts

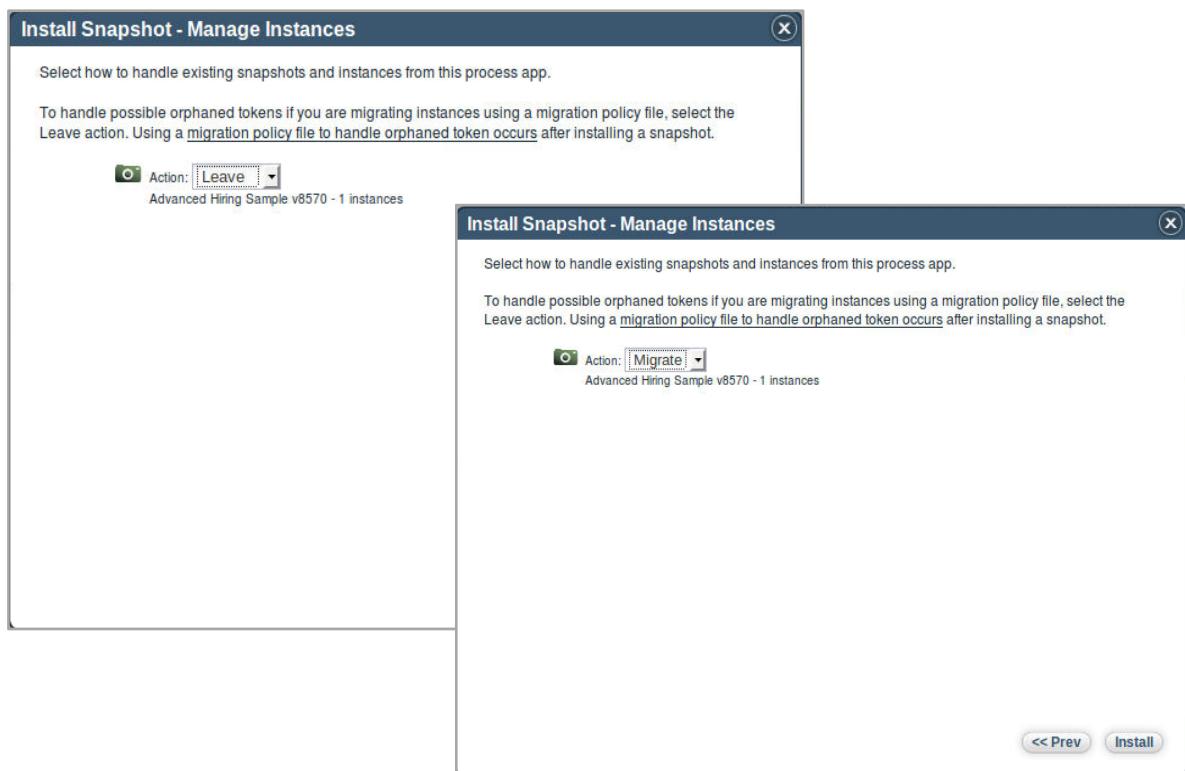
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Figure 10-35. Snapshot migration

Test your migration. Verify the results of instance migration in a test environment before you install the new snapshot on a production server. It is a risky oversight to test a new version by creating instances, but to fail to test for migrated instances.



Migrating an instance by using the Process Center Console



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Figure 10-36. Migrating an instance by using the Process Center Console

Options for migration

Online Migration Option	Offline Migration Option	Description
Leave running instances on current version of the snapshot	Leave	The instances currently running continue to completion with the previously installed version of the snapshot
Upgrade running instances to new version of the snapshot	Migrate	<ul style="list-style-type: none"> • Currently, running instances are upgraded to the new snapshot you are installing • Wherever the running instances are in the flow of the process. The new version is implemented for the next item or step
Delete running instances of current version of the snapshot	Delete	<ul style="list-style-type: none"> • The instances currently running are immediately stopped and do not continue to completion • All records of the running instances are removed from the process server

Application deployment concepts

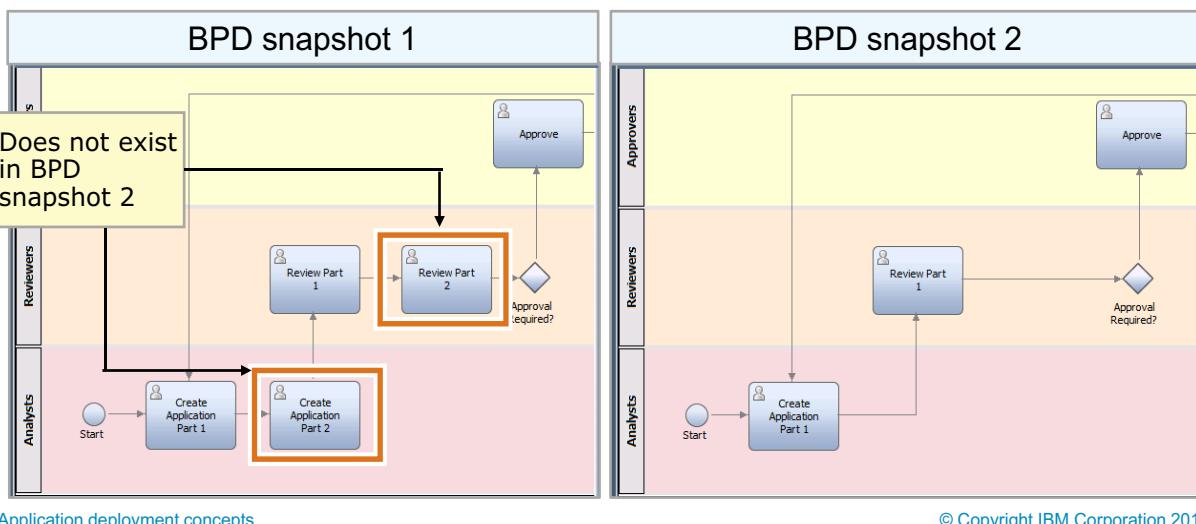
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Figure 10-37. Options for migration

The delete option is not available for process servers in production environments.

Orphaned tokens

- Think of a token as an active execution step within the process
- A token becomes orphaned if its associated activity is removed from a BPD of a migrated snapshot
- When migrating instances to a new version of the snapshot, you need to decide what to do with potential orphaned tokens or risk that the process instances does not complete



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Figure 10-38. Orphaned tokens

An orphaned token is a pointer that is associated with an activity that was removed from a business process definition (BPD). You can use a policy file, a REST API, or Process Inspector to manage orphaned tokens.

Think of a token as an active execution step within the process. Tokens exist on each active activity and also for timer and message events on an active activity.

A token becomes orphaned if its associated activity is removed from a BPD of a migrated snapshot. You need to decide what to do with potential orphaned tokens or risk that the process instances do not complete. For example, suppose that you installed a new version of a process application. The new version cleans up a number of activities that are no longer used from the earlier version. However, some tokens still exist for some of these unused activities. You must either delete or move these orphaned tokens, or the migrated process instances might not be able to complete. When orphaned tokens are deleted or moved, the process instance will try to resume at the next activity that contains tokens. If a next step cannot be determined from the revised BPD, the instance will complete when there are no more active tokens. For example, if you have an activity that contains three tasks (Task A, Task B, and Task C) and Task A is running, it has the token. If you delete the token while Task A is running, Task B and Task C do not run, and the process instance is considered complete.

Consider another example. Again, suppose that you are installing a new version of a process application. A number of explicit exception events are removed from some of the nested processes. This removal might potentially lead to orphaned tokens when instances are migrated to the new version. It should be possible to delete (that is, to ignore) these tokens when instances are migrated from the old to the new version of the process without causing instances to hang.

Managing orphaned tokens with a policy file

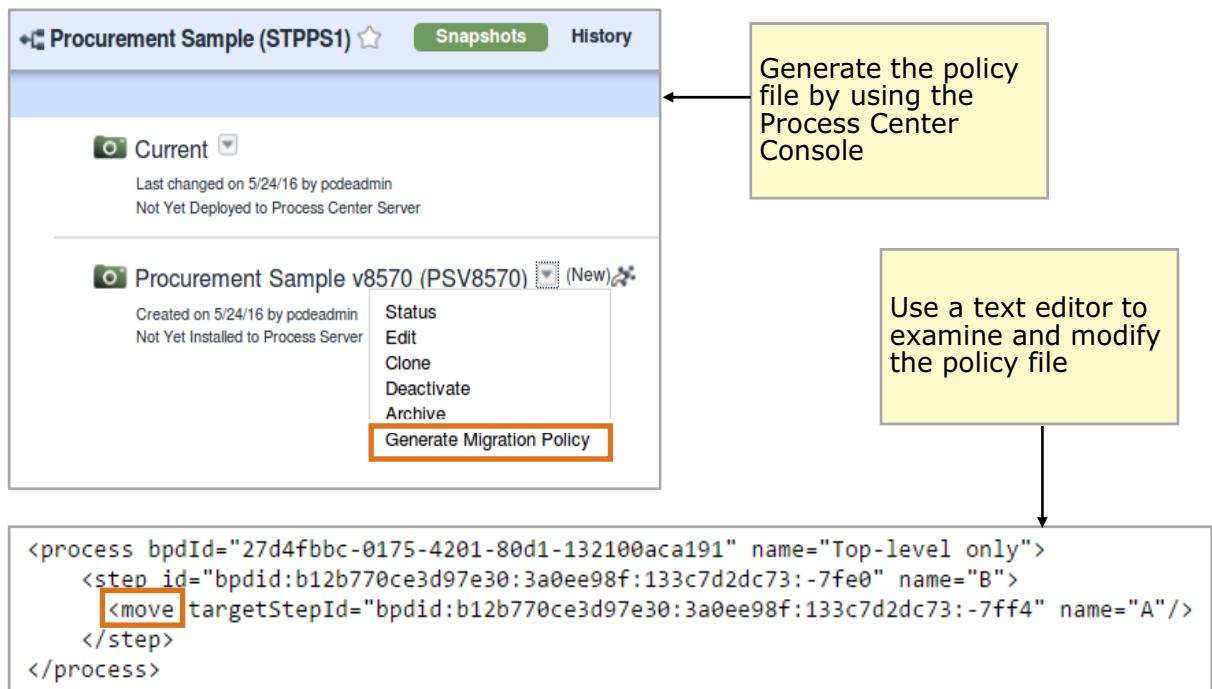
- Use a policy file to proactively compare snapshots before instance migration
 - Helps to identify the potential locations of orphaned tokens and specify whether each orphaned token should be deleted or moved
 - Generate the policy file by using the Process Center Console or `BPMCheckOrphanTokens` command
- Use the `BPMCheckOrphanTokens` command to detect the possibility of orphaned tokens before you install a new snapshot, and identify whether to delete or move each token
 - Compares two snapshots and produces an XML file that lists all the steps in the BPD where orphaned tokens might potentially occur
 - The command generates an XML representation of all possible locations of orphan tokens in a policy file
- Edit the policy file with a text editor
 - Go through the list of potential orphaned tokens and decide whether each token should be moved or deleted

Figure 10-39. Managing orphaned tokens with a policy file

The easiest way to identify and manage orphaned tokens is to generate a policy file and use it to specify whether each potential orphaned token should be moved or deleted during instance migration. If you migrate the snapshot instance without using a policy file, then orphaned tokens might be created. In this case, you can use the REST API client to delete or move these orphaned tokens. You can also use the web Process Inspector to delete orphaned tokens.



Migration policy file



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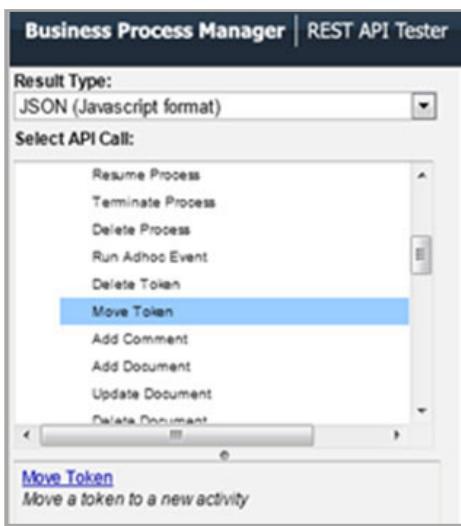
Figure 10-40. Migration policy file

Edit the file and identify whether each token should be moved or deleted. By default, tokens are deleted. To change **delete** to **move**, add a move instruction to the policy file in place of the delete instruction. In the **move** instruction, specify the target activity by using its activity acronym. In Process Designer, select the target activity to which you want to move the orphaned token. From the Properties view for that activity, copy its system ID (which has a value like `bpdid:b12b770ce3d97e30:3a0ee98f:133c7d2dc73:-7ff4`) to your clipboard and then paste it to the **targetStepId** attribute of the move instruction. The ID is case-sensitive.



Managing orphaned tokens

- Tokens can be moved and deleted by using
 - A migration policy file
 - Process Inspector
 - REST API client



Standard Employee Requisition for Tom Miller(103)

↳ Standard HR Open New Position
↳ Hiring Sample
🕒 V2.1

Status: Failed

⚠ Can't find activity with flowObjectid=bpdid:5cd499bd441308ca:37d49876:12e27ee26
Error: -67c6 for BPD=Snapshot.1e7008ca-dd05-4a06-bb08-e237d40baeed/Ref/[BPD.c904b3b1-afc1-4698-bf5a-a20892c20275]

Actions

- ↻ Retry failed steps
- 🔴 Terminate
- ✖ Delete
- ✖ Delete orphaned tokens

↳ Tasks

- ✓ Submit job requisition
tw_admin closed task 6 hours ago.
- ⚙ Approve or reject requisition
Task owned by tw_admin is due 5 hours ago.

⚠ Orphaned Tokens

- ⚠ Approve or reject requisition
- ⚠ Untitled2

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Figure 10-41. Managing orphaned tokens

The REST API Tester is a stand-alone web application that you can use to test BPM-related REST resources. These APIs can also be called directly from a web browser by passing the correct parameters and following the syntax for the API.

REST API client at URL: http://host_name:port_number/bpmrest-ui

Instance migration command

- Use the `BPMigrateInstances` command to migrates all instances to designated snapshot on all nodes in the environment
 - You can specify a policy file with the `-orphanTokenPolicyFile` parameter
 - Location: `<install_root>/bin`

```
BPMigrateInstances
-containerAcronym <process_application_acronym>
-sourceContainerSnapshotName <snapshot_name> |
-sourceContainerSnapshotAcronym <snapshot_acronym>
-targetContainerSnapshotName <snapshot_name> |
-targetContainerSnapshotAcronym <snapshot_acronym>
[-orphanTokenPolicyFile <file_path>]
[-useNetworkAvailablePolicyFile true | false]
```

Figure 10-42. Instance migration command

Run the command in the connected mode; that is, do not use the `wsadmin -conntype none` option.

Process instances migration: BPEL

- Template version is supported by using the template's valid-from date
 - The valid-from date is used to decide which process template to use when creating a process instance
 - After the instance is created, it runs against that version of the template
 - If a new template is deployed, in-flight process instances can be upgraded
- Whether a running instance can be upgraded to the newest version depends on the changes that were made and where the process instance is in its navigation
- To upgrade a running process instance to a new version of the process, you can use:
 - Business Process Choreographer Explorer to upgrade specific instances
 - The `migrateProcessInstances.py` script to upgrade process instances in bulk

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Figure 10-43. Process instances migration: BPEL

Migration of a process instance means that the process, variables, and activities that are at the current position of process navigation now refer to the new version of the process. Process instance migration can upgrade in-flight process instances to the new version at run time. To create a version of your process, you can define a process migration specification. It enables process instance migrations at run time. You deploy and install the new process version (with a new `validFrom` date) and the process migration specification to your runtime environment. An administrator can then upgrade existing instances of the process in the runtime to the new version of the process. The processes can be upgraded in two ways: in the Business Process Choreographer Explorer application for select business processes, or in a script for batch migration.

Of critical importance: the two versions must have the same name and namespace but with different valid-from dates, the correlation sets for the process versions must be the same, and the interfaces must be the same. The process instance migration tools are where you can update versions of running instances of processes in a late-binding situation. With early binding, a client is hard-wired to a particular process version.

IBM Training

Process instance migration (1 of 3)

The screenshot shows the 'All Versions Of Templates' page in the Business Process Choreographer Explorer. The left sidebar lists categories like 'Process Templates', 'Process Instances', 'Activity Instances', 'Task Templates', and 'Task Instances'. A callout box highlights the 'Select all template versions' option under 'Process Template Name'. Another callout box highlights the 'Select multiple versions to see all their instances to upgrade' option. In the main table, two specific versions of the 'Travel Booking Process' are selected and highlighted with orange boxes.

	Valid From	State	Namespace
<input type="checkbox"/> Travel Booking Process - Version 2008	3/26/2009 11:00 AM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Travel Booking Process - Version 2009	3/26/2009 4:05 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Link Conditions Incoming	3/26/2009 11:00 AM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Link Conditions Outgoing	4/9/2009 9:37 AM	Started	http://test
<input type="checkbox"/> Link Conditions Outgoing Receive	3/26/2009 11:00 AM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Loop Processes	3/26/2009 4:05 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Pick Process	3/26/2009 4:05 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Repeat Until	3/26/2009 4:05 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Stop Reason Activation Failed	3/26/2009 11:34 AM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Stop Reason Follow On Navigation Failed	3/26/2009 4:05 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Stop Reason Implementation Failed	3/26/2009 12:08 PM	Started	http://ExplorerTestProcesses62
<input type="checkbox"/> Stopped Application	4/7/2008 2:46 PM	Started	http://FREX002
<input type="checkbox"/> TestProc6201	7/15/2009 4:12 AM	Started	http://TestProc6201
<input type="checkbox"/> Transition Condition Failure	8/20/2008 11:08 AM	Started	http://ExplorerTestProcesses
<input type="checkbox"/> Travel Requests older 1 week	11/10/2008 11:53 AM	Started	http://TravelBookingRequest/Trav
<input type="checkbox"/> All Pi With Migrate	1/1/2009 9:00 AM	Started	http://TravelBookingRequest/Trav
<input type="checkbox"/> vers 1	3/26/2009 9:41 AM	Started	http://ExplorerTestProcesses62

Application deployment concepts

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Figure 10-44. Process instance migration (1 of 3)

When you deploy a new version of a BPEL process, you might want this version to apply both to new process instances and to instances that are already started. To upgrade running process instances to a new version of the process, you can use either an administrative script to upgrade process instances in bulk, or Business Process Choreographer Explorer to upgrade specific instances.

IBM Training

Process instance migration (2 of 3)

A screenshot of the Business Process Choreographer Explorer interface. The title bar says "Business Process Choreographer Explorer". The menu bar includes "Welcome wswf | Logout | My Substitutes | Define Substitutes | Define Views | Customize | Help | About". Below the menu is a toolbar with "Views" and "Reports" buttons. A sidebar on the left has sections for "Process Templates" (Currently Valid, All Versions) and "Process Instances" (Started By Me, Administered By Me, Critical Processes, Terminated Processes, Failed Compensations). The main content area is titled "Process Instances for Process Templates" with a sub-instruction: "Use this page to work with process instances that belong to specific process templates." It features buttons for "Migrate", "Terminate", "Delete", "View Process State", and "Refresh". A table lists three process instances: "Gloria: Dallas", "Charles: New York", and "John: London", all associated with "Travel Booking Process - Version 2008" and valid from "11/10/2008 11:53 AM". An annotation box with a yellow background and black border points to the "Migrate" button, containing the text "Select instances of potentially different versions".

Process Instance Name	Process Template Name	Valid From	State
Gloria: Dallas	Travel Booking Process - Version 2008	11/10/2008 11:53 AM	Runn
Charles: New York	Travel Booking Process - Version 2008	11/10/2008 11:53 AM	Runn
John: London	Travel Booking Process - Version 2008	11/10/2008 11:53 AM	Runn

Application deployment concepts

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Figure 10-45. Process instance migration (2 of 3)

A process template represents a version of a process. Running BPEL process instances can be upgraded to a different process template version. You can upgrade, for example, when a newer version of the process becomes available, or because the current version has errors in it and you want to roll back to a previous process version. Use Business Process Choreographer Explorer to upgrade selected process instances.

IBM Training

Process instance migration (3 of 3)

Shows in-flight instances that were upgraded to complete execution under new template version

Snapshot number	Process event	Event time	Process instance ID	Process template name
3	Started	2009-07-01 14:01:23.515	_PI:90030122.3630c788.9856df6.d61c010a	DiffProcessVersions-Process
4	Started	2009-07-01 14:01:23.515	_PI:90030122.3630c788.9856df6.d61c010a	DiffProcessVersions-Process
5	Started	2009-07-01 14:01:23.515	_PI:90030122.3630c788.9856df6.d61c010a	DiffProcessVersions-Process
4	Started	2009-07-02 09:08:06.797	_PI:90030122.3a4a9589.9856df6.3e990000	DiffProcessVersions-Process
4	Started	2009-07-02 09:09:08.141	_PI:90030122.3a4b946b.9856df6.3e990033	DiffProcessVersions-Process
5	Started	2009-07-02 09:09:08.141	_PI:90030122.3a4b946b.9856df6.3e990033	DiffProcessVersions-Process
4	Started	2009-07-02 09:09:24.531	_PI:90030122.3a4bd4b0.9856df6.3e990066	DiffProcessVersions-Process
5	Started	2009-07-02 09:09:24.531	_PI:90030122.3a4bd4b0.9856df6.3e990066	DiffProcessVersions-Process
4	Started	2009-07-02 09:10:52.797	_PI:90030122.3a4d2d79.9856df6.3e990099	DiffProcessVersions-Process
5	Migrated	2009-07-02 10:27:16.718	_PI:90030122.3a4d2d79.9856df6.3e990099	DiffProcessVersions-Process
4	Started	2009-07-02 10:07:18.813	_PI:90030122.3a80d26c.9856df6.3e9900cc	DiffProcessVersions-Process
7	Started	2009-07-02 10:07:18.813	_PI:90030122.3a80d26c.9856df6.3e9900cc	DiffProcessVersions-Process
5	Migrated	2009-07-03 10:23:45.062	_PI:90030122.3a8160d1.9856df6.3e9900ff	DiffProcessVersions-Process

Items found: 14 Page 1 of 1 Items per page: 20

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Figure 10-46. Process instance migration (3 of 3)

When a new version of a BPEL process is deployed, you can base new process instances on this process version if you start them in Business Process Choreographer Explorer from the corresponding template. However, existing process instances that are based on a previous version of the process continue to run with this version until they reach an end state. You can upgrade these existing process instances to a different process version; you do not require migration of all the instances to the same version.

You can also use the `migrateProcessInstances.py` script to upgrade process instances in bulk.

10.6. Purging data in the Process Server environment

Purging data in the Process Server environment

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Figure 10-47. Purging data in the Process Server environment

Snapshots

- You can delete inactive process application snapshots from a Process Server
- The process that you use varies depending on whether you use the Standard or Advanced editions of IBM Business Process Manager
- To delete snapshots on a process server, use the `BPMDeleteSnapshot` command
 - Required parameters include `containerAcronym` and `containerSnapshotAcronyms`
 - `containerAcronym`: Indicates the location of snapshots that are going to be deleted
 - `containerSnapshotAcronyms`: Indicates the named and archived snapshot

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Figure 10-48. Snapshots

Use the `BPMDeleteSnapshot` command in connected mode from Process Server to delete snapshots for process applications or toolkits. The `BPMDeleteSnapshot` command cannot be used from Process Center.

The `BPMDeleteSnapshot` command is run by using the `AdminTask` object of the `wsadmin` scripting client.

Prerequisites for deleting a snapshot

- The snapshot must exist
- You cannot delete the default snapshot
- The snapshot must be inactive
- There must not be any running BPEL instances (Advanced only)
- The snapshot must not be deployed (Advanced only)

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Figure 10-49. Prerequisites for deleting a snapshot

If one or more of the preconditions is not met when the command is run, the command is terminated and an error message is written to the command line console and the `SystemOut.log` file. The message indicates which of the preconditions was not met. Generally, the message contains some suggestions for achieving the preconditions.

Steps for deleting a snapshot (1 of 2)

- The snapshot must exist
 - Use the `BPMShowProcessApplication` command to verify
- You cannot delete the default snapshot
 - Use the `BPMShowSnapshot` command to see whether the snapshot is the default and whether there are running instances
- The snapshot must be inactive
 - Use the `BPMDeactivate` command to deactivate the snapshot
 - Also stops BPMN processes and allows running instances to acquiesce

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Figure 10-50. Steps for deleting a snapshot (1 of 2)

Various wsadmin commands are used when deleting a snapshot.

Over time, a Process Server can accumulate many snapshots of a process application. You can delete snapshots that are no longer in use. When you delete a snapshot, you also delete any business process definitions that are associated with it.

The snapshot cannot have any running instances. The snapshot cannot be active.

Toolkit snapshots are not automatically deleted when process application snapshots are deleted. Use the `BPMShowSnapshot` command to obtain a list of toolkit snapshots on which a process application depends. If any process application or toolkit does not need the toolkit snapshots, delete them using the `BPMDeleteSnapshot` command.

Steps for deleting a snapshot (2 of 2)

- There must not be any running BPEL instances (Advanced only)
 - Use the `BPMStop` command
 - Stops the BPEL process for the snapshot and allows running instances to acquiesce
- The snapshot must not be deployed (Advanced only)
 - Use the `BPMUndeploy` command
 - Removes BLAs and EAR related to the snapshot
 - There must be no active BPEL instances or the command fails

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Figure 10-51. Steps for deleting a snapshot (2 of 2)

Various wsadmin commands are used when deleting a snapshot.

Over time, a Process Server can accumulate many snapshots of a process application. You can delete snapshots that are no longer in use. When you delete a snapshot, you also delete any business process definitions that are associated with it.

The snapshot cannot have any running instances. The snapshot cannot be active.

Toolkit snapshots are not automatically deleted when process application snapshots are deleted. Use the `BPMShowSnapshot` command to obtain a list of toolkit snapshots on which a process application depends. If any process application or toolkit does not need the toolkit snapshots, delete them using the `BPMDeleteSnapshot` command.

Instances in Process Server

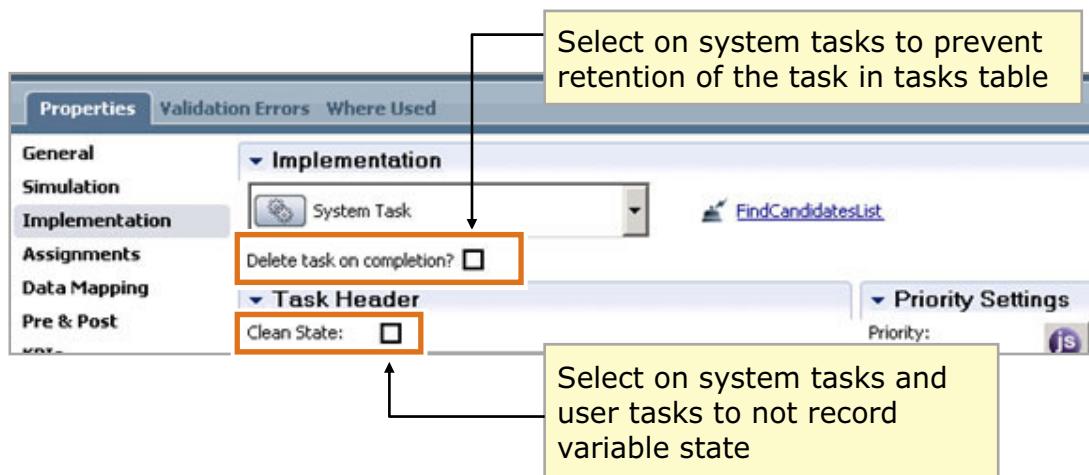
- There are two types of instances to consider
 - User or human task instances
 - Process instances
- Two types of instances for both BPD and BPEL processes
 - Archiving is not supported for Standard task and process instances
 - Archiving is supported for Advanced BPEL process instances
- To delete BPD instances on a process server, use the `BPMProcessInstancesPurge` command
 - Identify the specific instances to delete or the date range within which any instances that completed are going to be deleted
 - You can also indicate a state of completed, failed, or terminated
 - Includes the maximum deletion time and the size of the transaction for the delete operation
- Deleting BPEL processes is covered in the “Business process choreography cleanup” topic

Figure 10-52. Instances in Process Server

Using the `BPMProcessInstancePurge` command deletes the BPD instance and its associated tasks and documents for the instances that are specified by the command parameters. It also logs data to a standard `SystemOut.log` file to track which filter criteria was selected for deleting instance data and associated documents. The `BPMProcessInstancePurge wsadmin` command is used to delete specific instances or delete instances that completed within a specified date range.

Standard process and task instances

- When you delete process instances, task instances are also deleted
 - Archiving is not supported in the product
 - No method to delete task instances only
- System tasks also record entries in the task table, which can be avoided



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Figure 10-53. Standard process and task instances

By default, data about system tasks is saved after the task is complete. This data cannot be deleted after it is saved. If you do not want to store audit data for system tasks on Process Server, select **Delete task on completion** when you create a system task in Process Designer.

By default, the runtime execution state of an activity is saved after it is complete. This data cannot be deleted after it is saved. If you do not want to store execution data (such as variable values) for viewing after the process is complete, select **Clean State** from the Task Header section of the BPD diagram in Process Designer.

10.7. Business process choreography cleanup

Business process choreography cleanup

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Figure 10-54. Business process choreography cleanup

Periodic cleanup operations

- The database should contain running processes only, and completed processes should be deleted
 - Artifacts that are related to instances are deleted when the instance is deleted
- The number of processes in the database has an impact on performance
- Various cleanup procedures are available for the Process Server administrator to clean up the database
 - Cleanup service
 - Administrative console
 - Administrative scripts
 - Failed Event Manager
 - Business Process Choreographer Explorer
 - Business Process Choreographer APIs

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Figure 10-55. Periodic cleanup operations

Messages that cannot be processed are placed on the hold queue, which includes messages for instances that are deleted. You can empty the hold queue by replaying the messages in the queue, which causes any messages for deleted instances to be discarded.

Deletion of completed instances

- Deletion of completed process instances can be specified in the process or task properties
 - **Yes:** Delete instance if in FINISHED, TERMINATED, or FAILED state
 - **On successful completion** (default): Delete only if not in FAILED state
 - **No:** Do not delete

Process Template Description		
Process Template Name	HelloWorldProcess	
Description		
Documentation		
Details	Operations	Process Instances
Administrators	Nobody	
Created	1/27/09 3:30:50 PM	
Valid From	11/9/05 8:17:26 AM	
All		
Delete on Completion	only if successful	
Long Running	no	
Compensation Defined	no	
Continue on Error	yes	
Autonomy	Not Applicable	

- Set properties in business model by using IBM Integration Designer
- Settings can be viewed by using Business Process Choreographer Explorer on process template **Details** tab

Figure 10-56. Deletion of completed instances

The setting in IBM Integration Designer to automatically delete the process after completion is relevant only with long-running processes. It determines how the runtime environment will deal with the process instance that the process uses after it runs. You have the following options:

- **Yes:** Choose Yes to delete the data that is associated with this instance of the process after it completes. This setting removes the process instance, whether the process completed successfully or not.
- **On successful completion:** In this case, the data remains in the database when the process fails so that the problem can be traced and the process administrator can restart the process, if required.
- **No:** Choose No to not delete the data that is associated with this process after it completes.

Deletion of completed tasks

- Delete the database of the completed tasks, which are no longer needed at runtime
- Useful if you are migrating process instances
 - By removing completed tasks, you are migrating only the information that is needed by the process instances in their new location
 - Reduces the time that it takes to migrate process instances
- To delete completed, use the `BPMTasksCleanup` command
 - `containerAcronym`: Indicates the location of snapshots that are going to be deleted
 - `containerSnapshotAcronym`: Indicates the named and archived snapshot
 - `taskStatus`: Indicates what status a task must have to be deleted and is required
 - `taskType`: Indicates which types of tasks to delete
 - `taskID`: Indicates the ID of one or more tasks to delete

Figure 10-57. Deletion of completed tasks

In general, start by deleting completed system and decision tasks. Consider deleting completed user tasks only if you need further performance improvements because deleting user tasks before the process instance completes might distort duration statistics for users who worked on those tasks. If the process instance completed, use the `BPMProcessInstancesCleanup` command instead.

Cleanup service

- *Cleanup service* allows scheduled deletion of instances and tasks
 - Specify administratively which instances to delete and when
- *Cleanup service configuration* specifies:
 - When the cleanup service runs (during off-peak hours)
 - How long the cleanup service runs (maximum duration in minutes)
 - How many instances to delete in one transaction
 - Which instances to delete
- *Cleanup job configuration* specifies:
 - Template names and namespaces of instances to delete
 - End states of instances subject to the cleanup job
 - Time instances are kept after completion before they are eligible for deletion by cleanup service
 - Ordered list of jobs to run

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Figure 10-58. Cleanup service

Identify times of the day and days of the week when it would be best to schedule the cleanup service; for example, when there is the lowest load on the database. For each BPEL process and human task that you want the cleanup service to delete, decide which states make an instance a candidate for deletion. Then, decide how long an instance must be in one of those states before the next scheduled cleanup deletes them.

Cleanup service configuration

- Separate cleanup services for business processes and human tasks
- Configuration that is done by using the administrative console
 - Business Flow Manager configuration pane for business processes
 - Human Task Manager configuration pane for human tasks

Cleanup Service Jobs'."/>

Cleanup Service

Enable cleanup service

Frequency (CRON Calendar)
0 0 23 * * ?

Maximum duration (in minutes)
120

Transaction slice (instances per transaction)
10

To specify the templates, for which the cleanup service will delete instances, you must define one or more [Cleanup Service Jobs](#)

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Figure 10-59. Cleanup service configuration

You want to delete completed instances automatically after keeping them for a while. There is a separate cleanup service for the Business Flow Manager and for the Human Task Manager. For each of them, you must first enable the service and define the service parameters, such as the schedule, maximum duration of the cleanup, and the database transaction size. Then, you can define cleanup jobs for sets of templates and define the end states and the duration that an instance must be in to qualify for deletion.

The Human Task Manager cleanup service deletes stand-alone human tasks. When the Business Flow Manager cleanup service deletes a BPEL process, it also deletes all of the child processes and inline human tasks that are contained in the process. When security is enabled, the cleanup user ID specified for the Business Process Choreographer configuration must be in the business administrator role.

Cleanup service job configuration

- A cleanup job specifies which instances to delete
- One or more cleanup jobs can be specified
- Cleanup jobs are run in the order they are displayed in the job list

Server clusters > RMS.AppTarget > Business Flow Manager > Cleanup Service Jobs					
	Add	Delete			
Select	Order Number	Cleanup Job	Templates	States	Duration until deletion
<input type="checkbox"/>	0	Job 1 - Delete all terminated three days after completed	*	TERMINATED	0 0 3 0 0
<input type="checkbox"/>	1	Job 2 - Delete all instances of "HelloWorldProcess" template after 4 hours	HelloWorldProcess	FINISHED	0 4 0 0 0
Total 2					

General Properties

Order Number
0

Cleanup Job
Job 1 - Delete all terminated three days after completed

Templates
*

Cleanup States
Restrict cleanup to instances in the following states:

FINISHED

TERMINATED

FAILED

Duration Until Deletion

Minutes
0

Hours
0

Days
3

Months
0

Years
0

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Figure 10-60. Cleanup service job configuration

You activate the cleanup service and defined cleanup jobs to delete completed instances. When the cleanup service starts and finishes, the messages CWWBF0118I and CWWBF0119I are written to the SystemOut.log file. When one cleanup job starts and finishes, the messages CWWBF0116I and CWWBF0117I are written to the SystemOut.log file. Progress updates of the cleanup processing are written with message CWWBF0120I to the SystemOut.log file.

Deleting process templates by using scripting

- Use the `deleteInvalidProcessTemplate.py` script to remove, from the database, the templates, and all objects that belong to the template that are not contained in any corresponding valid application
 - Might occur if an application installation was canceled or not stored in configuration repository by the user
 - Use the `deleteInvalidTaskTemplate.py` script for human task templates
 - Location: `<install_root>/ProcessChoreographer/admin`

```
<install_root>/bin/wsadmin -f
deleteInvalidProcessTemplate.py
(([[-node <node_name>] -server <server_name>] |
 -cluster <cluster_name>))
-templateName <template_name>
-validFromUTC <validFromString>
```

Figure 10-61. Deleting process templates by using scripting

Use the `deleteInvalidProcessTemplate.py` script to remove from the database those templates that are not contained in any corresponding valid application in the configuration repository. This removal includes all of the objects that belong to these templates. This situation can occur if an application installation was canceled or not stored in the configuration repository by the user. These templates usually have no impact. They are not shown in Business Process Choreographer Explorer.

Deleting process instances by using scripting

- Use the `deleteCompletedProcessInstances.py` script to delete completed process instances
 - Location: `<install_root>/ProcessChoreographer/admin`
 - Indicate the criteria to selectively delete process instances

```
<install_root>/bin/wsadmin -f -deleteCompletedProcessInstances.py
[([-node <node_name>] -server <server_name> | (-cluster
<cluster_name>)
(-all | -finished | -terminated | -failed)
[-templateName <template_name> [-validFromUTC <timestamp>]]
[-startedBy <userID>
[(-completedAfterLocal <timestamp>) | (-completedAfterUTC
<timestamp>)
[(-completedBeforeLocal <timestamp>) | (-completedBeforeUTC
<timestamp>)]
```

Figure 10-62. Deleting process instances by using scripting

Run the `deleteCompletedProcessInstances.py` script when all completed process instances are deleted.

Deleting task instances by using scripting

- Use the `deleteCompletedTaskInstances.py` script to delete completed task instances
 - Location: `<install_root>/ProcessChoreographer/admin`
 - Indicate the criteria to selectively delete task instances

```
<install_root>/bin/wsadmin -f -deleteCompletedTaskInstances.py
[([-node <node_name>] -server <server_name> | (-cluster
<cluster_name>)
(-all | [-finished] [-terminated] [-failed] [-expired])
[-templateName <template_name> -nameSpace <name_space>
[-validFromUTC <timestamp>]]
[-createdBy <userID>
[(-completedAfterLocal <timestamp>) | (-completedAfterUTC
<timestamp>)]
[(-completedBeforeLocal <timestamp>) | (-completedBeforeUTC
<timestamp>)]
```

Figure 10-63. Deleting task instances by using scripting

Deleting audit log entries by using scripting

- Use the `deleteAuditLog.py` script to delete audit log entries from the database
 - Location: `<install_root>/ProcessChoreographer/admin`

```
<install_root>/bin/wsadmin -f -deleteAuditLog.py
[([-node <node_name>] -server <server_name>) | (-cluster
<cluster_name>)
(-all | -timeUTC <timestamp> | -timeLocal <timestamp>
| -processTimeUTC <timestamp> | -processTimeLocal <timestamp>)
[-slice <size>]
```

Figure 10-64. Deleting audit log entries by using scripting

Use an administrative script to delete some or all audit log entries for the Business Flow Manager.

Unit summary

- Describe the installation of a business process
- Describe the runtime behavior of business processes
- Describe the administrative options and the types of client access that are available for business processes
- Describe the uninstallation of a business process
- Define the purpose and function of the serviceDeploy tool
- Describe the process of using the Failed Event Manager to manage failed events
- Describe how to migrate process instances and generate a migration policy file
- Purge data in the Process Server environment
- Configure business process choreography cleanup

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Figure 10-65. Unit summary

Review questions

1. Business processes are packaged as:
 - A. RAR files
 - B. WAR files
 - C. EAR files
2. You cannot stop enterprise applications that contain stopped, but not deleted:
 - A. Process instances
 - B. Process templates
 - C. Process models
3. True or False: The `BPMProcessInstancesPurge` command can be used to clean up both BPMN and BPEL instances.
4. True or False: The cleanup service allows for scheduled deletion of process instances and tasks administratively.



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Figure 10-66. Review questions

Write your answers here:

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

Review answers (1 of 2)

1. Business processes are packaged as:

- A. RAR files
- B. WAR files
- C. EAR files

The answer is C.



2. You cannot stop enterprise applications that contain stopped, but not deleted:

- A. Process instances
- B. Process templates
- C. Process models

The answer is A.

Review answers (2 of 2)

3. True or False: The `BPMProcessInstancesPurge` command can be used to clean up both BPMN and BPEL instances.

The answer is False. The `BPMProcessInstancesPurge` command can be used to clean up only BPMN, not BPEL instances.



4. True or False: The cleanup service allows for scheduled deletion of process instances and tasks administratively.

The answer is True.

Exercise: IBM Process Server administration

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Figure 10-69. Exercise: IBM Process Server administration

Exercise objectives

- Use the administrative console to start and stop clusters
- Use the administrative console and wsadmin to install a business process application
- Work with the administrative console to manage applications
- Use the Business Process Choreographer Explorer to work with process instances
- Use the serviceDeploy command to create an enterprise archive (EAR) file
- Use the Failed Event Manager to query and manage failed events



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Figure 10-70. Exercise objectives

Exercise: Purging content in Process Server

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Figure 10-71. Exercise: Purging content in Process Server

Exercise objectives

- Purge data in the Process Server environment
- Delete BPMN and BPEL instances in the Process Server environment
- Delete snapshots in the Process Server environment
- Configure the business process choreography cleanup service and cleanup jobs



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Figure 10-72. Exercise objectives

Unit 11. Overview of deployment scenarios

Estimated time

00:45

Overview

This unit provides an introduction to deploying and managing process applications in both online and offline Process Server environments.

How you will check your progress

- Checkpoint
- Lab exercises

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Explain online and offline Process Server environments
- Work with an offline Process Server
- Deploy a process application to an offline Process Server
- Explain the various XML configuration files
- Deploy a process application to an online Process Server

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Figure 11-1. Unit objectives

Topics

- Offline and online Process Server environments
- Configuration files
- Deploying process applications

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Figure 11-2. Topics

11.1. Offline and online Process Server environments

Offline and online Process Server environments

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Figure 11-3. Offline and online Process Server environments

Business Process Manager environments (1 of 2)

- A typical Business Process Manager topology includes four environment types that support the development, staging, and eventual installation of process applications
- Development
 - Build and refine process applications in IBM Process Designer
 - Using the Process Center Console, you can install the process applications on test Process Servers
- Test
 - Using the Process Center Console, you can install process applications on the Process Server in the test environment to implement formal quality assurance tests
 - You can use the Process Inspector and Process Portal to help verify and resolve issues

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Figure 11-4. Business Process Manager environments (1 of 2)

If you want to modify the environment type that was specified during installation, update the configuration properties in the `100Custom.xml` file. The environment type indicates how IBM Business Process Manager is used (for example, in a production, stage, or test environment). Process authors can set environment-specific variables for each process application and then define values for each type of environment in which a process runs.

Business Process Manager environments (2 of 2)

- Staging
 - After all issues that are reported from formal testing are resolved, the process applications are installed on a staging Process Server, which looks similar to the production environment
 - You should test and resolve all issues in the staging environment before moving the applications to production
- Production
 - After all issues that are reported from formal testing are resolved, use the Process Center Console to install process applications on the Process Server in the production environment
 - You can use the Process Inspector in Process Server to investigate and resolve any issues reported in the production environment

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Figure 11-5. Business Process Manager environments (2 of 2)

Some enterprises do not allow deployment from Process Center to a Process Server in production. The production servers are in offline mode. In this case, you create the offline installation package and use the scripted deployment procedure. Offline production Process Servers are the suggested configuration. This configuration prevents the periodic heartbeat to Process Center, thus reducing the database load.

Connecting Process Server and Process Center

- Process Center is the hub of knowledge about process applications while Process Servers act as the runtime environments for completing the work
- An online development and test Process Server is the preferred method of configuration
- An offline production Process Server is the preferred method of configuration
- In order for a Process Center to know about the Process Server, the Process Server configuration must be changed to refer to the target Process Center
 - The configuration file `99Local.xml` contains the configuration information

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Figure 11-6. Connecting Process Server and Process Center

During development, the applications are built and tested in the Process Center environment with its local or unit test runtime. However, when it is time to deploy to production, many customers want to manually install such solutions directly on their Process Servers instead of dynamically from a Process Center. There are many reasons for choosing manual installation. A primary reason is when an exact copy of the application is needed so that the system can be re-created from artifacts that are stored on the file system. Another common reason for manual deployment is that it can be scripted for operations staff to conduct production installation and management. The script and associated artifacts can then be logged as the system of record for the production system.

Configuring the environment (1 of 2)

- Configuration is done during either:
 - Deployment Environment configuration
 - Process Server configuration
- Select the various environment types
- Provide Process Center connection information
 - Offline configuration
 - Online configuration

Process Center Connection Information

<input type="checkbox"/> Use server offline
* Protocol <input type="text" value="https://"/>
* Host name or virtual host in a load-balanced environment <input type="text" value="bpmhost"/>
Port <input type="text" value="9443"/>
Context root prefix <input type="text"/>
* User name <input type="text" value="pcdeadmin"/>
* Password <input type="password" value="*****"/>
* Confirm password <input type="password" value="*****"/>

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Figure 11-7. Configuring the environment (1 of 2)

When you add a server, it must be registered with the Process Center server. The registration process checks to see whether the capabilities of the new server match the capabilities of the Process Center server; if they match, registration succeeds. If the capabilities are out of sync between the two servers, the new server is not registered with the Process Center server.

Configuring the environment (2 of 2)

- Configuration can be completed in:
 - Deployment Environment wizard configuration
 - IBM BPM Configuration Editor for deployment environment properties file
 - Deployment manager administrative console

IBM BPM Advanced 8.5.5.0 Process Server

Topology	Security	Performance
PROD-PServerCell PServer_DE CellDb	Dmgr host : Port number Aliases	
SharedDb	ProcessServerDb	PerformanceDb
	Host name : Port number	Host name : Port number
Name: PServer_DE	PServer_DE	
Defer schema creation:	Node1	
ProcessServ...	true	
Type:	AppCluster [AppClust...	
Performance...	Advanced	
Environment:	AppClusterMember1	
MECluster [Mes...	Process Server	
Context root prefix:	MEClusterMember1	MEClusterMember1
Virtual host:	SupCluster [Sup...	SupClusterMember1
	SupClusterMember1	SupClusterMember1
Process Center Connectivity		
Server name:	PROD-ProcessServer	
Purpose:	Production	
Offline:	true	
Validation messages (14)		
PC transport protocol:	https	
Port number:	The required port number must have a value greater than 0.	
Host name:	bpmhost	The required host name must be valid and unique.
Protocol:		
PC context root:		

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Figure 11-8. Configuring the environment (2 of 2)

Using the Process Center Console

- The Process Center Console is used to configure and examine both online and offline Process Servers
- Process application snapshots can be deployed to configured Process Servers
 - Applications are deployed directly to the online Process Server
 - An installation package is created, extracted, and installed to the offline Process Server
- Installation packages are available in the Process Center server if the selected offline server exists
 - If you remove the offline server, the installation packages for that server are also deleted

[Overview of deployment scenarios](#)

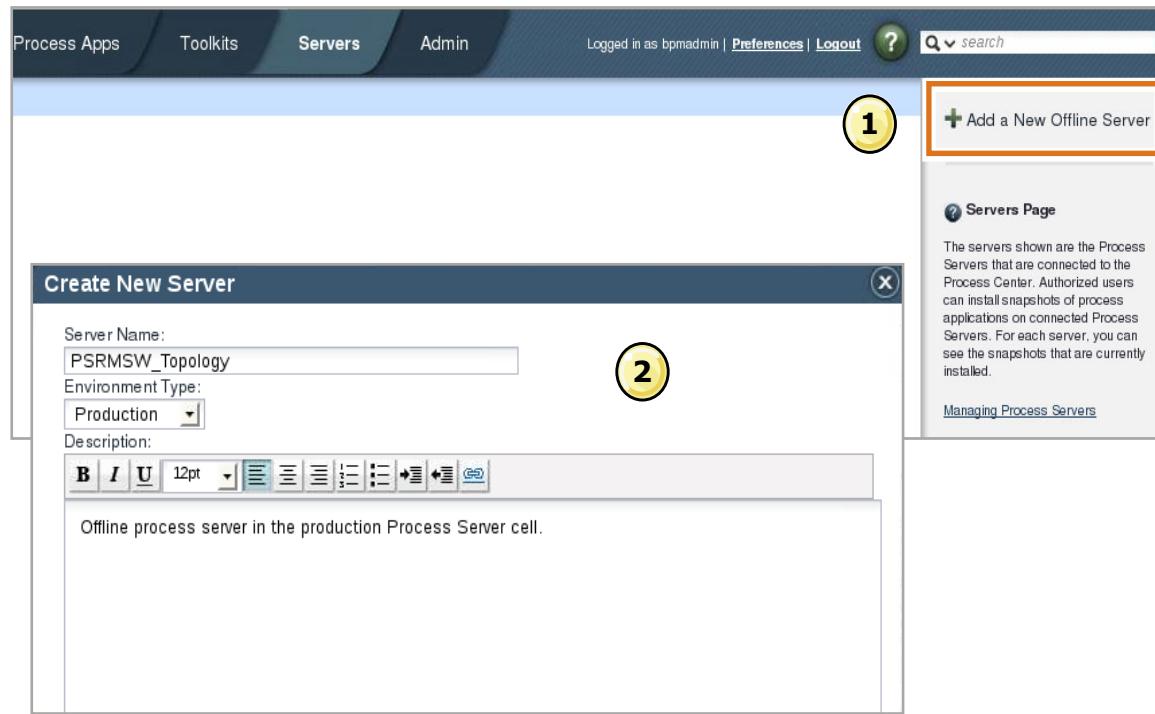
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Figure 11-9. Using the Process Center Console

Process applications can be deployed to multiple Process Server instances. To deploy an application, a snapshot of the application must first be taken. It is the content of the snapshot that is deployed. Changes that are made to the application after the snapshot will not be reflected in the deployed application until after a new snapshot is taken and that instance of the snapshot is deployed.

IBM Training

Adding an offline server (1 of 2)



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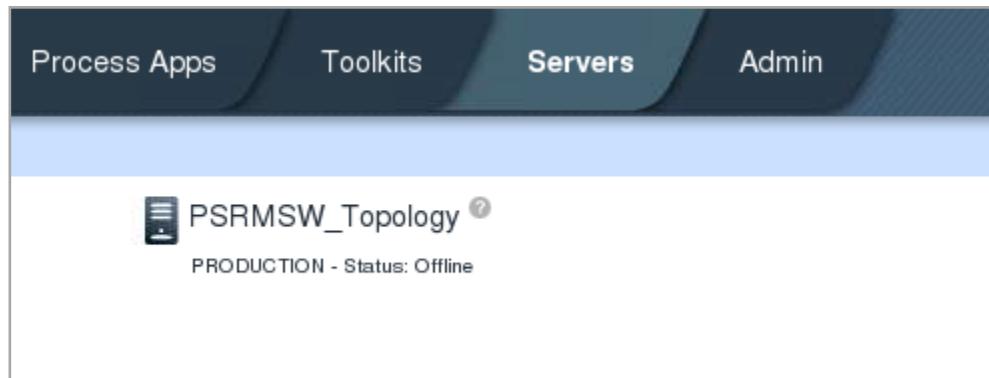
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Figure 11-10. Adding an offline server (1 of 2)

To complete a manual deployment of a solution, you must first export the package that represents the solution, which can be done from the Process Center Console. Before you can create and export an installation package, you must define the target environment as an offline server.



Adding an offline server (2 of 2)



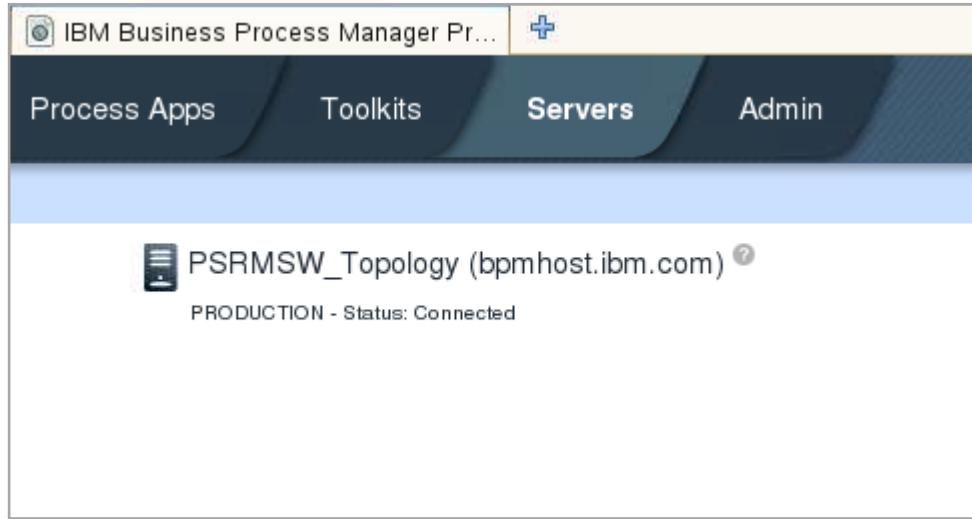
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Figure 11-11. Adding an offline server (2 of 2)

Adding an online server

- Process Center automatically discovers any online Process Servers that are configured during installation



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Figure 11-12. Adding an online server

11.2. Configuration files

Configuration files

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Figure 11-13. Configuration files

Configuration file basics

- Default XML configuration files are created during installation of the product
- Core configuration files are in:
 - A cluster configuration <core_directory> in:
`<bpm_install>/profiles/<profile_name>/config/cells
/<cell_name>/clusters/<cluster_name>`
 - Each cluster member configuration <core_directory> in:
`<bpm_install>/profiles/<profile_name>/config/cells/
<cell_name>/nodes/<node_name>/servers/<cluster_server_name>`
 - Process Server: <core_directory>/process-server/config
 - Process Center: <core_directory>/process-center/config
 - Performance Data Warehouse: <core_directory>
/performance-data-warehouse/config

Configuration files (1 of 2)

- `system/000Static.xml`: Contains static properties so IBM Business Process Manager can run
- `system/50AppServer.xml`: Is used to manage the application server
- `system/60Database.xml`: Contains queries and some XML schema; do not modify
- `system/80EventManager.xml`: Has different attributes for Event Manager including error handling, loading, and queuing
- `system/98Database.xml`: Contains configuration for the database name, user and password, database location, and other attributes

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Figure 11-15. Configuration files (1 of 2)

Configuration files (2 of 2)

- `system/99Local.xml`: Contains local settings for your environment; commented heavily
- `100Custom.xml`: File that is used to customize your environment
- `TeamWorksConfiguration.running.xml`: Contains the actual configuration values that are applied from merging all of the configuration files
 - Process Server: `<core_directory>/process-server`
 - Process Center: `<core_directory>/process-center`

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Figure 11-16. Configuration files (2 of 2)

In some cases, you might want to change the runtime configuration, such as modifying proxy settings, managing Enterprise Content Manager and IBM Case Manager server settings, or modifying the IBM Process Server connection properties. Configuration updates are made either in the `100Custom.xml` file or by using the Process Admin Console, depending on the type of change required.

How configuration files are used

- Configuration files are loaded in a sequence
 - Files starting with a letter of the alphabet are loaded first
 - Numbered files are loaded next in numerical order
- You can overwrite the settings from any of the default configuration files, which start with a number less than 100
- When you modify a server configuration, always make the changes to the `100Custom.xml` file, not to the original configuration file
- Files are merged to produce the overall configuration that Process Center or Process Server uses
 - Full and final configuration space is placed in: `TeamWorksConfiguration.running.xml`

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Figure 11-17. How configuration files are used

At run time, only the settings from cluster member files are read. If you make configuration changes after deployment, you must make them in the cluster member version of the file for each server to have the changes take effect at run time.

- Always make configuration changes to any of these XML configuration files on the deployment manager (dmgr) server.
- Make configuration changes to cluster members. Change the XML file for each node, but work in the deployment manager file system.
- Make configuration changes to the cluster level to ensure that each new cluster is created with your customizations.
- After any changes, select **Full Resynchronize** to replicate the settings from the deployment manager server to the individual nodes. If you edit these configuration files on an individual node, the changes might be lost in the next update.

The 100Custom.xml file

- To customize the environment, changes are made only to the 100Custom.xml file
- It is important to create a backup of this file before editing
 - Name of backup must not end with an .xml extension
 - Create a backup such as 100Custom.bak
- If the 100Custom.xml file does not yet exist (if, for example, you have not customized any of your configuration settings), you must create it
 - Open the appropriate 99Local.xml file for your environment and save it as 100Custom.xml in the correct directory
- XML configuration files on the cluster level are templates for XML configuration files that are created when new cluster members are added
 - If you change the file at the cluster member level, change the file at the cluster level also

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Figure 11-18. The 100Custom.xml file

To modify a Process Server configuration, update the 100Custom.xml file for the server. Here, you can modify the elements that make up the server configuration, including environment name, repository server information, and Performance Data Warehouse communication methods.

Merge attributes

- IBM Business Process Manager merges the changes that you make in the `100Custom.xml` file with the original configuration based on the value of the `merge` attribute
- The following values are used to merge attributes:
 - `append`: Appends the new tag
 - `mergeChildren`: Merges the new tag with the first of the existing tags; which is the default behavior
 - `replace`: Replaces all old tags with the new one
- Attribute values must be in quotation marks
- The first time that an element is loaded from a file, an entry is created in the merged configuration file
 - Use the attribute `replace` to overwrite an existing setting and change it in the merged file

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Figure 11-19. Merge attributes

Example: Modify the environment name

- Text from the 99local.xml file

```
<properties>
    <common merge="mergeChildren">
        <environment-name>Production_RMSW</environment-name>
    </common>
</properties>
```

- Text for the 100Custom.xml file

```
<properties>
    <common merge="mergeChildren">
        <environment-name merge="replace">RMSW</environment-
name>
    </common>
</properties>
```

Example: Loading of the configuration files

- Files in the `<core_directory>/process-server/config` directory are loaded in the following order:

```
.../config/system/Copy of 99Local.xml  
.../config/system/00Static.xml  
.../config/system/50AppServer.xml  
.../config/system/60Database.xml  
.../config/system/80EventManager.xml  
.../config/system/98Database.xml  
.../config/system/99Local.xml  
.../config/100Custom.xml
```

- Settings in `Copy of 99Local.xml` take effect first; all settings in the `99Local.xml` are ignored
 - Include the `merge="replace"` attribute to use settings from both of the files

Modify the configuration by using BPMConfig

- The `updateBPMconfig` admin task is available to update the XML configuration files that include the `100Custom.xml` file
 - Updates the bootstrap URL, the environment type, and the environment name
- Update server settings by using the `wsadmin AdminConfig` commands
 - The `processCenterURL` variable
 - The `processCenterInternalUrl` variable
 - The `heartBeatInterval` variable
- After running these commands, restart the deployment manager and Process Server cluster

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Figure 11-22. *Modify the configuration by using BPMConfig*

The **updateBPMconfig** admin task is available to update the XML configuration files, which include the `100Custom.xml` file, to provide a single file that has all of the changes that are applied to the environment. The admin task creates the `100Custom.xml` file if it does not exist. If you have multiple versions of the custom file, such as `101Custom.xml` and `102Custom.xml`, then only the `100Custom.xml` file is updated.

Modify the configuration by using administrative console

Configuration

General Properties 1

Environment Information

Environment name
PROD-ProcessServer

Environment type
Production

Process Center Connection Information

Use server offline

* Protocol
https:// 2

* Host name or virtual host in a load-balanced environment
bpmhost

Port
9443

Context root prefix

* User name
pcdeadmin

* Password

* Confirm password

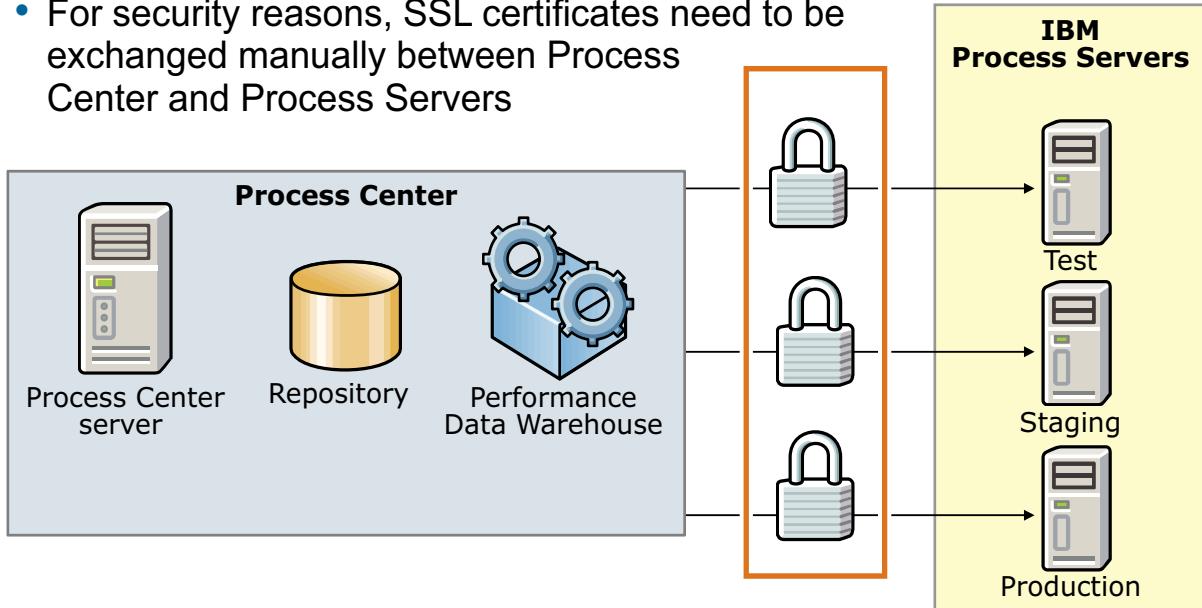
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Figure 11-23. Modify the configuration by using administrative console

Default security

- HTTPS is configured as the default communication protocol used between Process Center and Process Servers
 - Installation uses HTTPS by default
- For security reasons, SSL certificates need to be exchanged manually between Process Center and Process Servers



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Figure 11-24. Default security

11.3. Deploying process applications

Deploying process applications

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Figure 11-25. Deploying process applications

Installing process application snapshots

- When you install a process application snapshot to a process server:
 - Library items for that snapshot, including toolkit dependencies, are moved from the repository to the selected process server
 - The process server can be connected or offline
 - You can use the Process Center console or wsadmin commands to install the snapshot

- Important: The Process Center server and the connected or offline process server versions should match exactly *before* you install to the process server
 - Version matching is applicable to the first 3 digits only
 - For example: 8.5.0 or 8.5.1

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Figure 11-26. *Installing process application snapshots*

Understanding the individual steps in the installation process can help you identify and resolve any errors that occur during snapshot installation.

The following actions occur on the target server during the process application installation:

1. Install the necessary library items and assets for the process application and referenced toolkits. The installation process deploys only those referenced toolkits that are not already on the target server. Default values for environment variables and exposed process values (EPVs) are set, and other design-time versioned assets (such as Portal searches) are created.
2. Run the installation service for each toolkit. The installation service for each referenced toolkit must be started before the installation service for the referring toolkit.
3. Run the installation service for the process application. The installation service for the process application is the final installation service that is started.
4. Migrate data and process instances if there are running business process definition instances. The specific actions of this step depend on the migration option that you choose. Migrating process instances is not a fully automated process. Migration is handled according to these general principles:
 - Consider the business process definition and its variables as the interface, and process instances as the realization of that interface.

- As part of instance migration, completed tasks are migrated into the current process version. It is important that the process can resolve a completed execution context to preserve historical information.
 - The new process version must be designed to provide compatibility with earlier versions of instances that you want to migrate.
 - If you removed a task, it is sometimes possible to account for the difference by moving the resulting orphaned token, although there are limitations to this capability.
5. Send tracking definitions to the Performance Data Warehouse. The process server updates the Performance Data Warehouse with any new or changed tracking definitions.
 6. Activate scheduled undercover agents (UCAs).
 7. Deploy advanced content. If the snapshot has advanced content, then the advanced artifacts, such as SCA modules and libraries, are deployed to the process server.
 8. On a connected process server, send a message that says that the installation is complete. The user who initiated the installation can see the completion message in the Process Center Console.

Process applications and user permissions

- User permissions can affect whether a user can access or install a process application
- Only certain roles have the authority to install or deploy process applications on the runtime server
- Make sure that the user who does the installation or deployment operation is assigned to the appropriate administrative security role

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Figure 11-27. Process applications and user permissions

Map a group or groups, rather than specific users, to administrative roles. Configuring group permissions is more flexible and easier to administer than working with individual user permissions. When you map a group to an administrative role, adding or removing users to or from the group occurs outside of IBM Business Process Manager. Thus, you do not need to restart the server for the changes to take effect.

Access to process application installation (1 of 2)

By default, the following access levels are required to install a process application, depending on the Process Server environment.

- Production environments: Requires administrative access to Process Servers
- Non-production environments: Requires write or administrative access to Process Servers
- Development environments: Requires read, write, or administrative access to Process Servers

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Figure 11-28. Access to process application installation (1 of 2)

Access to process application installation (2 of 2)

- Installing IBM Business Process Manager Advanced content with a process application snapshot
 - User or group must be assigned the Configurator, Operator, and Deployer administrative security roles
 - Assign these roles to users or groups by using the WebSphere Application Server administrative console
- To further restrict installation access for process applications
 - You can define two more subgroups for `tw_admins` users through `wsadmin`: `processCenterInstall` and `offlineInstall` for offline process servers
 - Must belong to subgroup and `tw_admins` to install process applications

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Figure 11-29. Access to process application installation (2 of 2)

To define `processCenterInstall` and `offlineInstall`, use the `wsadmin` command line tool to define the groups.

- If the `processCenterInstall` or `offlineInstall` subgroups are defined, the user must be a member of both **`tw_admins`** and the subgroup to install a process application.
- For more information, see the IBM Knowledge Center documentation for IBM Business Process Manager V8.5.7.

Offline server: Deploying process application snapshots (1 of 2)

- To install a snapshot to a Process Server that is not currently connected to the Process Center server, you must:
 - Create an installation package
 - Extract the installation package
 - Transfer the installation package to the offline server
 - Use administrative commands on the server to install the installation package

- Common commands that pertain to offline deployment include the following commands:
 - `BPMCreateOfflinePackage`
 - `BPMExtractOfflinePackage`
 - `BPMInstallOfflinePackage`

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Figure 11-30. Offline server: Deploying process application snapshots (1 of 2)

- **`BPMCreateOfflinePackage`**: This command creates an installation package for a process application snapshot on the Process Center server. If you want to install a snapshot on an offline Process Server, use this command in connected mode from a Process Center server to create an installation package of a snapshot. This package is stored in the database. You can extract the package to a compressed file with the `BPMExtractOfflinePackage` command, and then install the compressed file on the offline Process Server with the `BPMInstallOfflinePackage` command.
- **`BPMExtractOfflinePackage`**: This command extracts the process application snapshot installation package from Process Center. If you want to install a snapshot on an offline Process Server, use the `BPMExtractOfflinePackage` command in connected mode from a Process Center server to extract the installation package to a file. You can then install the extracted file on the offline Process Server.
- **`BPMInstallOfflinePackage`**: This command installs a process application snapshot from a Process Center to an offline Process Server that is not currently connected to the Process Center. Use this command in connected mode from Process Server to install a process application snapshot installation package on Process Server. The installation package must already be created and extracted on the server. After this command is complete, the installed snapshot is active. You can also use the `installProcessAppPackage` command to complete this task.

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Offline server: Deploying process application snapshots (2 of 2)

Snapshots History Manage Governance

Sort Snapshots By: Date All | Installed | Deployed | Archived

Current
Last changed on 1/10/13 by bpmadmin
Not Yet Deployed to Process Center Server

Procurement Sample v801 (New)
Created on 1/10/13 by bpmadmin
Not Yet Deployed to Process Center Server
Not Yet Installed to Process Server

Export **Install**

Procurement Sample (STPPS1) **Snapshots** History Manage Governance

Sort Snapshots By: Date All | Installed | Deployed | Archived

Current
Last changed on 1/10/13 by bpmadmin
Not Yet Deployed to Process Center Server

Procurement Sample v801 (New)
Created on 1/10/13 by bpmadmin
Not Yet Deployed to Process Center Server
Deployment Package Available:
PSRMSW_Topo

Export **Install**

Server Details

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Figure 11-31. Offline server: Deploying process application snapshots (2 of 2)

Go to the **Process Apps** tab for the snapshot of the application that you want to deploy and click **Install**.



Online server: Deploying process application snapshots

The screenshot shows a list of process applications:

- Current** (highlighted with a yellow circle containing '1')
 - Last changed on 1/10/13 by bpmadmin
 - Not Yet Deployed to Process Center Server
- Hiring Sample Advanced v801 (New)**
 - Created on 1/10/13 by bpmadmin
 - Not Yet Deployed to Process Center Server
 - Not Yet Installed to Process Server

Buttons: Export (disabled), Install (highlighted with a red box).

The screenshot shows the same list of process applications, but the "Hiring Sample Advanced v801" entry now includes "Currently Installed:" information:

- Current** (highlighted with a yellow circle containing '2')
 - Last changed on 1/10/13 by bpmadmin
 - Not Yet Deployed to Process Center Server
- Hiring Sample Advanced v801 (New)**
 - Created on 1/10/13 by bpmadmin
 - Not Yet Deployed to Process Center Server
 - Currently Installed:
 - PSRMSW_Topo(bpmhost.ibm.com) - 0 instances

Buttons: Export | Install, Server Details (disabled).

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Figure 11-32. *Online server: Deploying process application snapshots*

Installing snapshots

- When you install snapshots on a Process Server, you must consider how to handle any running business process definition instances
- For an online server, you are prompted for how you want to handle the installation
 - Leave running instances on the current snapshot
 - Migrate running instances to the new snapshot
 - Delete running instances of the current snapshot (not available in production)
- For an offline server, you must make the necessary changes in the installation package
 - Leave
 - Migrate
 - Delete

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Figure 11-33. *Installing snapshots*

The options for installation include the following options:

- **Leave or Leave running instances on the current snapshot:** The instances currently running continue to completion by using the previously installed snapshot. Use this option if you want to use a policy file to manage orphaned tokens.
- **Migrate or Migrate running instances to the new snapshot:** Currently, running instances are migrated to the new snapshot you are installing wherever the running instances are in the flow of the process. The new version is implemented for the next item or step.
- **Delete or Delete running instances of the current snapshot:** The instances currently running are immediately stopped and do not continue to completion. All records of the running instances are removed from the process server. The delete option does not delete BPEL process instances, human task instances, or business state machine instances.

When you install snapshots on a connected process server along with BPEL content, the Migrate or Delete options that you are presented with do not apply to your running BPEL process instances. The snapshot installation options to delete or migrate apply only to the Business Process Definition instances of the selected snapshot, and not to the BPEL instances.

Unit summary

- Explain online and offline Process Server environments
- Work with an offline Process Server
- Deploy a process application to an offline Process Server
- Explain the various XML configuration files
- Deploy a process application to an online Process Server

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Figure 11-34. Unit summary

Review questions

1. True or False: A process application snapshot cannot be deployed to an offline server.
2. True or False: The environment can be customized by modifying the 100Custom.xml file.



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Figure 11-35. Review questions

Write your answers here:

- 1.
- 2.

Review answers

1. True or False: A process application snapshot cannot be deployed to an offline server.

The answer is False. A process application can be deployed to an online or offline Process Server. An installation package is created and deployed for an offline Process Server.



2. True or False: The environment can be customized by modifying the 100Custom.xml file.

The answer is True.

Exercise: Managing offline and online Process Servers

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Figure 11-37. Exercise: Managing offline and online Process Servers

Exercise objectives

- Create an offline server by using the Process Center Console
- Deploy a snapshot to an offline Process Server
- Change the configuration of an offline Process Server to an online Process Server
- Configure SSL communication in the network deployment environments
- Manage an online Process Server
- Deploy a snapshot to an online Process Server
- Deploy an installation package to Process Server



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Figure 11-38. Exercise objectives

Exercise: Migrating process instances

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Figure 11-39. Exercise: Migrating process instances

Exercise objectives

- Create snapshots
- Deploy snapshots to an online Process Server environment
- Migrate snapshots
- Create a migration policy for orphaned tokens



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Figure 11-40. Exercise objectives

Unit 12. Advanced administration concepts

Estimated time

01:15

Overview

This unit describes various options for extending the basic IBM Business Process Manager Advanced deployment topologies to add more processing capabilities. You learn about the high availability manager, how to create messaging engine policies, and log file high availability.

How you will check your progress

- Checkpoint
- Lab exercises

References

IBM Business Process Manager V8.5.5 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Explain the reasons for extending a topology
- List options for increasing cluster member capacity in a cell
- Expand a topology
- Explain the purpose of the high availability manager and the concept of core groups
- Explain the structure and purpose of the default messaging and transaction manager policies
- Explain how policies are applied at run time
- Define the transaction manager high availability policy type and identify how transaction policies are applied
- Explain the Process Federation Server

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Figure 12-1. Unit objectives

Topics

- Extending a topology
- High availability framework
- Policies
- Transaction manager
- IBM Process Federation Server

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Figure 12-2. Topics

12.1. Extending a topology

Extending a topology

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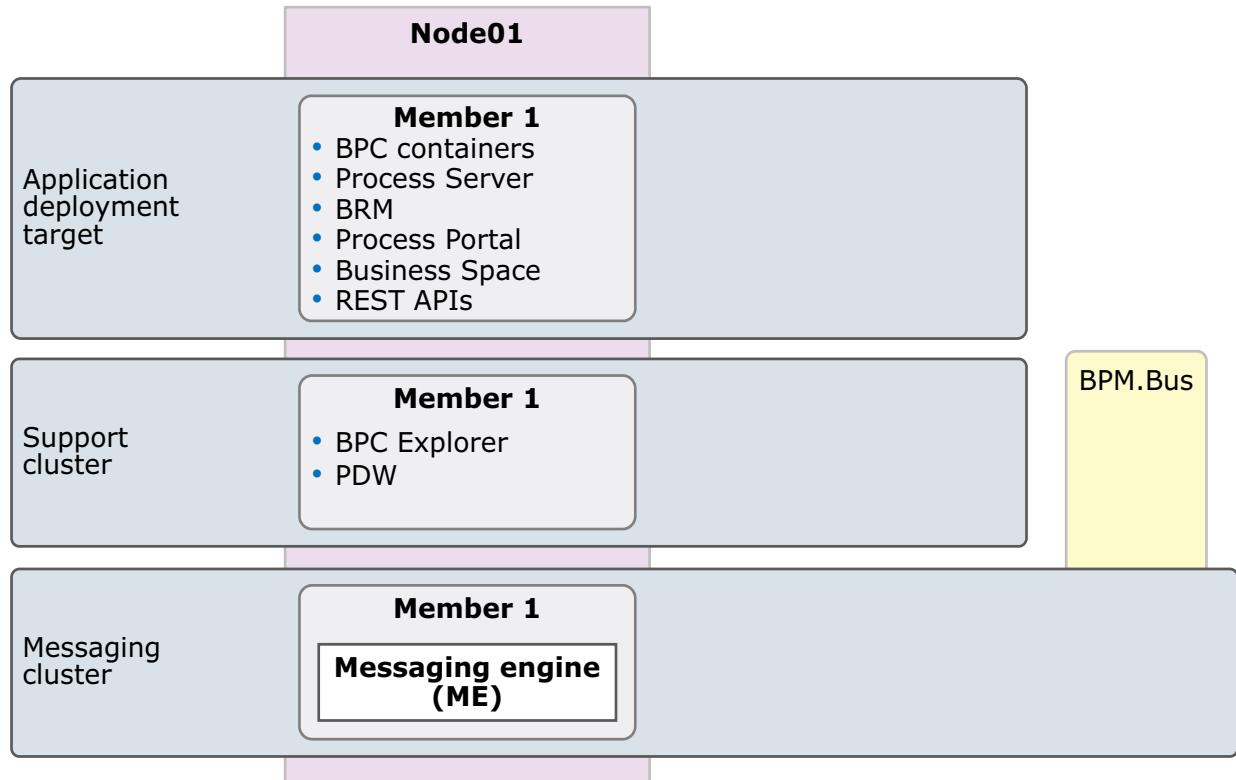
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Figure 12-3. Extending a topology

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Application, Remote Messaging, and Remote Support topology



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Figure 12-4. Application, Remote Messaging, and Remote Support topology

The Application, Remote Messaging, and Remote Support topology pattern is a topology for production environments. This topology provides three separate clusters:

- A remote messaging cluster
- A remote support cluster
- An application deployment target cluster

This slide is to introduce the current configuration in the course labs. It is meant to be an introduction to the slides on extending a topology. A number of single points of failure in this diagram must be addressed for high availability.

Methods to extend your topology

- Adding cluster members
 - The easiest way to extend your infrastructure
 - Add nodes and cluster members independently or in combination
 - Can improve your application throughput
- Adding cells
 - Create another deployment environment in another cell
 - Gives you the most room for growth and the most flexibility for expanded functional requirements
 - Provides complete isolation for your applications
- Adding deployment environments
 - Create an independent deployment environment in the same cell
 - Advanced topology that requires research and planning
 - Feature is for Process Server only, not for Process Center

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Figure 12-5. Methods to extend your topology

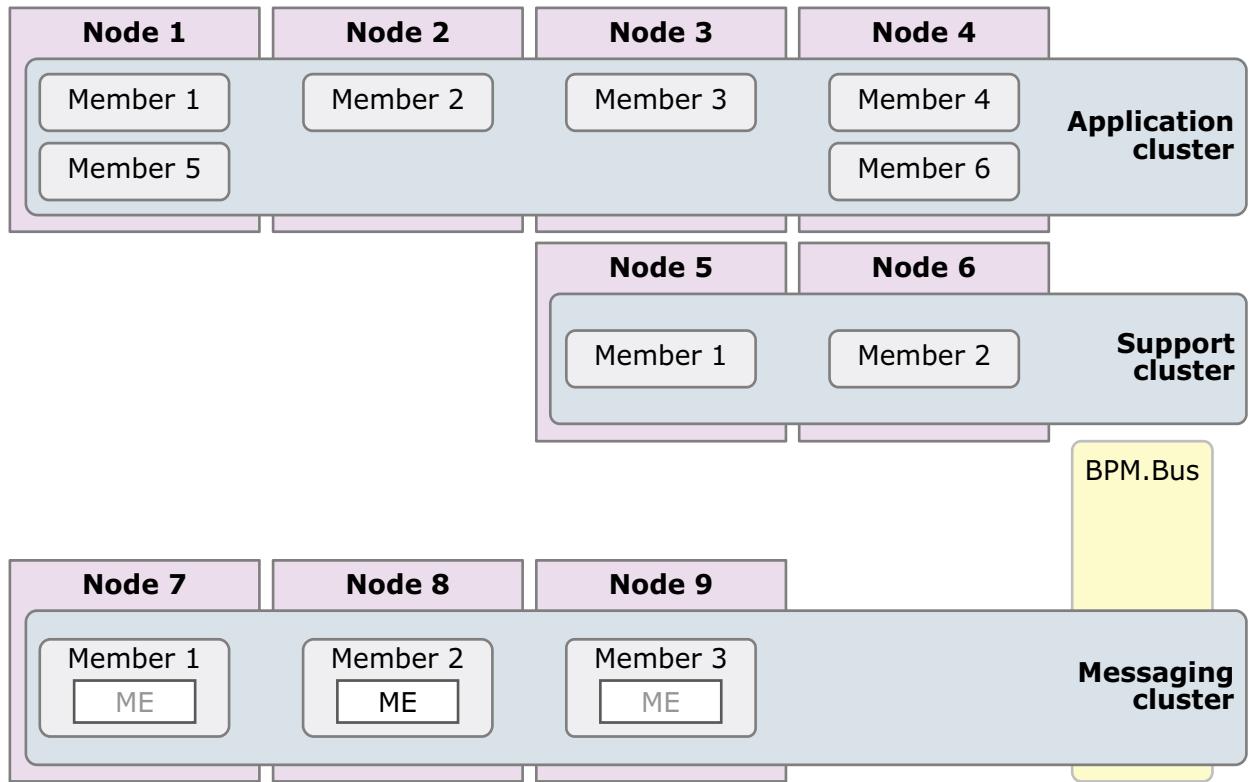
If you decide that expanding your existing clusters is not an appropriate solution, consider creating another deployment environment in another cell. This approach gives you the most room for growth, the most flexibility for expanded functional requirements, and complete isolation for your applications.

To add another cell, you duplicate common cell-level configurations, such as global security settings. You use multiple consoles to manage your applications, such as separate administrative consoles and Failed Event Managers.

Reasons for adding nodes and cluster members

- You are deploying new applications to your existing environment
- The need for increased application processing capability during peak usage times
 - For example, increased sales traffic during the fourth quarter
 - Increased accounting traffic at the end of the quarter
- Creating more capacity for migration or application updates
- The requirement to provide adequate failover capability
- An increasing number of applications is straining the system
 - Can be for same or different business purposes
 - Does not push the entire system beyond capabilities
- Preparing more capacity for failover or migration

Adding nodes and cluster members



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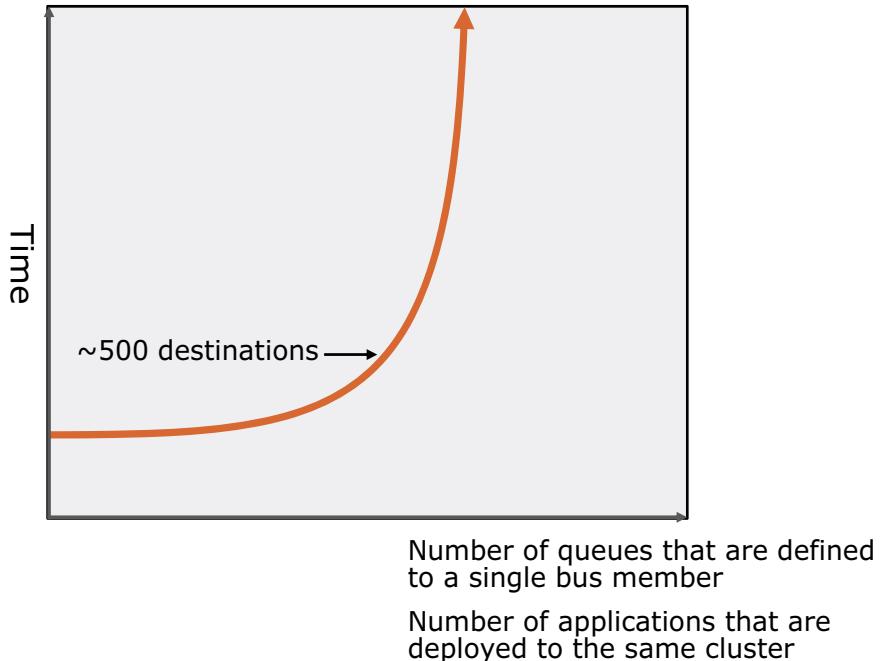
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Figure 12-7. Adding nodes and cluster members

If you require extra processing capability to the application deployment target cluster in the environment, you have the option of adding more nodes and cluster members. In typical representations of the Application, Remote messaging, and Remote support topology, there are typically two to three nodes, each with one cluster member, which is not mandatory. If you must add more cluster members to the application target cluster or the support cluster, it is possible to do so.

More cluster members cannot always be the answer

- Evaluate start time (start time impacts failover time)



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Figure 12-8. More cluster members cannot always be the answer

The more applications that you deploy, the more destinations you create. As the number of destinations increases, the start time of the ME is affected. At around 500 destinations, the start or failover time increases dramatically.

You can measure start time by subtracting the time that is recorded when the state “started” from the time that is recorded when the state is “ready for e-business.”

Reasons for which extending clusters is not appropriate

- The requirement to isolate application functions for the business units of your organization because of regulatory or governance requirements
 - You can deploy the applications for human resources to one cluster, while the applications for the accounting group are deployed to a separate cluster
- The requirement to isolate applications because they have unique runtime requirements
 - Heavy asynchronous traffic versus primarily synchronous traffic
- You want to isolate different application versions
- The need to provide more application processing capability
- The requirement to work around application bottlenecks
- You want to set up multiple test environments without having to configure security or nodes each time

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Figure 12-9. Reasons for which extending clusters is not appropriate

Here are some reasons for which extending clusters is not appropriate:

- Unique runtime requirements; for example, perhaps the original topology was optimized entirely for synchronous communications. If your new application is a heavy user of asynchronous communications, then the original topology might not properly support the requirements of the new application.
- Avoiding a bottleneck, which means to avoid the use of resources that are already heavily used.

Extending an existing environment

- You can extend your deployment environment by using two methods
 - Deployment environment wizard
 - `BPMConfig` command
- Deployment environment wizard
 - Easiest way to extend your topology to add more cluster members
 - Various options in the administrative console to extend the topology
- `BPMConfig` command
 - Run the `BPMConfig` command by using the properties file to create profiles or to add more nodes
 - You must create the initial deployment environment by using the `BPMConfig` command initially
 - Use the same properties file on all computers that participate in the deployment environment
 - Ensure that the deployment manager is running

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Figure 12-10. Extending an existing environment

Run the `BPMConfig` command with the `-create -de` option to add more managed nodes and profiles to your existing environment. When it runs, the `BPMConfig` command:

- Creates a managed node for each new node that is specified in the configuration properties that are based on the specified values.
- Federates the node and adds the node to the deployment environment. If the `-create -profile` action was run with the `-federateLater` option, the node is created but not federated.
- Creates any profiles that are specified in the configuration properties file that do not exist.

Considerations for multiple deployment environments

- Maintenance considerations
 - It is more difficult with more than one deployment environment in the same cell
 - Applying interim fixes affects all servers, deployment environments, and clusters in the cell
 - Might need to stop all your servers to apply interim fixes for one set of clusters
- Application considerations
 - You cannot install two instances of the same SCA application in the cell
 - Each Process Portal has one view to each deployment environment and requires unique context roots
- Administration considerations
 - Each application cluster must have a corresponding support and messaging cluster
 - You must ensure unique names for all applications that contain SCA modules
 - You need to add databases and schemas for each application and messaging cluster

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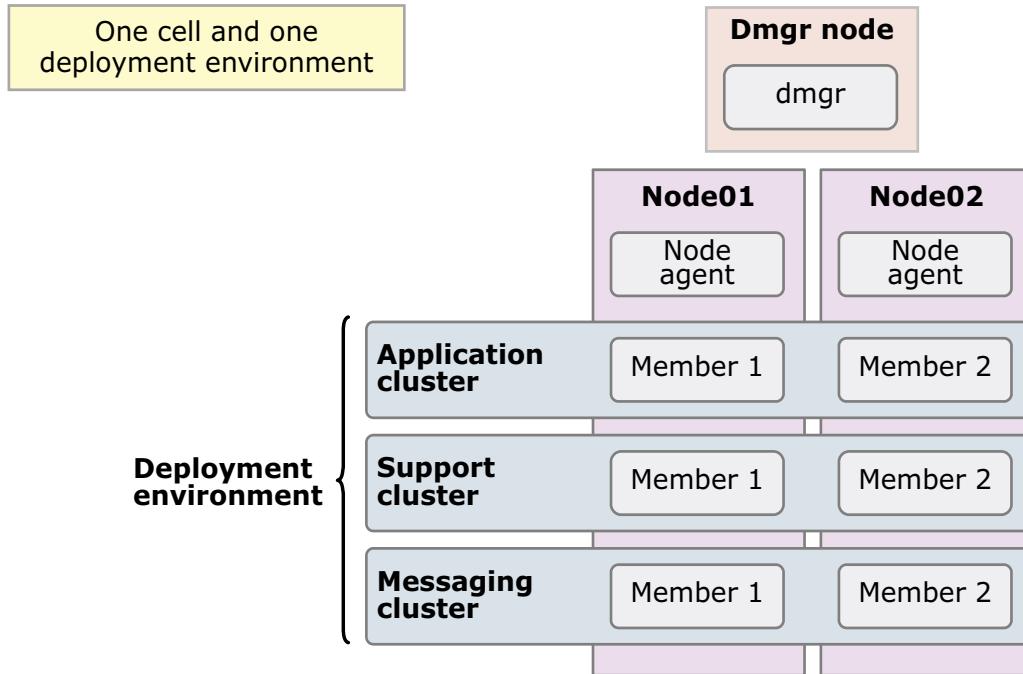
Figure 12-11. Considerations for multiple deployment environments

You cannot install two instances of the same Service Component Architecture (SCA) application in the cell. You can install many SCA applications, but they must have different module names. You can use the **SCARename** utility to rename them. As an example, you might create an environment with two deployment environments in the same cell and then try to import into both of them an IBM BPM export (.twx) file that contains BPEL processes. In this case, the second import fails because the SCA module names are the same and an SCA module name must be unique within a cell. To rename one of them, you must extract the EAR file from the .twx file, call the SCARename utility to rename it, and then package the new EAR in the .twx file.

Several ways to manage this problem are provided here.

- You can use the module with a naming convention that incorporates the name of the target deployment environment.
- If you are deploying the modules as part of a process application in Process Center, you can use the process app with naming conventions that incorporate the name of the target deployment environment.
- If you are deploying directly as an EAR file, you can use module versioning where the version name uses a naming convention that incorporates the name of the target deployment environment.

Multiple cells and deployment environments (1 of 3)

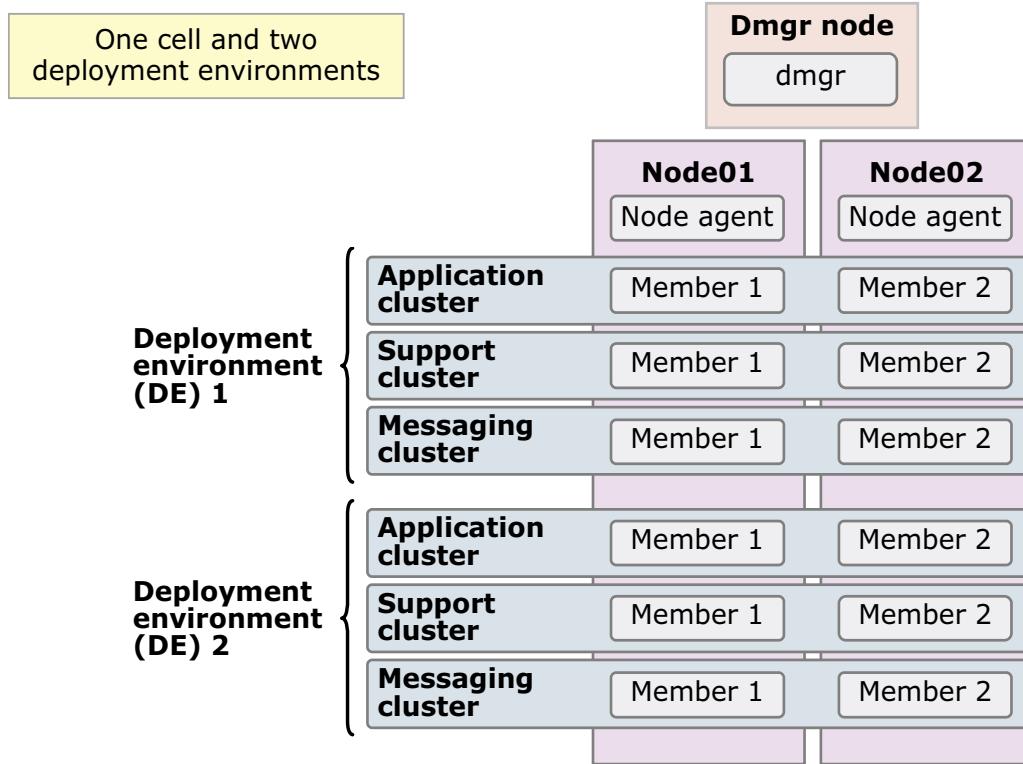


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Figure 12-12. Multiple cells and deployment environments (1 of 3)

Multiple cells and deployment environments (2 of 3)



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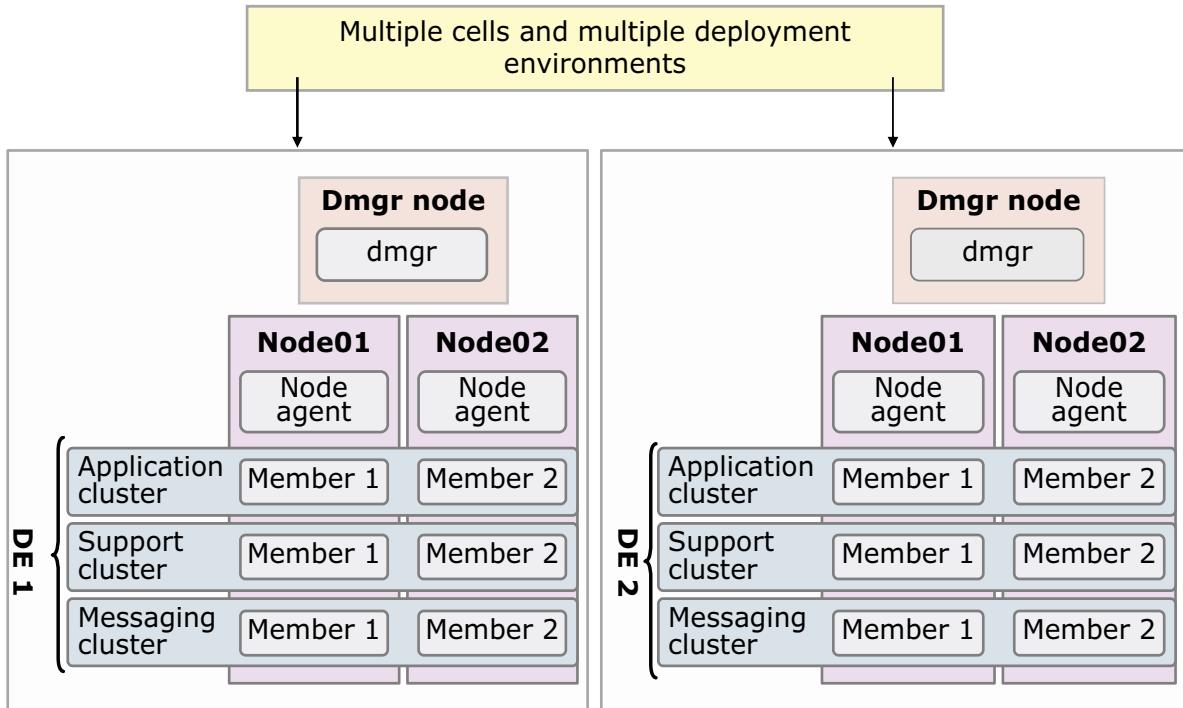
Figure 12-13. Multiple cells and deployment environments (2 of 3)

You can isolate multiple deployment environments within a single cell in your IBM Business Process Manager configuration. You must create unique HTTP endpoints for each deployment environment. Optionally, you can specify different security settings for each deployment environment by creating multiple security domains and attaching one security domain to each deployment environment.

Only users that are assigned to the administrator role can configure multiple security domains.

To isolate administrative access, you can specify administrative authorization groups to grant administrative access only to the resources of a single deployment environment.

Multiple cells and deployment environments (3 of 3)



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Figure 12-14. Multiple cells and deployment environments (3 of 3)

Details of the environments

- Deployment environment specifics
 - Number of nodes can vary
 - Number of members of each cluster on each node can vary
 - No requirement to have a member of every cluster on every node
 - Deployment manager can be on same physical computer as one of the custom nodes, but it is not necessary
 - Each cell has one set of CellDB tables
 - Each deployment environment has its own set of tables to support all other functions
 - Each deployment environment has its own SIBus

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Figure 12-15. Details of the environments

Multiple deployment environment considerations

- Applications do not jump from deployment environment to deployment environment
 - Applications that are deployed to DE1 AppCluster run only in DE1 AppCluster
 - BPDs or BPELs deployed to DE1 have data only in tables in DE1
- Bus messages do not jump from SIBus to SIBus
 - Each deployment environment has its own SIBus
- Each deployment environment has its own messaging and support capabilities
 - There is a strong 1-to-1 relationship between the Process Server capabilities of the AppCluster and the Performance Data Warehouse capabilities of the SupportCluster
 - For multiple reasons, there is a long-standing recommendation to always have a unique MessagingCluster for each AppCluster

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Figure 12-16. Multiple deployment environment considerations

12.2. High availability framework

High availability framework

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Figure 12-17. High availability framework

High availability manager framework

- A set of services that WebSphere Application Server provides
- Allows WebSphere components to provide highly available services
- Some runtime components in WebSphere products provide services that must be highly available
 - At least one instance of the service must be active in some process in the cell at all times
 - If the process that is hosting the service fails, the service must be activated in some other process in the cell
- Based on the principle of group communications system
- Consistent view of group membership across all members:
 - Servers going up and down cause view changes
 - New views are agreed upon by all members

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Figure 12-18. High availability manager framework

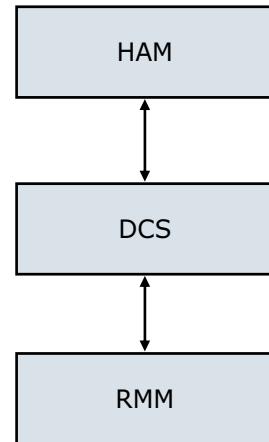
Some of the internal components of WebSphere Application Server require services that must be highly available in a cell. If an active instance of one of these services were to fail, some operations in the cell would not work successfully, for example, the transaction manager.

Some internal components of WebSphere Application Server require data from multiple sources to provide their service. Processes must be able to transfer data between themselves quickly and efficiently.

Group communications is a concept that has been around for a long time. Basically, it means that within a group, all of the members agree on which members of the group are currently participating and which members are unavailable. Also, when group members send messages, the order in which they are sent is guaranteed to be the order in which they are delivered to the other members.

High availability manager architecture

- HA manager services
 - High availability groups: Enforcement of high availability policies
 - Bulletin board: For sharing state
 - Agent framework: For data replication service (DRS)
- Distribution and consistency services (DCS)
 - Group membership service that knows who is up and who is down
 - Messages are delivered in the originating order
 - Either all or no group members receive a message (optional)
- Reliable Multicast Messaging (RMM)
 - The transport layer for DCS
 - Multicast emulation for TCP communication
 - Provides failure detection



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Figure 12-19. High availability manager architecture

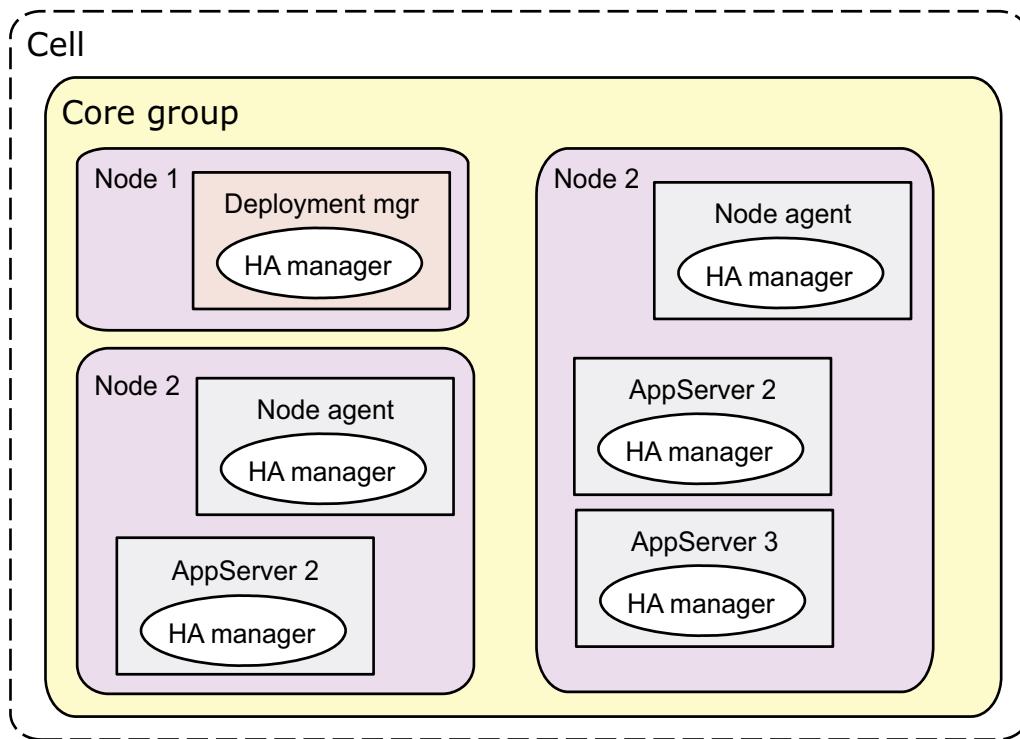
The high availability (HA) manager consists of a layered stack of components. This layered stack is collectively referred to as the HA manager. The components include:

- **The HA manager (HAM):** This component provides the abstractions that other WebSphere services use. These abstractions are generally based on a set of fine-grained group services that provide intragroup communications and group policies.
- **Distribution and consistency services (DCS):** The DCS layer provides coarse-grained group services, including reliable many-to-many messaging capabilities.
- **Reliable multicast messaging (RMM):** The RMM layer provides transport layer network function, including a multicast messaging abstraction over TCP connections.

DCS (which uses RMM) runs three protocols:

- Discovery Protocol for detecting new JVMs
- Failure Detection Protocol for detecting failed or unresponsive JVMs
- View Synchrony Protocol for maintaining virtual synchrony

High availability manager runs on each server



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Figure 12-20. High availability manager runs on each server

The high availability framework of WebSphere Application Server eliminates single points of failure. It is called the WebSphere High Availability (HA) Manager, and it provides peer-to-peer failover for applications and processes that are running within WebSphere. It also allows integration into the newest storage technologies, and supports other high availability frameworks, such as High Availability Cluster Multi-Processing (HACMP).

The HA manager runs as a service within each application server process (deployment manager, node agents, or application servers). In the event of a server failure, the HA manager will fail over services that were running on that server.

A WebSphere Application Server cell (main administrative domain) consists of one or more server processes that host resources such as applications or messaging engines. The cell is partitioned into groups of servers that are known as core groups, which the administrator defines. A core group cannot extend beyond a cell, or overlap with other core groups. It serves as physical grouping of JVMs in a cell. Each JVM process can be a member of one core group only. Naturally, cluster members belong to the same core group.

Components that are using the high availability manager service include the following components:

- WebSphere Application Server
 - Workload management

- Messaging engines
- Transaction manager
- Asynchronous PMI service
- Data replication service
- Business Process Manager
 - Highly available inbound JCA resource adapter
 - Event sequencing component

High availability groups

- WebSphere Application Server components that use HA manager failover services create or join a high availability group
 - Components create HA groups at run time
 - Members of the group are those processes for which it is possible to activate the component
- There can be many HA groups in existence for the same set of servers
 - Messaging engine HA group
 - Transaction manager HA group
- Components define a unique *HA group name* that they are going to use
 - An HA group name is a non-empty set of name-value pairs
- The activation or failover characteristics of an HA group are determined from *high availability policies that are defined* from HAM components or users

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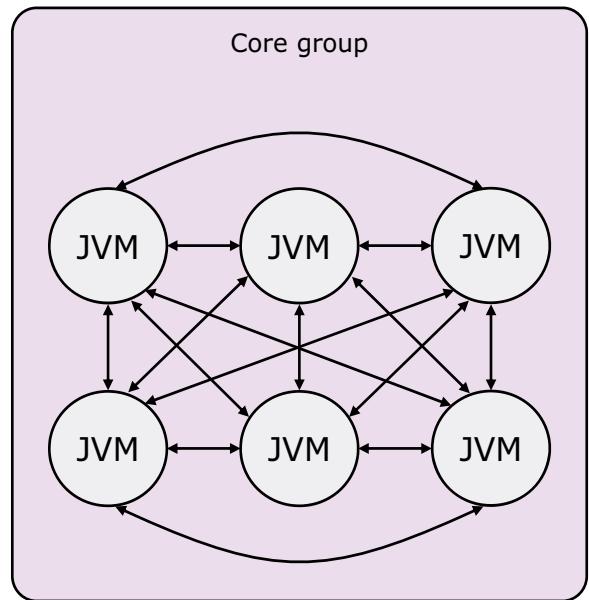
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Figure 12-21. High availability groups

The HA group service has the most users, and it is the only service where administrative configuration might be required. Settings for the HA group service are exposed to the administrator by using the core group policies. An HA group name is really a set of name-value pairs, where each name and value is a String. Theoretically, a set like {a=b,c=d,e=f} can be a valid HA group name. All HA groups must have a group name that matches to only one policy.

Core group

- A collection of processes (JVMs) *fully connected* to each other for HA manager communications
- Types of processes include application servers, node agents, deployment manager, and proxies
- *DefaultCoreGroup* is automatically created and can never be deleted
 - Server creation or deletion adds or removes servers to or from a core group
- A server cannot exist in more than one core group



Important: All members of an HA group must be in the same core group

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Figure 12-22. Core group

A core group is a high availability domain that consists of a set of processes in the same cell that can directly establish high availability relationships. Highly available components can fail over only to another process in the same core group, and replication can occur only between members of the same core group.

A cell must contain at least one core group, although multiple core groups are supported. Each core group contains a core group coordinator to manage its high availability relationships, and a set of high availability policies that are used to manage the highly available components within that core group.

Core group restrictions

- All members of an HA group must be in the same core group
 - A component service in one core group cannot fail over to a server in a different core group
 - HA group members in one core group cannot directly send information to other core groups by using DCS
 - Exception: A bulletin board service in one core group can use DCS to communicate with the bulletin board service in another core group
- Core groups do not scale indefinitely
 - Due to full mesh of connections between servers
 - Number of connections is $n*(n-1)/2$
 - For configurations with more than 50 servers, multiple core groups must be used

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Figure 12-23. Core group restrictions

A fully connected mesh has the advantage of low latency and fast failover, but also has a disadvantage of scalability considerations. The recommendation is to start with 50 members maximum per core group. With adequate processor, memory, and network, the core group can be larger; but do not exceed 100 members.

Multiple core groups must be connected by using the core group bridge service, which allows bulletin board messages to be communicated between core groups.

A WebSphere process (JVM) can belong to only one core group.

A core group cannot span cells. A cell can have more than one core group. A cluster cannot span core groups. A core group can have more than one cluster.

Existing servers can be moved between core groups. New servers can be created in a selected core group.

HA managed components do not communicate across core groups. An exception to this rule is the bulletin board service.

Bulletin board service

- Some information must be known cell-wide, even if there are multiple core groups
 - Workload Manager routing information
- This information is distributed throughout the cell by using the bulletin board service
- The bulletin board service must be able to communicate across core groups
- To communicate bulletin board information across core groups, you must build core group bridges
- No components other than the bulletin board service use core group bridges

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Figure 12-24. Bulletin board service

Core group coordinator (1 of 2)

- The (active) coordinator aggregates distributed state information from the individual processes
 - Where HA group members are located
 - Current state of all members
- Ensures that HA groups are compliant with the HA policy for the group
 - When a view changes, coordinator ensures that all policies are satisfied
- By default, there is one active coordinator per core group
- A single active coordinator does not introduce a single point of failure
 - If the active coordinator fails, a new coordinator is elected

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Figure 12-25. Core group coordinator (1 of 2)

The lexicographic sort uses the form **cell name, node name, server name**. In some installations, the deployment manager server gets elected as the active coordinator by default. However, it is suggested that you explicitly specify the preferred coordinator server.

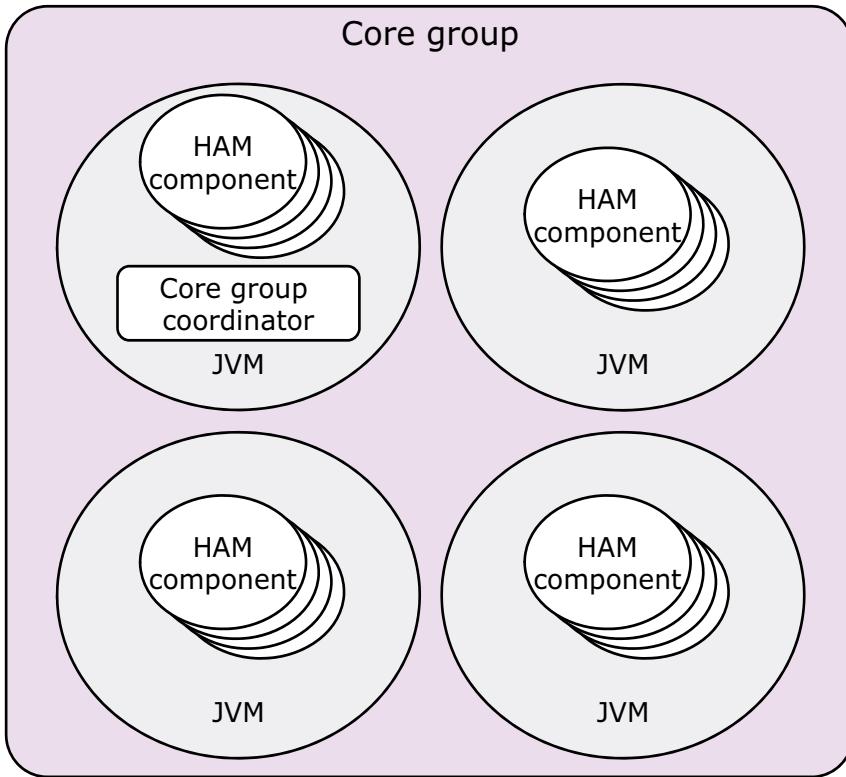
In large topologies, the preferred coordinator server might get tuned to have special settings, such as heap size. In such a case, it is suggested that you:

- Set up a non-singleton list of ordered preferred coordinator servers
- Set the appropriate tuning parameters in all of the members of the mentioned list

Otherwise, a domino-death effect due to conditions like “out of memory” can happen if the most preferred coordinator fails.

On smaller topologies, often the deployment manager or node agents are added to the preferred coordinator list. On large topologies, it is suggested that stand-alone servers be created to host both the active coordinator and bridge interface functions.

Core group coordinator (2 of 2)



- By default, the HA manager selects the lexicographically lowest-named server from the available core group members

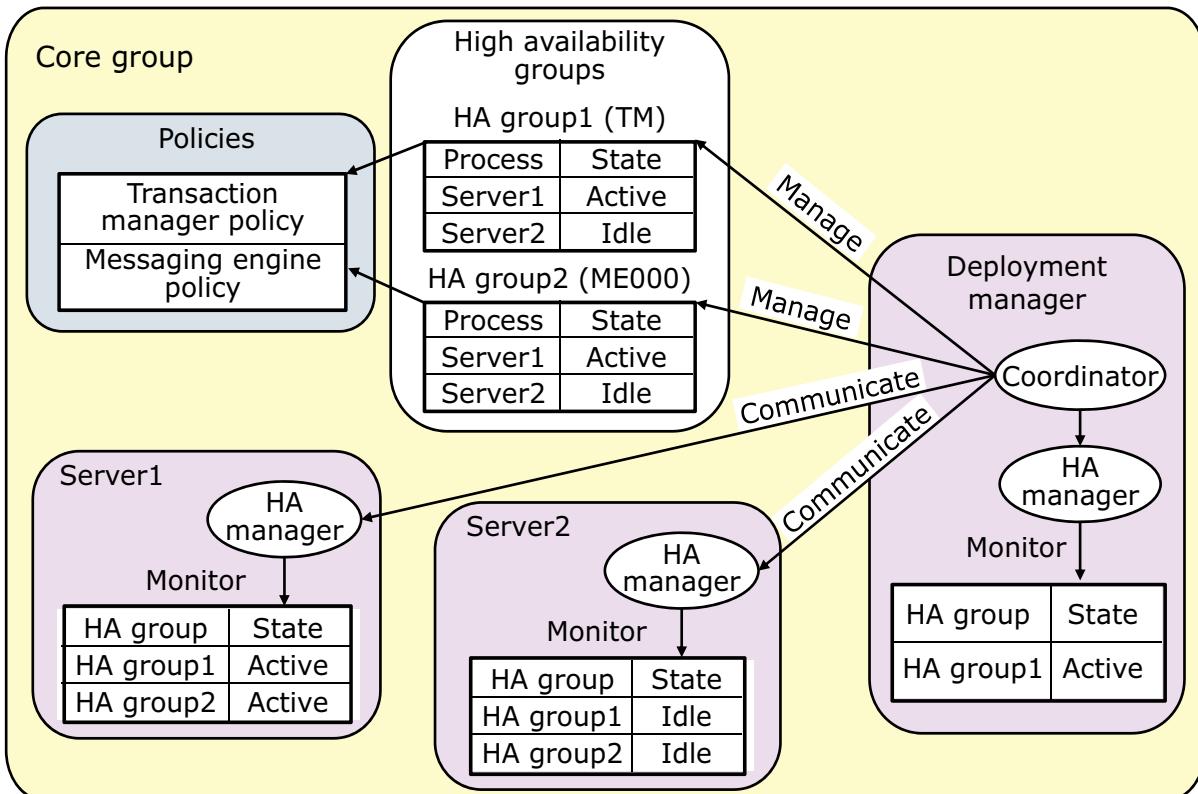
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Figure 12-26. Core group coordinator (2 of 2)

By default, there is only one coordinator per core group. But having one is not a single point of failure. An active coordinator can move to any process in the core group, if required. The number of preferred coordinators should always be greater than the number of active coordinators. If the number of active coordinators = 1, then specify at least two preferred coordinator servers. If the number of active coordinators = 2, then specify at least three preferred coordinator servers.

Core group collections and the HA manager



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Figure 12-27. Core group collections and the HA manager

A closer look at the HA manager concept is needed to understand the relationship between core groups, high availability groups, and policies. A core group is a component of the high availability manager function. A default core group, called DefaultCoreGroup, is created for each cell in the WebSphere Application Server environment. A core group can contain stand-alone servers, cluster members, node agents, and the deployment manager. A core group must contain at least one node agent or the deployment manager. The WebSphere Application Server administrator maintains core groups.

After the membership of the core group stabilizes at run time, certain members are elected to act as coordinators for the core group. Coordinators can be assigned or chosen at random. A core group coordinator manages the following aspects:

- Maintaining group information (group name, group members, and group policy)
- Tracking members of the group as they start, stop, or fail
- Assigning services to group members and handling failover of services that are based on core group policies
- Managing the high availability groups (HA groups) within a core group

HA groups are created dynamically at run time. Each HA group represents a highly available service; for example, each messaging engine has an HA group. The active members in an HA

group are ready to host the service at any time. Each core group can have a number of policies, which apply to particular HA groups and determine the high availability behavior of services that are running within the HA group. Each HA group can have its own policy. A single policy can manage a set of HA groups by using a matching algorithm. An HA group must be managed by exactly one policy.

During installation, two policies are automatically installed in the DefaultCoreGroup:

- Default SIBus policy: This policy is used for messaging engines.
- Clustered TM policy: This policy is used for the transaction manager.

Since being a coordinator takes up more resources in the JVM, you might want to override the default election mechanism by providing your own list of preferred coordinator servers in the administrative console. Click **Servers > Core groups > Core group settings > <core_group_name> > Preferred coordinator servers**.

12.3. Policies

Policies

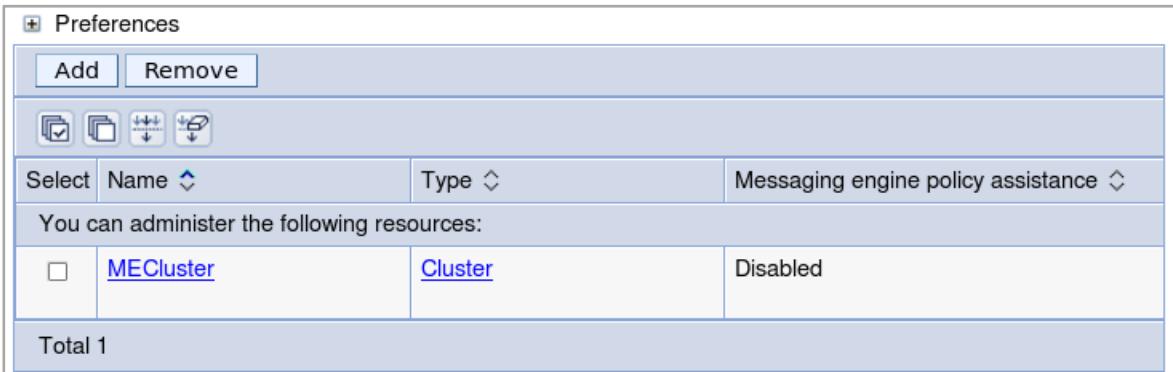
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Figure 12-28. Policies

Messaging engine policies

- The administrative console provides messaging engine policy assistance where you can choose one of three predefined messaging engine policies:
 - High availability
 - Scalability
 - Scalability with high availability
- By default, messaging engine policy assistance is disabled
 - Must be enabled to configure a policy



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Figure 12-29. Messaging engine policies

High availability policy: By default, only one application server in a cluster has an active messaging engine on a bus. If the server fails, the messaging engine on another server in the cluster is activated, which provides failover, but no workload management. The server with the active messaging engine has local access to the bus, but the rest of the servers in the cluster access the bus remotely by connecting to the active messaging engine. Servers accessing the bus remotely can consume asynchronous messages from a remote messaging engine. However, an instance of a message-driven bean (MDB) deployed to the cluster can consume from a local messaging engine only.

Because everything is funneled through one messaging engine, performance might still be an issue.

Scalability policy: Each cluster member has its own ME. If one cluster member fails, its ME does not fail over to another cluster member.

Scalability with high availability: Each server in the cluster is able to host at most two MEs, its own and one for another cluster member.

Policy wizard

- After enabling messaging engine policy assistance, a wizard provides guidance for the cluster
- Guidance includes details about creating one or more messaging engines for the cluster and configuring the messaging engine behavior
- Select a particular policy type for the cluster
 - Policy type is now listed for the bus member

Messaging engine policy assistance settings		
Select	Policy type	Is further configuration required?
<input checked="" type="radio"/>	High availability	<p>⚠ The current configuration has a single point of failure because there is only a single node. Consider adding a cluster member configured on a separate node.</p> <p>⚠ You need to correct the following number of messaging engine policies: 1.</p>
<input type="radio"/>	Scalability	<p>⚠ You need to correct the following number of messaging engine policies: 1.</p>
<input type="radio"/>	Scalability with high availability	<p>⚠ The current configuration has a single point of failure because there is only a single node. Consider adding a cluster member configured on a separate node.</p> <p>⚠ You need to add the following number of messaging engines: 1.</p> <p>⚠ You need to correct the following number of messaging engine policies: 1.</p>
<input type="radio"/>	Custom	Advice is not available for a custom configuration.

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Figure 12-30. Policy wizard

High availability policies

- Are used to determine which members of an HA group should be activated at a time
- Associated with an HA group by using match criteria
 - List of name-value pairs to match against the HA group name
 - The number of name-value pair matches determines the “match weight factor” (match degree)
 - Most specific wins: The match with highest “match weight factor”
- HA policy types
 - *All active*: All members are made active
 - *M of N policy*: M members are made active (if available)
 - *No operation policy*: No members are made active
 - *One of N policy*: One member is made active
 - *Static policy*: The component is activated on an explicitly specified set of servers

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Figure 12-31. High availability policies

One of N is the most popular policy. It is the policy that is used by both the transaction manager and the service integration bus in Business Process Manager. One of N can also be viewed as a mechanism to configure relevant components in an ACTIVE-PASSIVE mode in a cluster that is inherently ACTIVE-ACTIVE in nature. One of N can be viewed as a special case of M of N ($M=1$). One of N is provided for usability and convenience.



Important

Do not use M of N if all you need is a One of N policy.

M of N and AllActive are not in use today.

High availability policy attributes

- Is alive timer:
 - How often to check health of group members
- Quorum:
 - No members are activated until $(n-1)/2$ members of the core group are available
 - Not currently used by any WebSphere components
 - Do not set
- The “Fail back” flag specifies that if a server with a higher-listed order becomes available again, the ME instance should be activated on that server
 - Failover time might affect whether it is wise to configure fail back
- The “Preferred servers only” flag restricts the ME instance to run *only on* the preferred servers
 - The list specifies on which preferred servers the ME instance should be activated
 - The list is ordered; the HA manager first tries to activate the ME instance of the first server in the list (the other MEs are in a joined state)
 - If the first server in the list is not available, the HA manager activates the ME instance of the next server in the list

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Figure 12-32. High availability policy attributes

The list of preferred servers within a policy defines on which server the ME instance should be activated on start or failover. As the list of preferred servers is ordered, the HA manager tries to activate the ME on the first server in the list. If this server is unavailable, the next server in the list is chosen for ME activation. Additionally, a “Failback” flag can be checked for the policy, which specifies that if a server at higher order in the preferred server list becomes available, the ME instance should be activated on that server. The “Preferred servers only” flag of the policy restricts the ME instance to run only on the servers in the list.

Policy creation that uses scripts can be involved. The `CreateCoreGroupPolicy.jacl` file is available in `$WAS-INSTALL-ROOT/bin`. A template version of the `AddPolicy.properties` file is in the `$WAS-INSTALL-ROOT/properties` directory of WebSphere Application Server. To help HA manager performance, do not keep unused policies in the `coregroup.xml` file.

Creating policies

- To create a policy, you define:
 - Preferred servers
 - Match criteria _____
 - Policy type _____

The diagram illustrates the mapping of policy creation steps to a configuration table. Arrows point from the 'Match criteria' and 'Policy type' list items to the second and third columns of the table respectively.

MessageEngine000		One of N policy	WSAF_SIBMESSAGING_ENGINE=MyCluster.000-RolyBus, type=WSAF_SIB
MessageEngine001		One of N policy	WSAF_SIBMESSAGING_ENGINE=MyCluster.001-RolyBus, type=WSAF_SIB

Figure 12-33. Creating policies

High availability policies determine the activation and failover characteristics of the ME. You can add, delete, or edit policies while the core group is running. Changes take effect immediately, without having to restart any JVM in a core group. Policies are defined and maintained by using the administration console and have properties like policy type, match criteria, and preferred servers.

Policy selection example

- Consider an HA group with the following properties:
 - **IBM_hc** = MECluster
 - **WSAF_SIB_BUS** = BPM.freyaCell.Bus
 - **WSAF_SIBMESSAGING_ENGINE** = MECluster.000-BPM.freyaCell.Bus
 - **type** = WSAF_SIB
- *Default SIBus* policy (OneOfN) match criteria:
 - **type** = WSAF_SIB (match weight factor = 1)
- *MessagingEngine0* policy (OneOfN) match criteria:
 - **WSAF_SIBMESSAGING_ENGINE** = MECluster.000-BPM.freyaCell.Bus, **type** = WSAF_SIB (match weight factor = 2)
- The HA group name matches the MessagingEngine0 policy
- Result must match one policy; otherwise, the HA manager cannot assign a policy for the HA group

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Figure 12-34. Policy selection example

This slide shows the policy selection sample, which uses the match criteria:

- An HA group is a non-empty set of key-value pairs. In this case, the HA group has four keys: IBM_hc, WSAF_SIB_BUS, WSAF_SIBMESSAGING_ENGINE, and type.
- The core group in this sample has two policies: default SIBus policy and MessagingEngine0 policy. The two policies are both of the type One of N, which specifies key-value pairs that are used to derive the match weight factor.
- For each key match with the HA group keys, the match weight factor is increased by 1. So in the sample, the MessagingEngine0 policy is applied to the HA group because it has the higher match weight factor. Because only one policy can be applied, the occurrence of the same match weight factor with highest value results in a warning and no policy assignment.

Default SIBus policy: Match criteria and preferred servers

The figure consists of two vertically stacked screenshots of the IBM HACMP configuration interface.

Top Screenshot: Match criteria

- Title:** Core groups > DefaultCoreGroup > Policies > Default SIBus Policy > Match criteria
- Description:** Define the match criteria for the policy. Match criteria consists of name and value pairs of data, where the name is a property key and the value is a string value.
- Table:**

Select	Name	Value	Description
<input type="checkbox"/>	type	WSAF_SIB	Default SIBus MatchCriterion
- Total:** 1

Bottom Screenshot: Preferred servers

- Title:** Core groups > DefaultCoreGroup > Policies > Default SIBus Policy > Preferred servers
- Description:** Define the ordered list of preferred servers for the policy. The policy gives preference to the servers in this list when activating group members. Adjust the order of the list by clicking Move up or Move down.
- Configuration:** Configuration
- General Properties:**
- Core group servers:** freyaMgr/dmgr, freyaNode/nodeagent, friggaNode/nodeagent, freyaNode/CMME1
- Preferred servers:** (empty list)
- Buttons:** Move up ^, Move down v, Add >>, Remove <<

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Figure 12-35. Default SIBus policy: Match criteria and preferred servers

This figure depicts screen captures of the configuration panes for the match criteria and preferred servers. If the list of preferred servers is empty, then the HA manager chooses the server to start the ME (that is, the first cluster member that is starting).

12.4. Transaction manager

Transaction manager

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Figure 12-36. Transaction manager

Two-phase commit protocol in WebSphere Application Server (1 of 2)

- Two-phase commit involves a coordinator and two or more participants
 - The coordinator is the WebSphere Application Server transaction manager
 - The participants are also called resource managers (DBs, EISs, messaging, and others)
- First phase: Ready-to-commit
 - Transaction manager sends a “ready-to-commit” message to participants and waits for responses
 - All the information that is required to commit or roll back the transaction must be written in a safe place (write-ahead storage) – in the transaction log file
- Second phase: Go ahead with commit (or rollback)
 - If all the participants agree to commit, the transaction manager sends a “go-ahead-with-commit” message
 - Otherwise, it sends a “rollback” message
 - Waits for acknowledgements from all the participants and then cleans the transaction logs

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Figure 12-37. Two-phase commit protocol in WebSphere Application Server (1 of 2)

Support for transactions is provided by the transaction service within WebSphere Application Server. The way that applications use transactions depends on the type of application component.

A transaction is a unit of activity, within which multiple updates to resources can be made atomic (as an indivisible unit of work) such that all or none of the updates are made permanent. For example, during the processing of an SQL COMMIT statement, the database manager atomically commits multiple SQL statements to a relational database. In this case, the transaction is contained entirely within the database manager and can be thought of as a resource manager local transaction (RMLT). In some contexts, a transaction is referred to as a logical unit of work. If a transaction involves multiple resource managers, for example multiple database managers, an external transaction manager is required to coordinate the individual resource managers. A transaction that spans multiple resource managers is referred to as a global transaction.

WebSphere Application Server is a transaction manager that can coordinate global transactions, can be a participant in a received global transaction, and can also provide an environment in which resource manager local transactions can run.

Two-phase commit protocol in WebSphere Application Server (2 of 2)

- If a failure occurs between the first and second phase, the transaction is moved to the in-doubt state
 - Recovery occurs when the transaction manager and resource managers come back up (resynchronization)
 - Resynchronization requires an active transaction manager and the transaction log
 - Resource managers maintain any locks on their resources during that time
 - It is essential for HA that this recovery occurs as quickly as possible

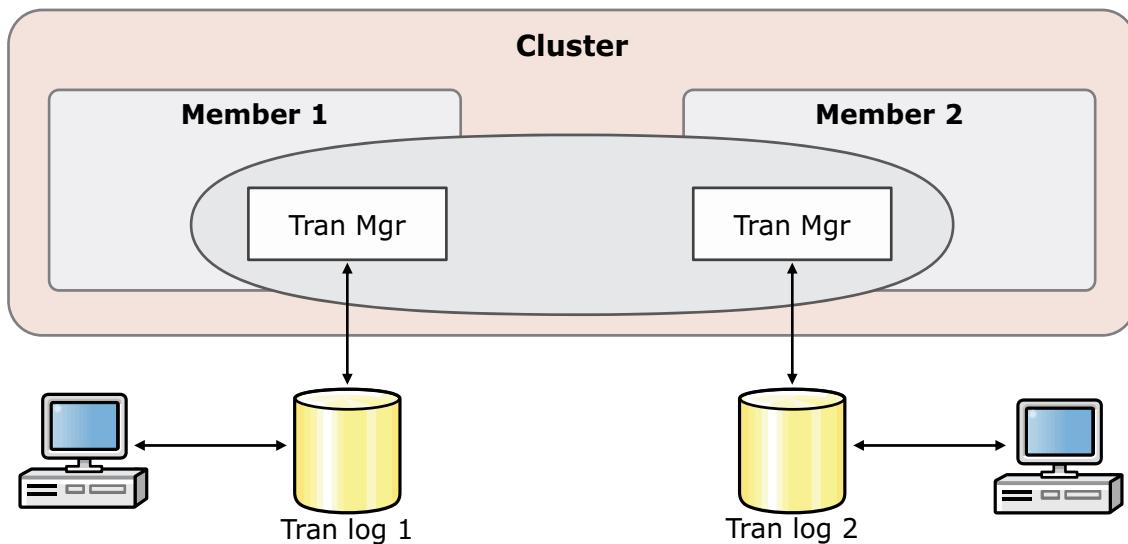
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Figure 12-38. Two-phase commit protocol in WebSphere Application Server (2 of 2)

Recovering transactions (1 of 2)

- Scenario 1: Transaction log files not shared
- If one of the two members fails, in-doubt transaction recovery occurs only when (and if) the member comes back up



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Figure 12-39. Recovering transactions (1 of 2)

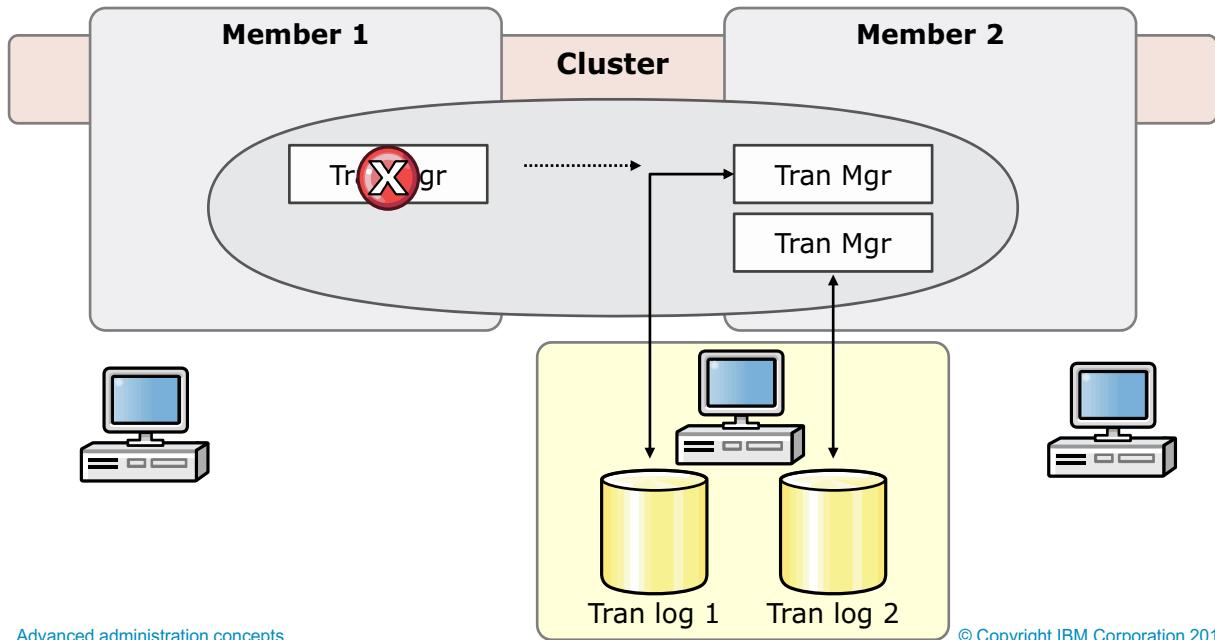
Never delete the transaction log file from a production environment. Deleting this file removes information on in-flight transactions from IBM Business Process Manager memory. Without the transaction log file, there are no functions to recover transactional information. In addition, long-running processes remain in an inconsistent state and you cannot complete the process flow except by deleting running instances. Deleting running instances might cause you to lose operational or business-critical data, which makes the database inconsistent with the message destination. Other inconsistencies that might be caused by deleting the transaction log file includes the following issues:

- Started transactions are not rolled back or committed.
- Artifacts remain in the Java virtual machine (JVM) since a transaction referenced or allocated them but never garbage collected.
- Database content (among others, the navigation state of long-running BPEL processes) remains in the Business Process Choreographer related tables and is never deleted.
- Navigation messages of the business process engine (BPE) of long-running processes are never processed further.
- Service Component Architecture (SCA) messages that belong to a process navigation and transaction remain on SCA-related queues.

Deleting the transaction log from a development environment causes the same problems. Because you can re-create business processes, deleting the files from a test environment is not as damaging as deleting them from a production environment.

Recovering transactions (2 of 2)

- Scenario 2: Transaction log files on a shared file system
- The HA manager can activate a new transaction manager on the surviving cluster member almost instantaneously



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Figure 12-40. Recovering transactions (2 of 2)

Default transaction manager policy

- Default transaction manager policy (like messaging engine policy) is One of N

Name	Value	Description
type	WAS_TRANSACTIONS	Default TM MatchCriteria

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Figure 12-41. Default transaction manager policy

The transaction manager component uses the policy Clustered TM Policy when the component is configured for high availability. The following description illustrates why, under these conditions, this policy is selected for the transaction manager high availability group:

- A cluster member process, such as ServerA, is started.
- The transaction manager component code joins a high availability manager to the high availability group named:
`GN_PS=testCell\testNode\ServerA, IBM_hc=MyCluster, type=WAS_TRANSACTIONS`
- ServerA is defined as a member of the DefaultCoreGroup core group for which the following policies are defined:
 - Clustered TM Policy, which has the match criteria `type=WAS_TRANSACTIONS`
 - Default SIBus Policy, which has the match criteria `type=WSAF_SIB`

The high availability manager compares the group name to the match criteria for the two available policies. The high availability manager eliminates the Default SIBus Policy because the match criteria is not a proper subset of the high availability group name. The high availability manager determines that Clustered TM Policy is the closest match because:

- The match criteria for that policy includes the name-value pair type=WAS_TRANSACTIONS, which is also specified in the high availability group name. Therefore, the match criteria is a proper subset of the high availability group name.
- The match criteria for that policy has more matches (one) than the match criteria for Default SIBus Policy, which is eliminated because it does not have any matches.

Sharing the transaction log file

- Sharing the transaction log file is critical to ensure a quick recovery of in-doubt transactions
 - In-doubt transactions might retain lock on the databases
 - Those locks can quickly reduce the system concurrency and availability
- The shared file system must be able to handle and quickly release file locks
 - Network File System (NFS) V4.0 (but *not* V3.0), IBM Storage Area Network (SAN), Windows Common Internet File System (CIFS) are valid options
- File system must also be highly available

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Figure 12-42. Sharing the transaction log file

12.5. Process Federation Server

Process Federation Server

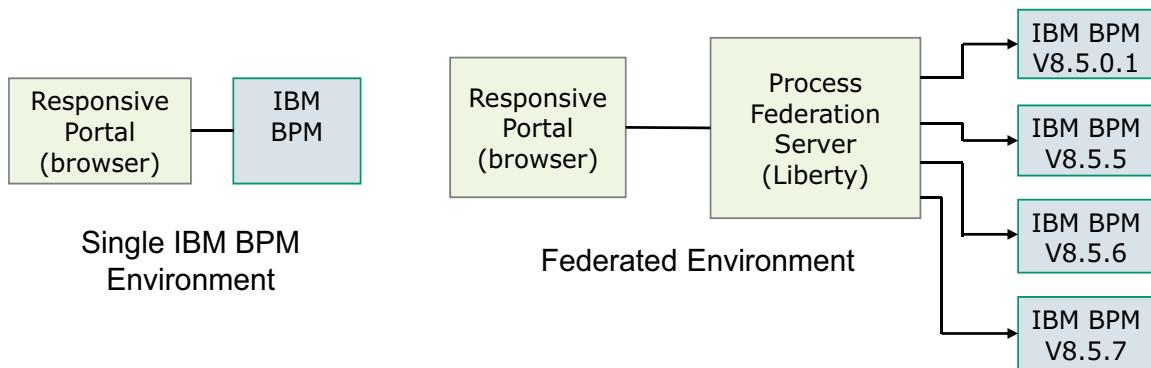
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Figure 12-43. Process Federation Server

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 IBM BPM cells
 - Multiple IBM BPM releases
 - BPMN and BPEL tasks



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Figure 12-44. Adding Process Federation Server

IBM Business Process Manager V8.0.1.3, IBM Business Process Manager V8.5.0.1, and IBM Business Process Manager 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 view across various task types such as BPMN and BPEL
- Supports process isolation
 - Isolate important process applications into their own cells
 - Avoid resource contention
- Simplify migration by using a drain down approach
 - Finish existing work on old environment
 - Start new work on new environment
- Massively scale the IBM BPM infrastructure across cells
 - Third scaling dimension (in addition to horizontal and vertical)
 - Scale beyond a single cell-scoped database
- Minimizes configuration impact to existing IBM BPM environments
- Relieves query pressure from IBM BPM transactional servers and databases
- Easy to scale horizontally by adding Liberty servers

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Figure 12-45. Process Federation Server benefits

The IBM Knowledge Center provides an excellent resource to create a roadmap for installing and configuring your IBM Process Federation Server.

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.6/com.ibm.wbpm.main.doc/topics/cfg_fps_roadmap.html

Configuring the Process Federation Server

- To include an IBM BPM system in a federated environment, you must:
 - Download the Process Federation Server package from the IBM BPM Standard or IBM BPM Advanced installation
 - Configure both the IBM BPM system and the Process Federation Server
 - Configure the Process Federation Server for secure outbound communications between Process Federation Server and each of the federated IBM BPM REST endpoints
 - Secure communication between the Process Federation Server and any Elasticsearch nodes, LDAP servers, databases, and client applications
- The distributed Process Federation Server index enables process participants to see a consolidated list of both BPD-related and BPEL-related tasks from all the IBM BPM systems in the federated environment
 - For data from a federated IBM BPM system to appear in the index, you must enable indexing on the system by using the properties in the Process Federation Server `server.xml` configuration file
- If you are using a browser-based client application to access your federated environment, you must configure cross-origin resource sharing (CORS)

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Figure 12-46. Configuring the Process Federation Server

Elasticsearch is a search server based on Lucene. It provides a distributed, multitenant-capable full-text search engine with a RESTful web interface and schema-free JSON documents. Elasticsearch is developed in Java and is released as open source under the terms of the Apache License.

If you are using a browser-based client application to access your federated environment, you must configure cross-origin resource sharing (CORS). Because the browser-based client application makes requests to services that are not on the system that originated the web application, the federated components use CORS to enable the browser to trust the cross-origin requests. Therefore, you must configure a list of allowed origins for Process Federation Server and the federated IBM BPM system.

For example, if the web server that hosts your client application is available at `https://portal.mycompany.com:9443`, configure this URL to be an allowed origin on IBM Process Federation Server, and on each federated IBM BPM system. The allowed origin indicates to Process Federation Server and IBM BPM systems that REST requests that originate from `https://portal.mycompany.com:9443` are trusted and are to be allowed.

Process Federation Server benefits

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

The screenshot shows the Process Federation Server interface. On the left is a sidebar with navigation links: Dashboards, Create Saved Search, Work, Processes, Process Performance, Team Performance, Show more..., Launch, Advanced HR Open New Position, AutoClaim, Claims Processing, Issue Letter of Offer, Issue Letter of Offer MBB Business Lending, and Manage Dispute Item. The main area is titled 'Work' with a count of 7. It contains a search bar and a list of tasks:

Task Description	Due Date	BPM Version
Step: Evaluate results of background check Process Mortgage Request 208	Due: Jan 31, 2016, 2:08:22 PM	BPM Version 8.5.7
Step: Evaluate results of background check Process Mortgage Request 210	Due: Jan 31, 2016, 2:10:25 PM	BPM Version 8.5.7
Step: Evaluate Mortgage Request Process Mortgage Request 211	Due: Jan 31, 2016, 2:23:28 PM	BPM Version 8.5.6
Step: Approve mortgage Process Mortgage Request 197	Due: Jan 31, 2016, 2:26:19 PM	BPM Version 8.0.1.3
Step: Approve mortgage Process Mortgage Request 206	Due: Jan 31, 2016, 2:34:30 PM	BPM Version 8.0.1.3
Step: Enter Trip Details Travel Request 271	All Users	

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Figure 12-47. 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

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`

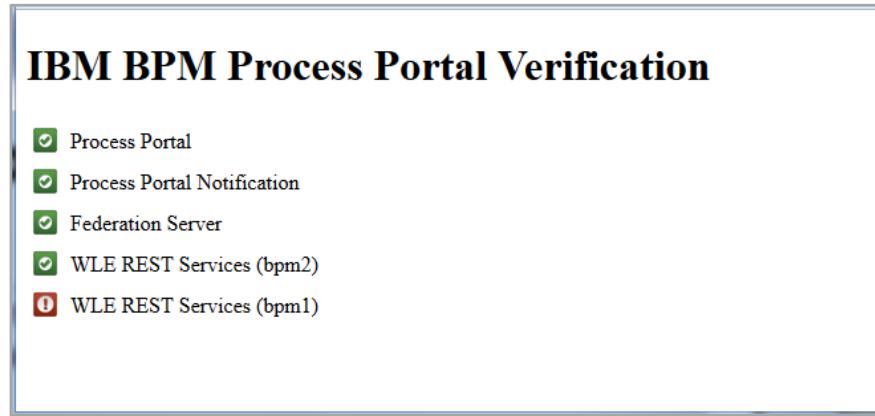


Figure 12-48. Process Federation Server web test tool

Unit summary

- Explain the reasons for extending a topology
- List options for increasing cluster member capacity in a cell
- Expand a topology
- Explain the purpose of the high availability manager and the concept of core groups
- Explain the structure and purpose of the default messaging and transaction manager policies
- Explain how policies are applied at run time
- Define the transaction manager high availability policy type and identify how transaction policies are applied
- Explain the Process Federation Server

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Figure 12-49. Unit summary

Review questions

1. True or False: You can use policies to distribute messaging engines across cluster members.
2. True or False: It can take several minutes for a messaging engine to start after the server is “ready for e-business.”
3. True or False: To include an IBM BPM system in a federated environment, you must configure both the IBM BPM system and the Process Federation Server.



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Figure 12-50. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. True or False: You can use policies to distribute messaging engines across cluster members.
The answer is True.

2. True or False: It can take several minutes for a messaging engine to start after the server is “ready for e-business.”
The answer is True.

3. True or False: To include an IBM BPM system in a federated environment, you must configure both the IBM BPM system and the Process Federation Server.
The answer is True.



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Figure 12-51. Review answers

Exercise: Advanced Process Server administration

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Figure 12-52. Exercise: Advanced Process Server administration

Exercise objectives

- Add a member to the messaging cluster
- Create messaging engine policies
- Verify the configuration of the messaging cluster and the start behavior of the messaging engines
- Configure transaction and recovery log high availability



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Figure 12-53. Exercise objectives

Unit 13. Security

Estimated time

01:00

Overview

This unit explains some of the key security concepts and how they relate to an IBM Business Process Manager Advanced server environment.

How you will check your progress

- Checkpoint
- Lab exercise

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe the key WebSphere Application Server security concepts
- Describe the user registries that are available in IBM Business Process Manager Advanced
- Explain how to interact securely with IBM Business Process Manager Advanced
- Describe some common security holes and how to fix them
- Explain how to synchronize users and groups

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Figure 13-1. Unit objectives

This unit provides an overview of security.

Topics

- WebSphere Application Server security concepts
- User registry
- Securing IBM Business Process Manager
- Common security holes
- Synchronizing users and groups

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Figure 13-2. Topics

13.1. WebSphere Application Server security concepts

WebSphere Application Server security concepts

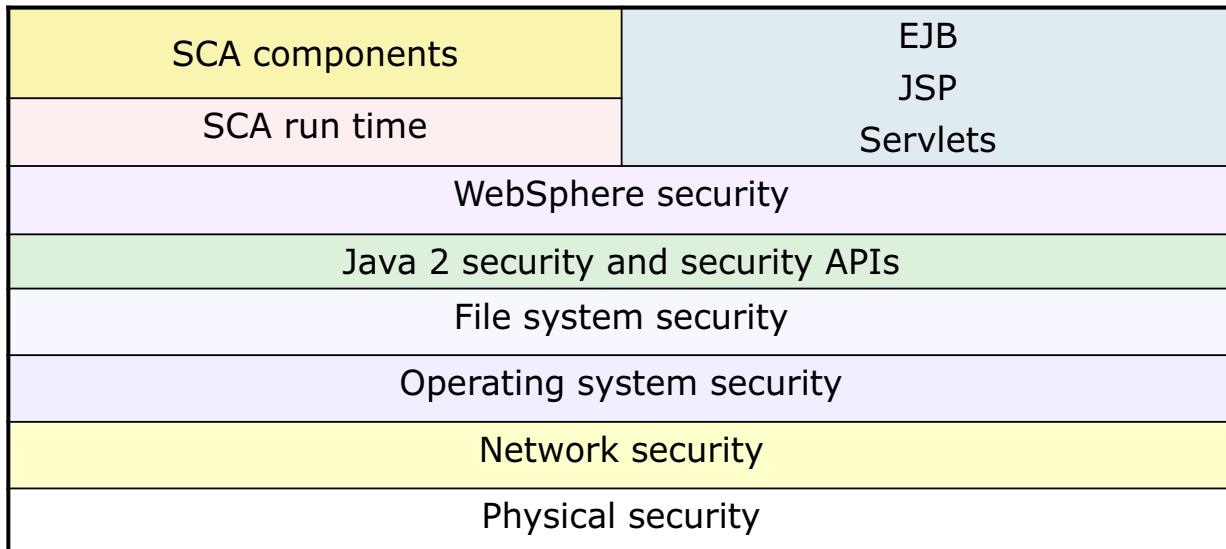
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Figure 13-3. WebSphere Application Server security concepts

IBM Business Process Manager security overview

- IBM BPM supports all security configuration and management capabilities that WebSphere Application Server offers



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Figure 13-4. IBM Business Process Manager security overview

IBM Business Process Manager comes with and is installed upon WebSphere Application Server, a J2EE-compliant application server. There are a number of concepts, which are specific to each of these products, that require understanding before you can implement security in a typical Business Process Manager environment.

Many levels are involved in securing an environment. WebSphere provides only part of the total security that must be applied.

Physical security refers to the protection of the hardware itself. Is it kept in a safe and secure area? Who has physical access to it?

Network security can involve setting up firewalls to protect an intranet or a DMZ where the web servers are going to run.

Operating system security is the security infrastructure of the underlying operating system. It provides certain security services to the WebSphere security application. These services include the file system security support to secure sensitive files in WebSphere product installation. The WebSphere system administrator can configure the product to obtain authentication information directly from the operating system user registry, for example, the Security Access Manager (SAM).

File system security is especially a concern about protecting your configuration files and key ring files.

The following list contains security APIs:

- JVM: The JVM security model provides a layer of security above the operating system layer.
- CORBA security: Any calls that are made among secure ORBs are over a Secure Association Service (SAS) or CSIV2 layer that sets up the security context and the necessary quality of protection. After the session is established, the call is passed up to the enterprise bean layer. This layer is for a distributed environment only.
- Java EE security: The security collaborator enforces Java EE-based security policies and supports Java EE security APIs.
- WebSphere security: WebSphere security enforces security policies and services in a unified manner on access to web resources and enterprise beans. It consists of WebSphere security technologies and features to support the needs of a secure enterprise environment.

Types of security

- Administrative security
 - Protects resources such as administrative console, wsadmin, scripts
- Application security
 - Protects access to the applications
- Java 2 security
 - Protects the local systems



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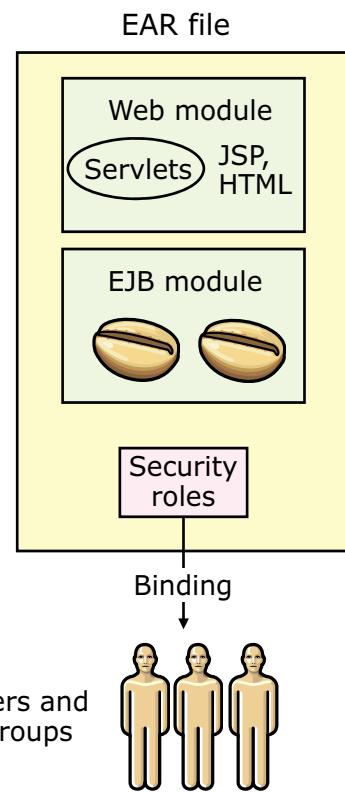
Figure 13-5. Types of security

Within WebSphere, there are a number of different types of security that can be configured. These types of security are covered in more detail during this lecture. They include:

- Administrative security
- Application security
- Java 2 security

Security roles: Application authorization

- Use security roles to do authorization
 - Specify security at an abstract level without knowledge of actual users and groups
- Security roles are then applied to the web and EJB application components
 - Web URIs or EJB methods
- Binding of the users and groups to the security roles is generally done at the application installation time
 - Can be done postinstallation as well



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Figure 13-6. Security roles: Application authorization

Java EE security is concerned with controlling access to application resources, not system resources.

Administrative security

- Turning on administrative security enables many features, including:
 - Authentication of HTTP and IIOP clients
 - Administrative console security
 - Naming security
 - Use of SSL transports
 - Role-based authorization checks of servlets, EJBs, and MBeans
 - Propagation of identities (RunAs)
 - The common user registry
- Console and other administrative tools; access is initially restricted to only the primary user
 - You must create your administrative users and groups
 - Fine-grained access can be defined for console users; for example:
 - Bob can be configured to have administrative access to application servers A and B
 - Fred can be configured to have operator access to only servers C and D

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Figure 13-7. Administrative security

Administrative security not only protects the administrative tools, but also enables a number of other security features:

- Authentication of HTTP and IIOP clients
- Administrative console security
- Naming security
- Use of SSL transports
- Role-based authorization checks of servlets, EJB beans, and MBeans
- Propagation of identities (RunAs)
- The common user registry

Console security: Mapping users and groups

- To set up console security
 - Turn on administrative security
 - Create console users and groups
 - Map users and groups to administrative roles



Administrative user roles

Administrative user roles > User

Use this page to add, update or to remove administrative roles to users enables them to administer application administrative console or through wsadmin scripting.

★ Role(s)

Admin Security Manager
Administrator
Auditor
Configurator

Search and Select Users

Decide how many results to display, enter a search string (e.g. Search). Select users from the Available list and add them to the Mapped to role list. Users which have already been mapped to a role will not be returned.

Search string

Maximum results to display

Available	Mapped to role

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Figure 13-8. Console security: Mapping users and groups

This diagram shows the mapping of users to specific console security roles. The interface for mapping administrative groups is virtually the same.



Enabling Java 2 security

Global security

Use this panel to configure administration and the default policy for all administrative functions and is used as a default security policy for user applications. Security domains can be defined and customized for user applications.

[Security Configuration Wizard](#) [Security Configuration Report](#)

Administrative security

- Enable administrative security
 - [Administrative user roles](#)
 - [Administrative group roles](#)
 - [Administrative authentication](#)

Application security

- Enable application security

Java 2 security

- Use Java 2 security to restrict application access to local resources
 - Warn if applications are granted custom permissions
 - Restrict access to resource authentication data

Authentication

Authentication mechanisms and expiration

- LTPA
- Kerberos and LTPA
 - [Kerberos configuration](#)
 - [Authentication cache settings](#)

- Web and SIP security
- RMI/IOP security
- Java Authentication and Authorization Service
- Enable Java Authentication SPI (JASPI)
 - [Providers](#)
- Use realm-qualified user names

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Figure 13-9. Enabling Java 2 security

In Java role-based security, Java 2 security is about protecting system resources. It is policy-based (several .policy files control it) and provides fine-grained access control to system resources, such as:

- File I/O
- Sockets
- Properties

To find Java 2 access exceptions, look for the following string:

```
java.security.AccessControlExceptions
Look in the SystemOut.log or SystemError.log file.
```

When Java 2 security is enabled in WebSphere, the security manager component by default produces a java.security.AccessControl exception when a permission violation occurs. This exception, if not handled, often causes a runtime failure. This exception is also logged in the SystemOut.log file.

However, when the JVM com.ibm.websphere.java2secman.norethrow property is set and has a value of true. The Security Manager does not produce the AccessControl exception, it is only logged.

This property is intended for a sandbox or debug environment only since it instructs the security manager not to produce the AccessControl exception. By not rethrowing the exception, Java 2 security is not truly enforced. Do not use this property in a production environment where a relaxed Java 2 security environment weakens the very integrity that Java 2 security is intended to produce.

The JVM parameter that is entered on the command line starts the server, usually in the script startServer. Enter as: -Dcom.ibm.websphere.java2secman.norethrow=true

Look in the log for the next line to verify that the norethrow parameter is in place:

```
SecurityManag W SECJ0381I: Warning, the com.ibm.websphere.java2secman.norethrow property is true. The WebSphere Java 2 Security Manager is not rethrowing AccessControl exceptions. Do not use this debug setting in a production environment. See the information center for Java 2 Security debugging features.
```

13.2. User registry

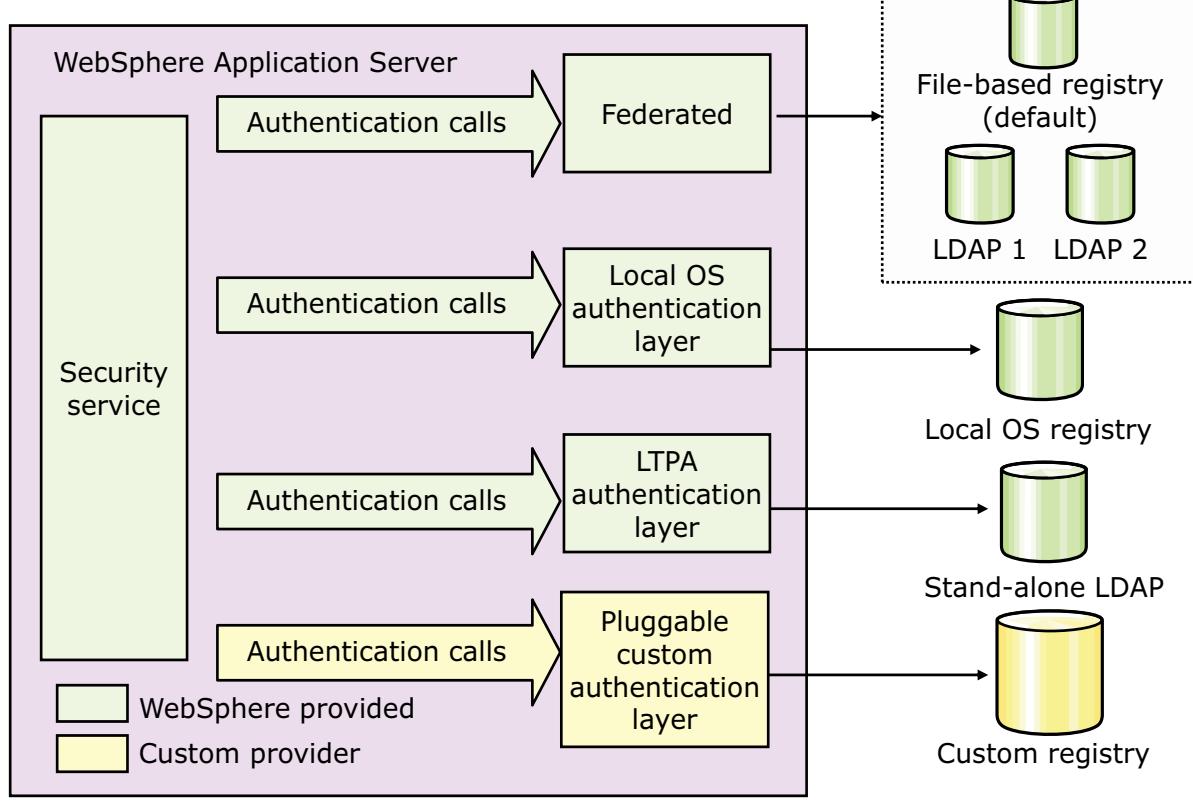
User registry

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Figure 13-10. User registry

Registries and authentication mechanisms



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Figure 13-11. Registries and authentication mechanisms

The user registries that are supported include local operating system, stand-alone lightweight directory access protocol (LDAP), custom user registry, and federated registry. The federated registry effectively combines multiple repositories into a single view. It can support multiple LDAP servers, file-based repositories, database repositories, and custom repositories.

Authentication mechanisms:

An authentication mechanism defines rules about security information, such as whether a credential can be forwarded to another Java process, and the format of how security information is stored in both credentials and tokens.

Authentication is the process of establishing whether a client is who or what it claims to be in a particular context. A client can be either a user, a computer, or an application. An authentication mechanism in WebSphere Application Server typically collaborates closely with a user registry. The user registry is the user and groups account repository that the authentication mechanism consults with when completing authentication. The authentication mechanism is responsible for creating a credential, which is an internal product representation of a successfully authenticated client user. Not all credentials are created equal. The configured authentication mechanism determines the abilities of the credential.

Lightweight third-party authentication (LTPA) is the only authentication mechanism available in a Network Deployment environment.

User registries:

In WebSphere Application Server, a user registry or repository authenticates a user and retrieves information about users and groups to complete security-related functions, including authentication and authorization. The information about users and groups is within a registry or repository. WebSphere Application Server uses the user registry or repository to make access control decisions.

WebSphere Application Server provides implementations that support multiple types of registries and repositories, including the local operating system registry, a stand-alone LDAP registry, a stand-alone custom registry, and federated repositories.

These authorization mechanism choices are valid for all user registries and repositories, such as virtual member manager. The exception is Tivoli Access Manager, which is supported for stand-alone LDAP registry configuration only.

With WebSphere Application Server, a user registry or a repository, such as virtual member manager, authenticates a user and retrieves information about users and groups to complete security-related functions, which include authentication and authorization.

With WebSphere Application Server, a user registry or repository is used for:

- Using basic authentication, identity assertion, or client certificates to authenticate a user
- Retrieving information about users and groups to complete security-related administrative functions, such as mapping users and groups to security roles

Although WebSphere Application Server supports different types of user registries, only one user registry can be active. All of the product server processes share this active registry.

Stand-alone custom user registries:

A stand-alone custom registry is a customer-implemented registry that implements the UserRegistry Java interface, as the product provides. A custom-implemented registry can support virtually any type of account repository from a relational database or flat file. The custom user registry provides considerable flexibility in adapting product security to various environments. In these environments, some form of a registry or repository other than federated repositories, stand-alone LDAP registry, or local operating system registry is already present in the operational environment.

WebSphere Application Server security provides an implementation that uses various local operating system-based registries and various stand-alone LDAP-based registries. However, situations can exist where your user and group data is in other repositories or custom user registries, such as a database. Moving this information to either a local operating system registry or a stand-alone LDAP registry implementation might not be feasible. For these situations, WebSphere Application Server security provides a service provider interface (SPI) that you can implement to interact with your current registry. The custom registry feature supports any user registry that WebSphere Application Server does not implement.

Defining user registries

Global security

Use this panel to configure administration and the default application security policy. This security policy for all administrative functions and is used as a default security policy for user applications. You can override and customize the security policies for user applications.

Administrative security

- Enable administrative security
 - [Administrative user roles](#)
 - [Administrative group roles](#)
 - [Administrative authentication](#)

Application security

- Enable application security

Java 2 security

- Use Java 2 security to restrict application access to local resources
 - Warn if applications are granted custom permissions
 - Restrict access to resource authentication data

User account repository

Realm name: defaultWIMFileBasedRealm

Current realm definition: Federated repositories

Available realm definitions:

- Federated repositories (selected)
- Local operating system
- Standalone LDAP registry
- Standalone custom registry

Configure... Set as current

Authentication

Authentication methods:

- LTPA
- Kerberos authentication

Authentications:

- [Web and SIP](#)
- [RMI/IOP security](#)
- [Java Authentication](#)

Java providers:

- Enable Java providers
- Use realm-specific providers

Security domains:

- [Security domain](#)
- [External authentication](#)
- [Programmatic authentication](#)
- [Custom properties](#)

- Use the administrative console to configure user registries
 - Manually (preferred)
 - Wizard (considered too simplistic)

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Figure 13-12. Defining user registries

Defining which user registry is used and how it is configured can be done through the console, through a manual interface, or through a wizard. Generally speaking, the wizard is considered too simplistic to be used for configuring anything but the simplest user registry.

Manual security configuration

The screenshot displays two configuration panes side-by-side.

User account repository: Shows a dropdown menu under "Available realm definitions" with options: Federated repositories, Local operating system, Standalone LDAP registry, and Standalone custom registry. The "Federated repositories" option is selected and highlighted with a red box. A "Configure..." button is also highlighted with a red box.

Global security > Federated repositories: This pane contains the following sections:

- General Properties:** Includes fields for "Realm name" (defaultWIMFileBasedRealm) and "Primary administrative user name" (wasadmin).
- Server user identity:** Contains radio buttons for "Automatically generated server identity" (selected) and "Server identity that is stored in the repository". It includes fields for "Server user ID or administrative user on a Version 6.0.x node" and "Password".
- Ignore case for authorization:** A checked checkbox.
- Allow operations if some of the repositories are down:** An unchecked checkbox.
- Repositories in the realm:** A table listing repositories:

Add Base entry to Realm...	Use built-in repository	Remove	
Select	Base Entry	Repository Identifier	Repository Type
You	<input type="checkbox"/> o=defaultWIMFileBasedRealm	InternalFileRepository	File

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Figure 13-13. Manual security configuration

This slide shows some of the panes, such as the Global security pane, that is used to configure federated repositories.

Federated repositories

- Why might you have multiple registries in a federated repository?
 - Perhaps two companies merged
 - Perhaps your applications require access to multiple LDAP servers
- Users must be unique within the whole federated repository
 - If the federated repository finds multiple entries for a user that is attempting to authenticate, it returns a failure
- All members of the federated repository must be available for authentications to succeed
 - If not, you cannot be sure that the user was unique (it can return a false positive)
 - This behavior can be turned off

[Security](#)

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Figure 13-14. Federated repositories

If one or more repositories in the federation are down, you cannot authenticate, regardless of which repository your particular ID is stored in. The VMM component always checks all repositories before an authentication can succeed. However, there can be situations when you might not want this feature. In that case, the VMM is configured to allow authentication even if all the repositories are not available.

To disable this security feature, use the `createIdMgrRealm` or `updateIdMgrRealm` wsadmin command to set the `-allowOperationIfReposDown` parameter to true. The default value of the `-allowOperationIfReposDown` parameter is false. After you disable this security feature, even if one of the configured repositories is down, virtual member manager works with the other active repositories. You can log in successfully, if the login user ID and password are in a repository that is active.

To configure, enter the following wsadmin command:

```
$AdminTask updateIdMgrRealm {-name defaultWIMFileBasedRealm
 -allowOperationIfReposDown true}
```

Custom registries

- *Custom registries* can be written to allow other kinds of registries to be supported
 - For example: When there is a special database with your user information, you can write certain methods that would take care of validating the user
 - You can also tell WebSphere to issue the appropriate credentials (for example, the LTPA token)
 - These methods are documented in the IBM Knowledge Center
 - Sample code is also available in the IBM Knowledge Center
 - It is frequently more difficult to do correctly than anticipated
- *Custom pluggable registries* can be written to add a custom registry through the federated repository
 - Typically more difficult to write than a stand-alone custom registry
 - It has the advantage of being more likely to work with stack products as some support only federated repositories

13.3. Securing IBM Business Process Manager

Securing IBM Business Process Manager

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Figure 13-16. Securing IBM Business Process Manager

IBM Business Process Manager administration tools (1 of 2)

- Integrated solutions console
 - The main administrative application for the embedded WebSphere Application Server
 - Start or stop the IBM Business Process Manager servers within your environment, and define the universe of users who are allowed to access the servers

- Process Admin Console
 - The main administrative application, which you can use to associate users with specific roles that are defined within the Business Process Manager process applications and individual process models
 - Define different sets of users for each of your Business Process Manager deployment environments

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Figure 13-17. IBM Business Process Manager administration tools (1 of 2)

Business Process Manager contains three web applications, which support most of your security hardening and ongoing security management:

- **Integrated solutions console:**

This console is the main administrative application for WebSphere Application Server. Using this console, you complete some generic hardening steps, you start or stop the IBM Business Process Manager servers within your environment, and you define the set of users who are allowed to access the servers.

- **Process Admin Console:**

The main administrative application, where you can associate users with specific roles that are defined within the Business Process Manager process applications and individual process models. You are able to define different sets of users for each of your Business Process Manager deployment environments.

IBM Business Process Manager administration tools (2 of 2)

- Process Center Console
 - By using the main administrative application, you can grant IBM Business Process Manager process analysts, process authors, and software developers access to the various Business Process Manager process applications and process models in your organization
 - Selectively grant certain developers access to process applications by privilege level, process application, and environments

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Figure 13-18. IBM Business Process Manager administration tools (2 of 2)

- **Process Center Console:**

The main administrative application, where you can grant permissions to IBM Business Process Manager process analysts and process authors. Also, this console is for providing developers access to the various Business Process Manager process applications and process models in use at your organization. You are able to selectively grant certain developers access to process applications by privilege level, process application, and environments.

Administrative security roles

- Monitor: View the configuration and the current state of the server
- Configurator: Edit the configuration
- Operator: Monitor privileges, plus the ability to modify the runtime state
- Administrator: Combination of configurator and operator roles plus extra privileges that granted solely to the administrator role
- ISC Admins: Available only for administrative console users and not for wsadmin users
- Deployer: Both configuration actions and runtime operations on applications
- Admin Security Manager: Map users to administrative roles
- Auditor: View and modify the configuration settings for the security that is auditing subsystem

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Figure 13-19. Administrative security roles

Several administrative security roles are provided as part of the IBM Business Process Manager installation.

Eight roles are provided within the administrative console. These roles grant permission to ranges of functions within the administrative console. When administrative security is enabled, a user must be mapped to one of these roles to access the administrative console. The first user to log in to the server after installation is mapped to the administrator role.

- Monitor role can view the IBM Business Process Manager configuration and the current state of the server.
- Configurator role can edit the IBM Business Process Manager configuration.
- Operator role has monitor privileges, plus the ability to modify the runtime state (that is, start and stop the server).
- Administrator role is a combination of configurator and operator roles plus more privileges that are granted solely to the administrator role. Examples include:
 - Modifying the server user ID and password.

- Mapping users and groups to the administrator role. The administrator also has the permission that is required to access sensitive information, such as Lightweight Third Party Authentication (LTPA) passwords.
- ISC Admins role is available only for administrative console users and not for wsadmin users.
- Deployer role can complete both configuration actions and runtime operations on applications.
- Admin Security Manager role can map users to administrative roles.
- Auditor role can view and modify the configuration settings for the subsystem that audits security.

IBM Business Process Manager security roles

- CellAdmin: Maps to an authentication alias that contains the cell administrator user, which is the primary administrator at the WebSphere Application Server level
- DEAdmin: Maps to an authentication alias that contains the deployment environment administrator user, which is the primary administrator at the IBM Business Process Manager level
- BPMAuthor: Maps to an authentication alias for a user that requires the authority to access and deploy snapshots to the runtime Process Server
 - Also used to access the Process Server from the Process Inspector that is part of the IBM Process Designer
- SCADeploymentUser: Maps to an authentication alias for a user that has authorization to deploy SCA applications

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Figure 13-20. IBM Business Process Manager security roles

An IBM Business Process Manager role maps to an authentication alias for a user ID that is authorized to access applications that run in IBM Business Process Manager.

The cell administrator user:

- Has authorization in all deployment environments
- Can assign other administrator roles
- Is responsible for the administration of the cell and topology
- Has access to all interfaces, enabling users to alter or delete all types of available library items and assets, including process applications and toolkits
- Enables administration of Process Servers, Performance Data Warehouses, and internal users and groups

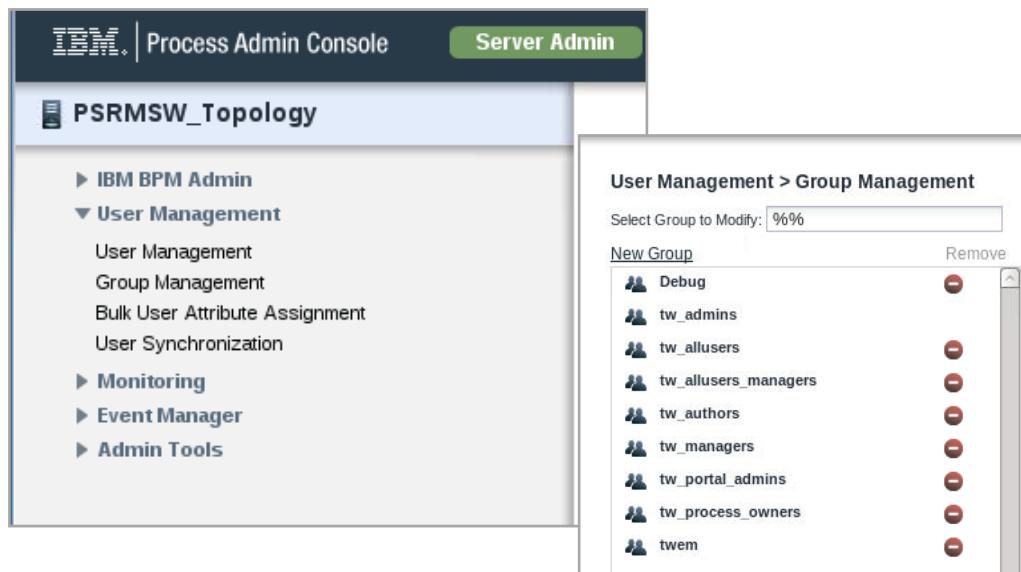
The deployment environment administrator user:

- Has authorization in the user's assigned deployment environments
- Has administrative access to Process Center and Process Admin Console
- Has access to all interfaces, enabling users to alter or delete all types of available library items and assets, including process applications and toolkits

- Is authorized to administer Process Servers, Performance Data Warehouses, and internal users and groups

Default groups in IBM Business Process Manager

- IBM Business Process Manager has an internal security provider that includes several default groups



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Figure 13-21. Default groups in IBM Business Process Manager

IBM Business Process Manager has an internal security provider that includes several default users and groups. For each default user account, default authentication aliases are provided for external components to connect to the Process Server.

- **Debug:** You can use this account to restrict access to service debugging in the Inspector in the Process Designer.
- **tw_admins:** Members of this group have full access to all interfaces, assets, servers, and security.
- **tw_allusers:** This group is the default lane assignment for non-system lanes when creating business process definitions (BPDs) in the Designer in Process Designer. The reports and scoreboards that you create in the Process Designer are available to this group by default.
- **tw_allusers_managers:** This group contains the team of managers for the tw_allusers group. In the Team Performance dashboard in Process Portal, members of this group can see the dashboard for the All Users team and the sample teams that are delivered with the product.
- **tw_authors:** Members of this group have access to the Designer and other interfaces in the Process Designer, including the Process Center console. From the Process Center console, members of this group can create process applications and toolkits, and they can control

access to projects. An example is access to other process applications and toolkits (projects) and the assets they contain that Process Center repository administrators control.

- **tw_managers:** Members of this group can see the Team Performance dashboard in Process Portal. To see dashboards for individual teams, the group member must also be a member of a managers team that is defined in Process Designer.
- **tw_portal_admins:** Because of functional changes in IBM BPM V8, members of this group no longer have any special access rights.
- **tw_process_owners:** Members can use critical path analysis tools in Process Portal.
- **tw_event_managers:** Members of this group have full access to historical information about Event Manager processing.
- **twem:** The group for users with Event Manager access.

Integrating with LDAP

- When integrating with external security providers (LDAP):
 - Can view the LDAP groups in Process Admin Console
 - Cannot edit those external groups
 - Can add the users and groups from the LDAP to the IBM BPM security groups
 - Can combine accounts from different groups into one group
- Must add LDAP to the federated repository

Select	Repository Identifier	Repository Type
	InternalFile Repository	File
Total 1		

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Figure 13-22. Integrating with LDAP

If you configured IBM Business Process Manager to work with an external security provider, you can view the groups from that external provider in the Process Admin Console, but you cannot edit the external groups. However, you can add users and groups from your external provider to any IBM Business Process Manager security groups that you create. You can also combine accounts from different providers into one group.

The default installation of IBM Business Process Manager provides a federated repository that includes the following items, depending on your installation type:

- Stand-alone environment: The federated repository contains the internal security provider and file repository.
- Network deployment environment: The federated repository contains the file repository.

To implement an external security provider, which uses a different user registry than the internal security provider, you must add the provider to the federated repository. Several types of repositories are supported, including the local operating system registry, a stand-alone LDAP registry, a stand-alone custom registry, and federated repositories.

13.4. Common security holes

Common security holes

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Figure 13-23. Common security holes

Topology and installation

- Regarding the topology and installation choices, the most common security holes are in the following areas:
 - 100% trust in firewalls
 - Failure to use SSL between IBM BPM and database server
 - Failure to encrypt data at rest
 - Failure to use SSL between Process Center and Process Server
 - Overuse of trust in certificate authorities

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Figure 13-24. Topology and installation

Regarding the topology and installation choices, the most common security holes are in the following areas:

- **100% trust in firewalls:**

Without doubt, the biggest security hole is an overly optimistic belief in the security of a corporate, perimeter-wide firewall. You often hear the phrase “It is the internal network, so it is secure.” Taking this posture can be dangerous. Can you completely trust that your firewall vendors never release a software update that has a security exposure in it? How often is your notebook’s operating system updated with security fixes?

Security breaches do not have to be the result of malice. They can be the result of simple, honest mistakes. But in the end, it does not matter. The security breach occurs, and you must deal with the consequences.

- **Failure to use SSL between IBM BPM and database server:**

Everyone recognizes that database user accounts should be password-protected. What some fail to recognize is how easy it is to observe database traffic while it is in transit. If hackers can view unencrypted text on its way to the database, they also have the opportunity to store this data in their own systems. By viewing such data, they might gain knowledge of how your SQL statements are formed, possibly leading to SQL injection attacks.

The solution to this security exposure is simple: Secure Sockets Layer (SSL). The specific steps to ensure SSL between your Business Process Manager and database servers are unique to the database vendor you selected and to your company's certificate management strategy. However, the SSL concept is simple enough, and should be familiar to your database analysts and administration team.

- **Failure to encrypt data at rest**

Most security breaches and identity thefts that are widely publicized in the mass media create a sense of urgency to find solutions. Government agencies and regulators push for more restrictions and legislation to govern how data is stored and exchanged, and new reporting requirements when security breaches are detected.

- **Failure to use SSL between Process Center and Process Server**

During the installation of Process Server, you turn to the WebSphere Application Server Integrated Solutions Console and run a wizard to create the deployment environment. This wizard includes a step where the Process Server specifies the host name of the Process Center it is using as its repository. The protocol defaults to `http://`. During Process Server start, the runtime environment uses this information to communicate back to the Process Center, notifying the Process Center of the runtime Process Server's availability to receive deployments of process application snapshots. This communication between Process Server and Process Center includes a URL, a user account, and the corresponding password. This information is all an attacker needs to know to deploy new snapshots of process applications, which can effectively change the way that you do business. An attacker might also deploy a malware application, which monitors the network, carries out denial of service attacks, and spreads other types of malware to other systems in the same network. This exposure might not be restricted to the systems your process applications connect to, but might extend to any systems that can be reached.

- **Overuse of trust in certificate authorities**

The certificate authority (CA) digitally signs a web server's certificate, and if the browser holds a certificate from that CA, the browser might choose to trust the web server that is based on the certificate.

Certificate authorities might not check the identities of the parties who purchase certificates from them. It is hard to imagine that a low-cost certificate is subject to a great deal of scrutiny.

You must reduce the number of certificate authorities in use within your organization to just the minimum needed. Start with minimum number of certificates, and add only those certificates that you need for specific purposes.

Authentication

- Regarding the authentication choices, the most common security holes are in the following areas:
 - Weak password policies
 - Failure to change default passwords
 - Faith in firewalls
 - Insecure LDAP connections
 - Insecure single sign-on solutions

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Figure 13-25. Authentication

Regarding the authentication choices, the most common security holes are in the following areas:

- **Weak password policies**

When asked to create a password, individuals often create passwords that are easy to remember. Easy to remember usually means easy to guess. Often, people use names of people, pets, or locations with which they are familiar. Or perhaps they use some geometric pattern on the keyboard (like “asdf”). When they do think to include numbers within the password, they often use 2 or 4 digits that represent milestone years, birth dates, or anniversaries, in some combination with the choices referenced earlier.

- **Failure to change default accounts and passwords**

You should remove these default accounts, and instead map actual users in your organization into the groups and roles that these accounts fill by default.

- **Faith in firewalls**

Encrypt the communications channels, and eliminate the possibility of attacks before the opportunity arises.

- **Insecure LDAP connections**

Unless you secure your LDAP server by using encryption (SSL), you are leaving your corporate LDAP server open to browsing every time any Business Process Manager users log in to their portal inbox.

- **Insecure single sign-on solutions**

Many SSO technologies rely upon cookies or HTTP headers to carry the user's credentials with each HTTP request. Often, these credentials are encrypted. Unfortunately, such encryption might not be enough since the header can still be copied, and injected into a hacker's browser HTTP requests.

Authorization

- Regarding the authorization choices, the most common security holes are in the following areas:
 - Overuse of administrator privileges
 - Failure to map participant groups
 - Overpopulation of groups
 - Faith in firewalls

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Figure 13-26. Authorization

Do not underestimate the amount of information that a curious, motivated, or mischievous user can accumulate. If users can sniff the network traffic, then they can analyze it. If they can analyze it, they can spoof it. It is a short path from unencrypted network traffic to unauthorized access.

Specifically, given IBM Business Process Manager's ability to complete instance-based authorization that is based on runtime criteria, it is conceivable that someone might be able to sniff an in-flight process and alter its authorization criteria.

Encrypt all communications links between the following components:

- Business Process Manager and LDAP
- Business Process Manager and database
- Business Process Manager and web or proxy servers
- Business Process Manager and any web services hosts
- Process Center and Process Server
- Process Center and Process Designer
- Process Center and Integration Designer
- Process Servers and users

Integration

- Regarding the integration choices, the most common security holes are in the following areas:
 - Failure to secure web services passwords
 - Faith in firewalls

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Figure 13-27. Integration

An important aspect in Business Process Manager security is integration.

Any user who has access to a process application in Process Center, even read-only access, has full visibility to the values of the web services passwords. It does not matter if they are hardcoded into the **Properties** tab (under Implementation or Security) or if they are referenced from environment variables. In each of these cases, they are visible to anyone who cares to look.

A “faith in firewalls” can lead to a huge security hole because of the nature of Business Process Manager’s reliance upon HTTP Basic Authentication for web service credentials. It is suggested that all communications between Business Process Manager and each server that hosts web services be encrypted by using SSL or TLS.

13.5. Synchronizing users and groups

Synchronizing users and groups

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Figure 13-28. Synchronizing users and groups

IBM Business Process Manager security providers

- The default installation of IBM Business Process Manager provides a federated repository that contains an internal security provider
- IBM Business Process Manager can be configured to use an external security provider by adding the provider to the WebSphere federated repositories list
 - Several types of repositories are supported, including the local operating system registry, a stand-alone Lightweight Directory Access Protocol (LDAP) registry, a stand-alone custom registry, and federated repositories

Repositories in the realm:

Add repositories (LDAP, custom, etc)...		Use built-in repository	Remove
Select	Base Entry	Repository Identifier	Repository Type
You can administer the following resources:			
<input type="checkbox"/>	o=defaultWIMFileBasedRealm	InternalFileRepository	File
Total 1			

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Figure 13-29. IBM Business Process Manager security providers

Synchronizing users and groups

- IBM Business Process Manager implicitly synchronizes external users and groups between the WebSphere Application Server user registry and the IBM BPM database in response to certain triggers
 - You can trigger synchronization explicitly by using administrative scripts or the Process Admin Console
- IBM Business Process Manager synchronizes external users and groups based on the following triggers:
 - Upon startup of a cluster member or server, all available groups (without members) are synchronized
 - When a user logs in to an IBM BPM web application for the first time, that user is created in the IBM Business Process Manager database
 - When a new or existing user logs in to an IBM BPM web application, that user's full name and group memberships are queried from the external user registry, and the IBM Business Process Manager database content is updated
 - When a REST call is triggered because a user that was newly registered in a federated repository (by using an LDAP server) is not yet known to IBM Business Process Manager, synchronization with IBM Business Process Manager takes place; this synchronization is only performed one time

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Figure 13-30. Synchronizing users and groups

Manual user synchronization

- You can use the administrative scripts to trigger the synchronization of user availability between the WebSphere Application Server user registry and the IBM BPM database explicitly
 - You can use the `usersSync` and `usersFullSync` scripts to perform a manual synchronization

- Synchronization of user availability can also be triggered from the Process Admin Console



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Figure 13-31. Manual user synchronization

For more information on manual synchronization, go to the IBM Knowledge Center:

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.admin.doc/topics/sync_users_and_groups.html?lang=en

Manual group synchronization

- Use the `syncGroupMembershipForGroups` and `syncGroupMembershipForAllGroups` commands
 - The command trigger synchronization of group membership by groups between the WebSphere Application Server user registry and the IBM BPM database
- Synchronization for group membership takes into account only users that are already in the IBM BPM database
 - This is users that either logged in to IBM BPM or have been synchronized to IBM BPM by using one of the available user synchronization commands
 - All other users are not considered by the synchronization commands to be group members

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Figure 13-32. Manual group synchronization

Unit summary

- Describe the key WebSphere Application Server security concepts
- Describe the user registries that are available in IBM Business Process Manager Advanced
- Explain how to interact securely with IBM Business Process Manager Advanced
- Describe some common security holes and how to fix them
- Explain how to synchronize users and groups

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Figure 13-33. Unit summary

Review questions

1. True or False: In federated repositories, you can connect similar repositories, such as two flat file repositories.
2. Which type of security restricts access to the operating system?
 - A. Administrative security
 - B. Application security
 - C. Java 2 security
 - D. File system security



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Figure 13-34. Review questions

Write your answers here:

1.

2.

Review answers

1. True or False: In federated repositories, you can connect similar repositories, such as two flat file repositories.
The answer is False. In federated repositories, you can connect any mixture of heterogeneous repositories, including flat file and LDAP servers, or multiple LDAP servers.

2. Which type of security restricts access to the operating system?
 - A. Administrative security
 - B. Application security
 - C. Java 2 security
 - D. File system security**The answer is C.**



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Figure 13-35. Review answers

Unit 14. Problem determination

Estimated time

01:00

Overview

This unit provides an overview of problem determination methods and tools.

How you will check your progress

- Checkpoint

References

IBM Business Process Manager V8.5.7 IBM Knowledge Center

http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html

Unit objectives

- Describe problem determination
- Identify resources for problem determination
- Describe tools for troubleshooting
- Describe how to configure logs and trace
- Explain how to use tracing to determine problems
- Describe common troubleshooting facilities
- Use High Performance Extensible Logging capabilities
- Use cross-component trace capabilities
- Identify common database configuration pitfalls

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Figure 14-1. Unit objectives

Topics

- Problem determination approach
- Resources for investigating a problem
- Tools for troubleshooting
- Log files, console messages, and tracing
- Cross-component trace capabilities
- IBM BPM troubleshooting
- Troubleshooting database-related problems

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Figure 14-2. Topics

14.1. Problem determination approach

Problem determination approach

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Figure 14-3. Problem determination approach

Prepare for effective production troubleshooting

- Good problem determination starts long before anything bad happens
- Implement problem prevention “best practices”
- Perform monitoring and problem detection
- Keep good system documentation
- Have a diagnostic data collection plan
- Have a relief or recovery plan
- Keep a maintenance plan: Scheduled and emergency
- Keep a change log

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Figure 14-4. Prepare for effective production troubleshooting

Problem categories and symptoms

- Categorize and describe the problem that is based on diagnostic data
 - What are the symptoms of the problem?
 - Where does the problem occur?
 - When does the problem occur?
 - Does the problem occur after a recent configuration change?
 - Can the problem be reproduced?
- Here are the common types of symptoms that you might see:
 - The system is not responding
 - An application failed to start
 - An application does not respond to incoming requests
 - An application produces unexpected results
 - An application cannot connect to an external system or resources
 - An application works slowly or its performance degrades over time

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Figure 14-5. Problem categories and symptoms

The following list contains general observations about problem determination:

- Problem determination is not an exact science.
- Problem determination is *not* difficult.
- Problem determination is often a cooperative and iterative process.
- An obstacle to problem determination is poor communication.
- Not every problem requires the most complex problem determination skills and techniques.

Problem determination goals

In any troubleshooting situation, you have three goals:

- Quickly provide a temporary solution so that affected users can get back to work, while you look for the permanent solution
- Find and implement the right, permanent solution
- Make sure that a similar problem will not occur again in the future
 - If it does, you will be as prepared to deal with it as possible after what you learned from this problem

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Figure 14-6. Problem determination goals

A major challenge of problem determination is dealing with unanticipated problems. It is much like detective work: finding clues, making educated guesses, verifying suspicions, and various other steps. The most important skills are common sense, focus, thoroughness, and rigorous thinking. The first step in the troubleshooting process is to describe the problem completely.

Communicating with IBM support

- Define the problem
 - Describe the problem and symptoms
 - Be as specific as possible when you explain a problem
- Gather background information
 - What levels of software were you running when the problem occurred?
 - Has the problem happened before, or is this problem an isolated one?
 - What steps led to the failure?
 - Can the problem be re-created?
 - Were any messages or other diagnostic information produced?
 - Define your technical question in specific terms and provide the version and release level of the IBM Business Process Manager
- Gather relevant diagnostic information
- Determine the severity level

Often, the biggest challenge in problem determination is effectively communicating the issue and how to reproduce it

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Figure 14-7. Communicating with IBM support

The IBM service request (SR) application is used to open and update service requests (formerly called Problem Management Records or PMRs) online. You can access the SR application here: <https://www.ibm.com/support/servicerequest/Home.action?lnk=msdTS-srap-user>

14.2. Resources for investigating a problem

Resources for investigating a problem

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Figure 14-8. Resources for investigating a problem

Resources for investigating a problem

Resources to help investigate your problem:

- Product support pages
- IBM Knowledge Center
- IBM Support Assistant

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Figure 14-9. Resources for investigating a problem

Resources for troubleshooting IBM Business Process Manager include:

- A strategy for troubleshooting and diagnosing problems
- A list of error messages and specific troubleshooting documentation about the tasks you are doing in IBM Business Process Manager
- Documentation about tools that help you track and monitor errors in your deployed applications
- Links to technical support websites



Searching the product support pages

- IBM Support Portal: www.ibm.com/support/entry/portal/overview

The support pages provide easy access to valuable troubleshooting information

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Figure 14-10. Searching the product support pages

The IBM Support Portal is a unified, customizable view of all technical support tools and information for all IBM systems, software, and services. It brings all the support resources available for IBM hardware and software offerings together in one place and is replacing all IBM technical support sites. The overview page includes links to news, alerts, notifications, training, and services.

For more information, see: www.ibm.com/support/entry/portal/overview

The portal is customizable. You can select any IBM products and get links relevant to those products.

MustGather: Collecting diagnostic data

- Before you call IBM support, gather troubleshooting data (*MustGather* data) for problems with IBM BPM
- The term “MustGather” represents the diagnostic data that is required to resolve a problem such as:
 - System information
 - Problem symptoms
 - Log and trace files
- By collecting MustGather data early, you help IBM support to quickly determine the following details:
 - Whether symptoms match known problems
 - Whether you have a non-defect problem that can be identified and resolved
 - Whether a workaround exists for the defect to reduce severity
 - Whether locating the root cause can speed development of a code fix

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Figure 14-11. *MustGather: Collecting diagnostic data*

Collecting diagnostic data (MustGather) aids in problem determination and saves time when resolving problem management records (PMRs) for IBM Process Server. You must know what documentation to collect (MustGather) so that the IBM Business Process Manager support team can diagnose your problem. If you gather this documentation before contacting support, it expedites the troubleshooting process and saves you time.

The **Troubleshooting** tab on the IBM Support Portal gives advice on how to collect troubleshooting data for the IBM Business Product Manager products.

IBM Knowledge Center: Troubleshooting and searching

Troubleshooting and support

- Overview of troubleshooting
- Troubleshooting checklist for IBM Business Process Manager
- Messages overview
- IBM Business Process Manager log files
- Transaction log file
- Known issues for translated IBM BPM components
- ▶ Troubleshooting installation and configuration
- ▶ Troubleshooting migration
- ▶ Troubleshooting your deployment environment
 - Troubleshooting memory issues for Business Process Manager servers
 - Troubleshooting NIST SP800-131a environment configurations
- ▶ Troubleshooting service module deployment failures
 - Process Designer window is blank
 - Failure to access help topics
- ▶ Troubleshooting administration tasks and tools
 - Troubleshooting WebSphere Application Server
- ▶ Tools for troubleshooting your applications
- ▶ Development toolkit troubleshooting
- ▶ Recovering from a failure
- ▶ Disaster recovery
- Searching knowledge bases
- Getting fixes
- Contacting IBM Software Support

Specific problem areas are documented, and a search facility is provided

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Figure 14-12. IBM Knowledge Center: Troubleshooting and searching

The IBM Knowledge Center is a good resource for troubleshooting. Specific problem areas are documented, and a search facility is provided.

IBM Support Assistant Team Server 5.0

- Free self-help problem determination application
 - Cloud based
 - Multiple installation options
- Use to organize diagnostic files into cases
 - Store diagnostic files by problem incident or other categories
 - Simplifies collaboration
- Provides a growing collection of problem determination tools
 - Report generators
 - Interactive web-based tools
 - Desktop tools
- Provides automated analysis of diagnostic files
- Download IBM Support Assistant Team Server 5.0
<http://www.ibm.com/software/support/isa/teamserver.html>

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Figure 14-13. IBM Support Assistant Team Server 5.0

The IBM Support Assistant provides a framework for IBM software products to deliver customized self-help information into the different tools within it. Customize your IBM Support Assistant client by using the built-in update capability to find and install new product features or support tools.

Being server-based provides several advantages over IBM Support Assistant V4.

- Processing resources are moved from your workstation to the server.
- No installation is required on user workstations. All that you need is a browser.
- Diagnostic files and analysis reports are available to all members of the team for each case.
- Report generator tools and interactive web tools are supported plus the desktop tools you used with IBM Support Assistant V4.

Installing IBM Support Assistant 5: Overview

- Installation option: Use the Installation Manager
 - Choose which problem determination tools to install
 - Makes it easy to keep IBM Support Assistant and tools up-to-date
- Installation option: All-in-one compressed file
 - Includes IBM Support Assistant and all available problem determination tools
 - Ideal for environments that are disconnected from the internet
- Deployment option: Embedded server (preferred)
 - Embedded server (Liberty profile)
 - Configuration ready to run
- Deployment option: EAR deployment to an existing WebSphere Application Server environment
 - Any full profile application server instance
 - Flexibility

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Figure 14-14. *Installing IBM Support Assistant 5: Overview*

There are two installation options and two deployment options. This slide covers how to use the Installation Manager for installation and stand-alone or embedded server deployment.

14.3. Tools for troubleshooting

Tools for troubleshooting

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Figure 14-15. Tools for troubleshooting

Types of tools and where to find them (1 of 4)

- Logging and tracing (Basic and HPEL modes)
- Troubleshooting panes in the administrative console
- Specialized tracing and runtime checks:
 - Connection leak detection
 - Memory leak detection
 - Enabled by tracing a specific component or setting a specialized custom property
- First-failure data capture (FFDC)
 - Always enabled
 - Captures key information when a potentially abnormal situation occurs
 - Data is collected in the `<profile_root>/logs/ffdc` directory
 - If an FFDC record is written, that does not necessarily mean that a serious problem occurred

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Figure 14-16. Types of tools and where to find them (1 of 4)

The next few slides provide an overview of some of the types of tools that are used for troubleshooting and where they can be found. It is not an exhaustive list. Some of these tools are described in more detail later in the course. The following article provides a more detailed explanation of this topic:

http://www.ibm.com/developerworks/websphere/techjournal/0702_supauth/0702_supauth.html

The first-failure data capture (FFDC) log file saves information that is generated from a processing failure (for example, a Java exception):

- Captured data, which is saved in log files for use in analysis
- An index file that references all of the exceptions that FFDC logs
- An exception file for each exception type from each probe

Capturing FFDC data does not affect performance.

You can configure the number of days this information is saved (afterward, it is deleted). Retrieve these log files with an FTP client from any other environment. Because the index and exception logs are text files, they can be viewed in any ASCII-capable text editor or viewer.

The FFDC configuration properties files are in the properties directory under the WebSphere Application Server product installation. There are three properties files, but only the

`ffdcRun.properties` file should be modified. You can set the `exceptionFileMaximumAge` property to configure the number of days between purging the FFDC log files. The value of the `ExceptionFileMaximumAge` property must be a positive number.

The following Redbooks publication contains some good documentation on using the FFDC for problem determination: SG246880: *WebSphere for z/OS V5 Problem Determination*.

Types of tools and where to find them (2 of 4)

- JVM diagnostic data can be generated per server from the administrative console
 - Verbose garbage collection
 - Heap memory dump, javacore, system memory dump
- Performance-related tools:
 - Performance Monitoring Infrastructure (PMI) is a facility specific to WebSphere
 - Tivoli Performance Viewer, available from the administrative console, is the primary tool for viewing PMI data
 - Java Health Center: GC and memory monitoring
 - Request metrics can be accessed by using Application Response Measurement (ARM) infrastructure
 - IBM Application Performance Diagnostics Lite is a powerful, lightweight tool that can be used to optimize the performance of Java EE applications

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Figure 14-17. Types of tools and where to find them (2 of 4)

The Java Diagnostics Guides also provide details about some of these tools and how to generate various types of memory dumps. You can find the V6 guide here:

http://www.ibm.com/support/knowledgecenter/SSYKE2_6.0.0/welcome/welcome_javasdk_version.html

Request metrics are available from many products, making it possible to follow a request from end to end in a complex system. Both PMI and request metrics are exported through public APIs, making it possible to write specialized or third-party tools to use this information.

The Tivoli Composite Application Manager family of tools is the comprehensive platform for working with performance data, including PMI, request metrics, and other techniques.

For more information about IBM Application Performance Diagnostics Lite, see the developerWorks website: <http://www.ibm.com/developerworks/servicemanagement/apm/apd/>

Types of tools and where to find them (3 of 4)

Monitoring and detection:

- *Hung thread detection facility* is directly connected into the WebSphere Application Server runtime
- *Performance and diagnostic advisors* are accessible from the administrative console
- Performance advisor is available in the Tivoli Performance Viewer

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Figure 14-18. Types of tools and where to find them (3 of 4)

You can specify a hang threshold, or timeout period, for threads, and receive alerts about potentially hung threads.

Types of tools and where to find them (4 of 4)

Specific component investigation:

- *System Management Configuration Validation* can detect errors in the XML configuration files
 - It is accessible from the administrative console
- *DumpNameSpace* dumps the contents of the JNDI namespace at a particular server
 - It is a stand-alone product with WebSphere Application Server (<install_root>/bin)
- *Class loader viewer* helps resolve class loading issues and is accessible through the troubleshooting menu of the administrative console

Figure 14-19. Types of tools and where to find them (4 of 4)

The System Management Configuration Validation facility can do automated checks to detect inconsistencies and errors in the complex set of XML files that contain the entire WebSphere Application Server system configuration. Such errors, though relatively rare in recent versions of the product because of many runtime safety checks, can still crop up. These errors can be because of as-yet-undiscovered product defects, unexpected events that occur during configuration operations (like crashes), or operator mistakes during configuration. This facility is embedded inside the WebSphere Application Server runtime itself, and can be started from the administration console (in the troubleshooting pane).

14.4. Log files, console messages, and tracing

Log files, console messages, and tracing

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Figure 14-20. Log files, console messages, and tracing

General troubleshooting tool: Logging and tracing

- Logs
 - Report key events in the system; enabled by default
 - Incur minimal performance usage
 - Look for key messages like warnings, errors, and exceptions
- Tracing
 - Application code-level events; level of detail can be configured
 - Detailed tracing can be enabled by specifying a trace string
 - Trace helps you understand the flow of the application
- When you encounter a problem, the first place to look for more information is the *logs* and *traces*
 - Troubleshooting panes in the administrative console to view errors
 - *Log Analyzer* accessible through IBM Support Assistant
 - Specialized tracing and runtime checks such as connection leak detection by tracing a specific component or setting a specialized custom property

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Figure 14-21. General troubleshooting tool: Logging and tracing

IBM Business Process Manager offers a comprehensive set of log files to help you identify and resolve problems during installation, configuration, and run time. Various log files are created during the installation and uninstallation of IBM Business Process Manager and during profile creation, augmentation, and deletion. Examine these logs when problems occur during the product installation and configuration process.

WebSphere logs (1 of 2)

- JVM logs
 - Created by redirecting the System.out and System.err streams of the JVM to independent log files
 - One set of JVM logs for each server and all of its applications that are located by default in
`<profile_root>/<profile_name>/logs/<server_name>`
 - SystemOut.log and SystemErr.log files
- Process logs
 - Contain two output streams (stdout and stderr) that are accessible to traditional code that is running in the process
 - One set for each application server
 - native_stderr.log and native_stdout.log files
- IBM service log
 - Contains both the WebSphere messages that are written to the System.out stream and some special messages that contain extended service information
 - One per profile (node)
 - activity.log file

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Figure 14-22. WebSphere logs (1 of 2)

The JVM logs (SystemOut and SystemErr) are text files and can be viewed from the administrative console or any text editor. The process logs (native_stdout and native_stderr) are text files and can be viewed with any text editor. The IBM service log (activity.log) is not a text file and must be viewed with a tool such as Log Analyzer.

- Viewing JVM logs:
 - Click **Troubleshooting > Logs and Trace** in the administrative console navigation tree and view in the console.
 - Browse to `<profile_root>/<profile_name>/logs/<server_name>` on the computer where logs are stored.
 - Open the SystemOut.log file or SystemErr.log file in a text editor.
- Viewing process logs:
 - Browse to `<profile_root>/<profile_name>/logs/<server_name>` on the computer where logs are stored.
 - Open the native_stdout.log file or native_stderr.log file in a text editor.
- Viewing the IBM service log:
 - At `<profile_root>/<profile_name>/logs/activity.log`.

- Use Log Analyzer in IBM Support Assistant.

WebSphere logs (2 of 2)

- The SystemOut.log file
 - Verify that there is sufficient disk space for your log file configuration
 - Log files automatically roll over and purge the oldest data
 - You can implement custom or third-party background batch processes to capture the oldest logs before rollover
- Transaction log file
 - Never delete the transaction log file
 - The file is self-maintaining
 - Verify that the file is on a highly available file system
 - Option to store transaction log file in a database versus the file system

High Performance Extensible Logging (HPEL) (1 of 2)

- Performance
 - Log and trace events are stored as binary data so performance is substantially faster than default log and trace framework (Basic mode)
 - Less impact to systems when trace is enabled
- Extensions
 - HPEL includes information about which application each log or trace record is from
 - When used with cross-component trace, HPEL includes information about which request each log or trace record is from
 - Developers can add their own log or trace record extensions
 - `HPEL logViewer` command enables filtering logs or trace data by extension name and value
- Filtering
 - `HPEL logViewer` command helps you filter logs and trace data by date, time, level, thread ID, and others

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Figure 14-24. High Performance Extensible Logging (HPEL) (1 of 2)

A number of factors contribute to the overall performance of HPEL logging and tracing.

Log and trace events are each stored in only one place.

Log events, `System.out`, and `System.err` are stored in the log data repository. Trace events are stored in the trace data repository. If the text log file is disabled, HPEL might write log and trace content only to these repositories. Storing each type of event in one place ensures that performance is not wasted on redundant data storage.

Log events, and optionally trace events, are written to the text log file when it is enabled. Since this data is always also stored in the log data and trace data repositories, the text log file content is redundant. The text log is convenient for users who do not want to run the `LogViewer` command line tool to see their logs and trace. You can disable the text log if this convenience is not needed.

Data is not formatted unless it is needed.

Formatting data for a user to read uses processor time. Rather than format log event and trace event data at run time, HPEL log and trace data is stored more rapidly in a proprietary binary representation. This fast binary storage improves the performance of the log and trace facility. By deferring log and trace formatting until the `LogViewer` is run, sections of the log or trace that are never viewed are never formatted.

Log and trace data is buffered before being written to disk.

Writing large blocks of data to a disk is more efficient than writing the same amount of data in small blocks. HPEL provides buffer log and trace data before writing it to disk. By default, log and trace data is stored in an 8 KB buffer before being written to disk. If the buffer is filled within 10 seconds, the buffer is written to disk. If the buffer is not filled within that time it is automatically written to disk to ensure that the logs have the most current information.

High Performance Extensible Logging (HPEL) (2 of 2)

- Enable HPEL on any server in the cell
 - Deployment manager
 - Node agent
 - Application server

- Click **Troubleshooting > Logs and trace > server_name**
 - Click **Switch to HPEL Mode**

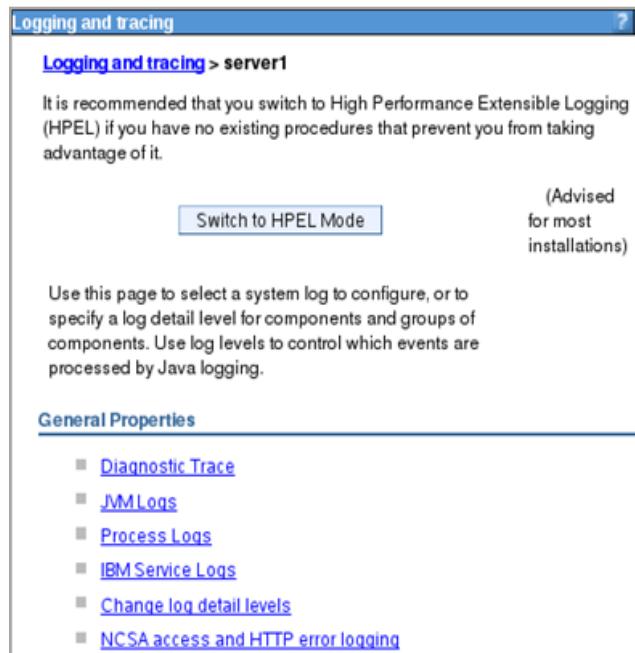


Figure 14-25. High Performance Extensible Logging (HPEL) (2 of 2)

As soon as the log level is switched to HPEL mode for a server, new links appear in the General Properties section for configuring HPEL logging and tracing. These links are shown on the next slide. A new link appears to change log and trace mode, where you can switch back to basic logging.

Diagnostic tracing

- Trace files show the time and sequence of methods that WebSphere base classes call, and you can use these files to pinpoint the failure
 - Tracing is enabled by default
- Trace output can be directed to:
 - File (default)
 - `${SERVER_LOG_ROOT}/trace.log`
 - Memory ring buffer that is dumped after trace stops
- Tracing has a significant impact on performance
 - Enable temporarily for problem determination
 - Trace to file is slower than trace to memory ring buffer **Runtime** tab

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Figure 14-26. Diagnostic tracing

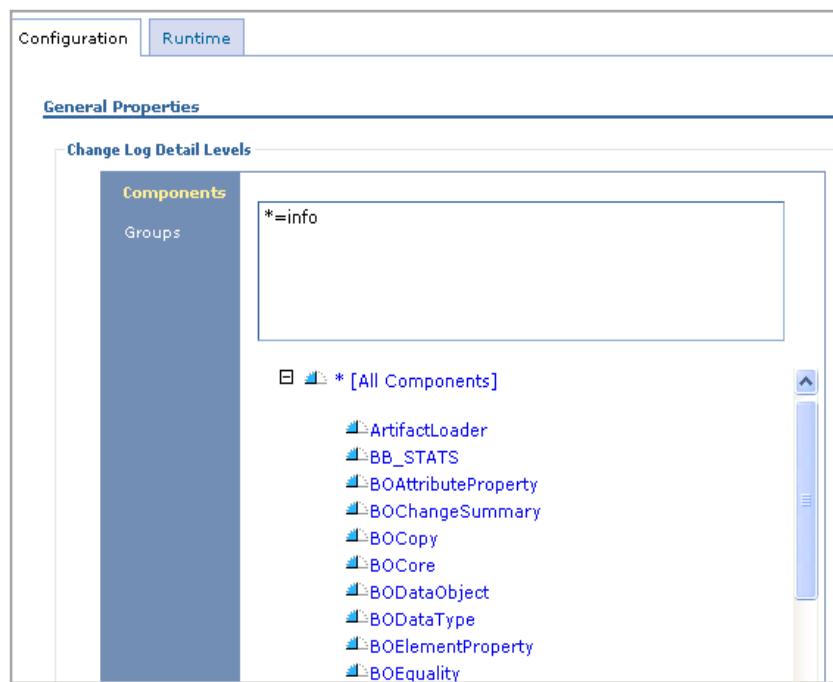
To take advantage of tracing, you must do the following tasks:

- Enable tracing of one or more WebSphere components
- Configure and view trace logs
- Interpret trace log and trace messages

Trace output allows administrators to examine processes in the application server and diagnose various issues. On an application server, trace output can be directed either to a file or to an in-memory circular buffer. If trace output is directed to the in-memory circular buffer, it must be dumped to a file before it can be viewed. On an application client or stand-alone process, trace output can be directed either to a file or to the process console window. In all cases, trace output is generated as plain text in either basic, advanced, or log analyzer format that the user specifies. The basic and advanced formats for trace output are similar to the basic and advanced formats that are available for the JVM message logs.

Setting the log detail level

- Log detail level affects tracing *and* regular logging
 - Setting levels below **info** reduces the amount of data in logs
 - ***=off** disables logging altogether
- Trace levels (fine, finer, finest) are not displayed in the trace file unless logging is enabled
- Log string can be typed in or set by using the graphical menu
 - Default is ***=info**
- User-created applications can be instrumented as well, and can be included in the trace output



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Figure 14-27. Setting the log detail level

Log levels control which events the Java logging processes.

WebSphere controls the levels of all loggers in the system. The level value is set from configuration data when the logger is created and can be changed at run time from the administrative console.

Trace information, which is events at levels fine, finer, and finest, can be written to the trace log. Therefore, if you do not enable diagnostic trace, setting the log detail level to fine, finer, or finest does not affect the data that is logged.

Enable logging to gather relevant runtime data

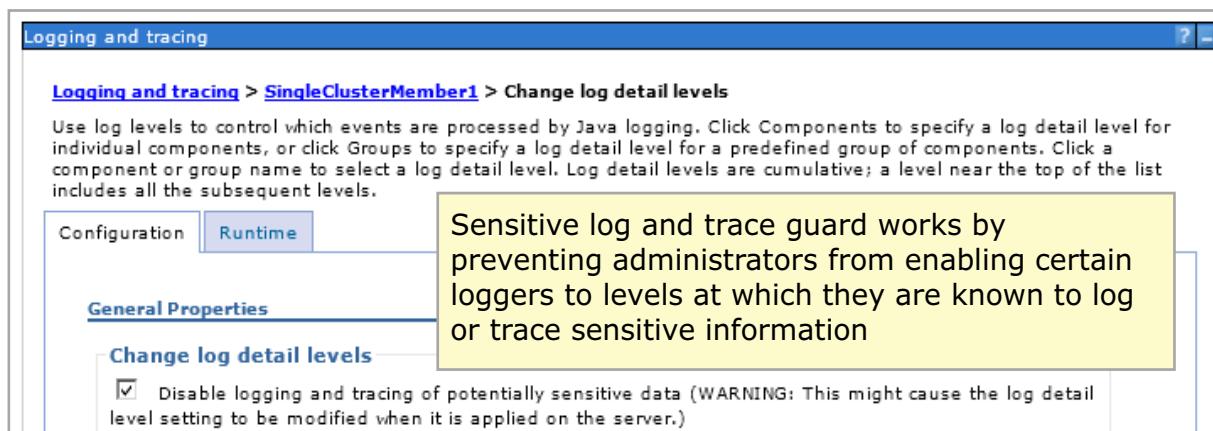
- In the administration console, expand **Troubleshooting > Logs and Trace > server_name > Change Log Detail Level**
 - Business Flow Manager (BFM): `com.ibm.bpe.*=all`
 - Business Process Choreographer Explorer and web client:
`com.ibm.bpe.client.*=all`
 - Compensation: `compensation=all`
 - For database problems: `RRA=all`
 - Human Task Manager (HTM): `com.ibm.task.*=all`
 - Staff resolution, staff support, and LDAP problems:
`com.ibm.task.*all:com.ibm.ws.security.*=all:com.ibm.ws.staffsupport.*=all`
- Messages that belong to Business Process Choreographer are prefixed with:
 - `CWWB` for process-related messages
 - `CWTK` for task-related messages

Figure 14-28. Enable logging to gather relevant runtime data

You can configure the server or cluster member to start in a trace-enabled state by setting the appropriate configuration properties.

Enabling and disabling sensitive log and trace guard

- Administrators can prevent sensitive information, such as data provided from users in HTTP requests, from being written in log and trace files
- In some cases, if access to private data can help with debugging, you can disable sensitive log and trace guard
 - For example, you might see that a credit card number that was entered in a web form did not have the required number of digits



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Figure 14-29. Enabling and disabling sensitive log and trace guard

Administrators who use WebSphere Application Server can prevent sensitive information, such as data that users provide in HTTP requests, from being written in log and trace files. In some cases, when having access to private data can help with debugging, you might want to disable sensitive log and trace guard. For example, you might see that a credit card number that was entered in a web form did not have the required number of digits.

Sensitive log and trace guard works by preventing administrators from giving loggers access to levels at which they are known to log or trace sensitive information.

After you enable sensitive log and trace guard, the server is now configured to prevent known sensitive loggers from writing sensitive content to the log and trace files. After you disable sensitive log and trace guard, the server is now configured to allow known sensitive loggers to write sensitive content to the log and trace files. If you used the deployment manager to complete these steps, you might be required to synchronize the node agent on the target node before restarting the server.

14.5. Cross-component trace capabilities

Cross-component trace capabilities

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Figure 14-30. Cross-component trace capabilities

What is cross-component trace (XCT)?

- XCT is a feature that annotates the logs so that entries that are related to a request are identified as belonging to the same unit of work
 - The request might traverse more than one thread, process, or server
- XCT helps identify the root cause of problems across components, which provides the following benefits:
 - Enables administrators and support teams to follow the flow of a request from end-to-end as it traverses thread or process boundaries, or travels between stack products and WebSphere Application Server
 - Helps to resolve questions about which component is responsible for a request that fails
- Do not use XCT in production or while obtaining performance data
 - Incurs significant performance resource usage

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Figure 14-31. What is cross-component trace (XCT)?

Depending on the nature of your applications, multiple threads within an application server can be used to handle requests, such as HTTP requests or JMS requests. More than one application server might handle some requests, such as when one application server makes a request to another application server for a web services request.

Applications that are built by using distributed architectures, such as service-oriented architecture, can benefit from XCT, since XCT helps facilitate problem determination across multiple services on different systems.

Cross-component trace capabilities

- Cross-component trace (XCT) maps `SystemOut.log` and `trace.log` records back to the SCA programming model
 - Logs message process sequence from module to module and the entering time and exiting time of an SCA invocation
- Supports all SCA call patterns
 - Asynchronous one way
 - Asynchronous with callback
 - Asynchronous with deferred response
 - Synchronous call
- Works with business objects, or simple data types
- Supports a network deployment environment
 - Load files from each server
 - Might load only some of the files from all the servers

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Figure 14-32. Cross-component trace capabilities

Cross-component trace (XCT) is available only in IBM BPM Advanced. XCT maps `SystemOut.log` and `trace.log` records back to the SCA programming model by using Integration Designer.

Use cross-component trace for problem determination

- Supports Business Process Execution Language (BPEL) microflows
- Support for long-running business processes
 - Follow flow and correlate log records to long-running processes
 - Supports multiple “pick” and “receive” activities
 - Follow internal thread work
 - Follow callouts to partners
- Supports HTTP, JMS, WebSphere MQ, and MQ JMS bindings
 - Another step toward end-to-end call chains
 - Captures work done as part of export: Function selectors and data bindings
- Rolling log support
 - SystemOut and trace files are often split over multiple files
 - Load all the files in for the full call chain

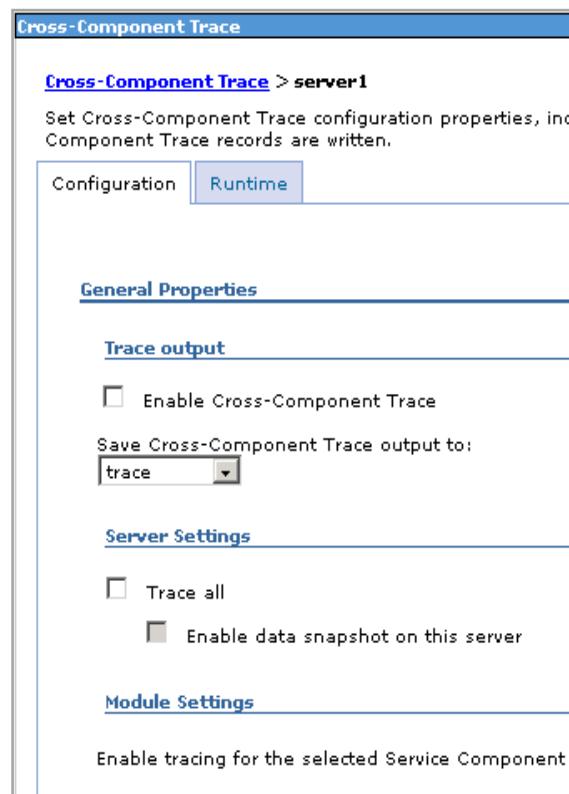
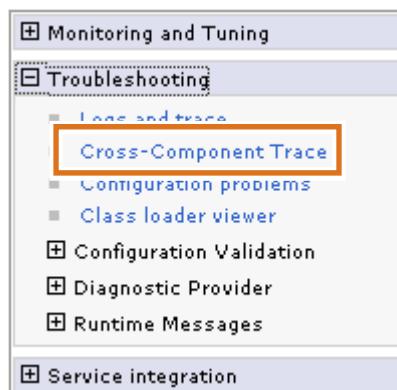
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Figure 14-33. Use cross-component trace for problem determination

Activating cross-component trace in production

- Select **Troubleshooting > Cross-Component Trace**
- Select the server to modify; each server is set individually



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Figure 14-34. Activating cross-component trace in production

Enable XCT to include request IDs in log and trace files when you want to see which log and trace entries, in all threads and application server processes, are related to the same request. Request IDs are recorded only when using HPEL log and trace mode, and they can be seen or used for filtering by using the `logViewer` command.

Administering XCT

- XCT can be enabled for a server that uses HPEL or Basic mode
- Click **Troubleshooting > Logs and trace > server_name > Change log detail levels**
- Select **Enable log and trace correlation**

Correlation

Enable log and trace correlation so entries that are serviced by more than one thread, process, or server will be identified as belonging to the same unit of work.

Enable log and trace correlation

Include request IDs in log and trace records

Include request IDs in log and trace records and create correlation log records

Include request IDs in log and trace records, create correlation log records, and capture data snapshots

- Select option for including request IDs, creating correlation logs, and capturing data snapshots

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Figure 14-35. Administering XCT

Enable XCT to create correlation log records when you want to log how requests branch between threads and processes, and see extra information about each request. Enabling XCT to create correlation log records might have a significant performance impact on your system, so is best suited to test and development environments.

Enable XCT to capture data snapshots when you want to store entire request and response bodies to the file system. Enabling XCT to capture data snapshots might have a significant performance impact on your system, so is best suited to test and development environments. XCT captures data snapshots for message requests and responses that the SIBus handles.

You can also use wsadmin scripting to enable and configure cross-component trace (XCT). See the IBM Knowledge Center topic: “Configuring XCT with wsadmin scripting.”

Here is an example:

```
LoggingService =
AdminConfig.getId("/Cell:myCell/Node:myNode/Server:myServer/HighPerformanceExtensibleLogging:/")
AdminConfig.create("Property", LoggingService, [[{"name": "com.ibm.websphere.logging.enableCorrelation"}, {"value": "true"}]])
```

14.6. IBM BPM troubleshooting

IBM BPM troubleshooting

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Figure 14-36. IBM BPM troubleshooting

What should you do for IBM BPM problems? (1 of 3)

- Use the Event Manager

- Examine the Event Manager parameters that are configured
- Look for any long-running tasks that are in a running state
- A number of tasks can show up there, and the type of task gives a hint to the problem

- Use the Process Monitor

- Indicates whether you have a service or a BPD in a loop
- Get a list of active services and processes that are currently running and consuming CPU
- Find out how long a step of a process takes and the most complex process

- Examine the settings in the

`TeamworksConfiguration.running.xml` file

- Look for any Event Manager related parameters
- Check the cache, snapshot, and interval parameters

Figure 14-37. What should you do for IBM BPM problems? (1 of 3)

After monitoring the operating system, start with the Event Manager. Look for any long-running tasks that are in an executing state. A number of tasks can show up there, and the type of task gives a hint to the problem. BPDNotification and DBNotification are tasks in the BPD engine. It should generally execute in a small amount of time. SystemTask and UCATask are generally services. If these tasks are long-running, then the associated services are likely “stuck.” If you see items rapidly popping up and being completed, you might be in a loop that is moving between the BPD engine and the service engine. For instance, you might have a system lane task that is failing. If you have a catch exception on that system lane activity that loops back to itself, then the system task fails. Go back to the BPD engine in the catch, then immediately back to the service engine to fail again.

The Process Monitor indicates if you have a service or a BPD in a loop. If you go there, you see a list of active services and processes. Active services and processes are jobs that are currently running and consuming CPU. You can click them to find out which service or BPD is involved and then find out what step (or steps) you are stuck in. If you find a loop in the Process Monitor or Service Monitor, it is likely that the loop is what is causing CPU and memory usage. If you do not find a loop, you need to look elsewhere. Thread dumps are the right next step.

What should you do for IBM BPM problems? (2 of 3)

- Use the Instrumentation Monitor
 - Display and collect instrumentation data
 - Useful for identifying BPMN process instance performance bottlenecks
 - You can see whether functions such as EJB API, caches, and database queries are taking longer than usual
 - You can use it to log instrumentation data and play later
- It is always good to examine Process Monitor and Instrumentation Monitor data together

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Figure 14-38. What should you do for IBM BPM problems? (2 of 3)

For a BPMN-based application (developed in the Process Designer), you can turn on process instrumentation so that you can see which services and processes take the longest time to complete.

Business Process Manager provides the integrated Process Inspector as part of Process Designer. With the integrated Process Inspector, you can debug a process in Process Designer. When you click the **Inspector** tab on the Process Designer view, it switches to the Process Inspector. Click **Start** to start a process and simulate it in Process Designer and to monitor the state of the process.

What should you do for IBM BPM problems? (3 of 3)

- Explore the Process Inspector
 - Provides information about events and processes in your entire system
 - You can view detailed activity information about process instances and perform troubleshooting tasks
 - Interfaces in the Process Admin Console and integrated in Process Designer
- Use the Failed Event Manager
 - Administered through the Failed Event Manager application in the administrative console
- Failed Event Manager monitors and logs failed events for:
 - Runtime faults of asynchronous SCA, JMS, and MQ invocations
 - Long-running BPEL process failures
 - Business Flow Manager infrastructure failures

Instrumentation files (1 of 2)

- Compacted binary files that are produced in Process Admin Console
- Must be decoded before read
- Show every command that is issued on Process Server and time that is taken to run
- Process Admin Console: **Monitoring > Instrumentation**
 - BPD instances that completed, failed, started, or terminated
 - Inbound and outbound web service connectors
 - Event manager and tasks
 - Cache hits and misses
 - Persistence services on searches

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Figure 14-40. *Instrumentation files (1 of 2)*



Instrumentation files (2 of 2)

Name	Count/Value	In Process	Average Duration (ms)
BPD			
Instances			
BPD Instances Completed	0		
BPD Instances Failed	0		
BPD Instances Resumed	0		

Decode instrumentation files:

```
java -Xmx1024M -cp svrcoreclnt.jar
com.lombardisoftware.instrumentation.log.tools.NonXMLDump
logFile.dat > logFile.txt
```

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Figure 14-41. *Instrumentation files (2 of 2)*

1. Instrumentation logging is available in the Process Admin Console. Administrators control access to the Instrumentation tools with console configuration files.
2. Click **Start Logging** to begin capturing instrumentation data. Data can be set to automatically refresh on periodic intervals, but this process affects system performance.
3. Data is captured and displayed in the instrumentation screen. The log files are stored physically in the `logs` directory of the Process Center profile, for example:
`/opt/ibm/BPM/v8.0/profiles/ProcCtr01/logs`. The log file and location are shown when the administrator stops logging.

Instrumentation log files contain a `.dat` extension. To work with the instrumentation log files, they must be decoded.

Troubleshooting IBM BPM configuration issues

- The `BPMConfig` command line utility is used to create or extend a typical network deployment environment
 - Can also create the database scripts and profiles
 - Validate the deployment environment configuration
 - Uses a properties file that contains all of the values that are used in the configuration of your deployment environment
 - Sample properties files are provided for you to copy and customize to configure your own environments
- Messages that are related to the running of the `BPMConfig` command are recorded in the file
`<install_root>/logs/config/BPMConfig.log`
 - Check the log for the message: `BPMConfig completed successfully`

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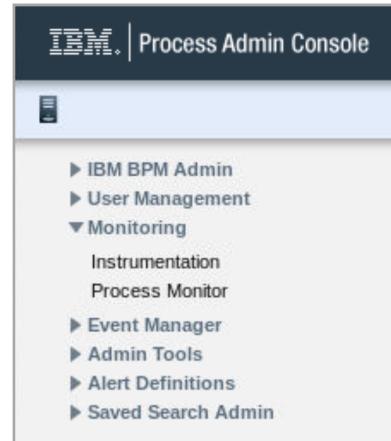
Figure 14-42. Troubleshooting IBM BPM configuration issues

The `BPMConfig` command line utility is used to create or extend a typical network deployment environment.

The `BPMConfig` utility can also be used to create the database scripts and profiles, start and stop the deployment environment, and validate the deployment environment configuration.

Optimizing performance (1 of 5)

- You can monitor IBM BPM processes by using Process Monitor utility in Process Admin Console.
 - The Summary page provides an overview of active and most expensive processes and services.
 - The Processes page shows the details of the process app. You can view the duration of each step in the process, including the type of activity, such as event, gateway. You can also view the list of services that are running and the total duration of each service.



The screenshot shows the "Monitoring > Process Monitor" page. At the top, it displays the server information: "Server: cell=PCenterCell,node=PCenterNode01,process=PCenter_DE.AppCluster.member1". Below this are three tabs: "Summary" (selected), "Processes", and "Services". Under the "Summary" tab, there are two tables:

Active Processes Currently Executing	0
Active Services Currently Executing	0

 Below the tables is a section titled "Most Expensive Services" with a table:

Process App	Service Name
No data available	

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Figure 14-43. Optimizing performance (1 of 5)

Optimizing performance (2 of 5)

- System performance can be improved by cleaning up completed tasks.
- Clean up deleted tasks by using Task Cleanup utility in Process Admin Console
 - You can select the required option to clean up the tasks that are marked as DELETED, CLOSED, or SENT



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Figure 14-44. Optimizing performance (2 of 5)

Optimizing Performance (3 of 5)

- Administrators should establish blackout periods to specify times when events cannot be scheduled, for example, due to a holiday or when regular system maintenance is scheduled.
- The Event Manager takes blackout periods into account when scheduling and queuing events, event subscriptions, and undercover agents (UCAs)



The interface shows the 'Blackout Period Details' configuration screen. It includes fields for Date/Time Range (From: 12/25/2015, To: 12/26/2015, 08:00) and Weekday/Time Range (From: Monday, To: Monday, HH:mm). Buttons at the bottom include Delete, Add, Update, and Clear.

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Figure 14-45. Optimizing Performance (3 of 5)



Optimizing Performance (4 of 5)

- In the Process Admin Console, you can create alert definitions
- APIs can then be used to check the status of these alert definitions
 - For example, to notify administrators of potential issues
- An application, service, or dashboard must be created to display or otherwise handle the alert definitions and to display whether they are triggered or not

The screenshot shows a navigation sidebar with the following structure:

- Event Manager**
 - Monitor
 - Blackout Periods
 - Synchronous Queues
 - EM JMS Error Queue
- Admin Tools**
 - Manage EPVs
- Alert Definitions**
 - Process Instance Alerts
 - Task Alerts** (highlighted with a red box)
- Saved Search Admin**

The dialog box has the following fields:

Name	<input type="text" value="Type in a name"/>				
Process App	<input type="text" value="All"/> <input type="button" value="..."/>	Snapshot	<input type="text" value="All"/> <input type="button" value="..."/>	Process	<input type="text" value="All"/> <input type="button" value="..."/>
Instance status	<input type="text" value="All"/> <input type="button" value="..."/>	Task status	<input type="text" value="All"/> <input type="button" value="..."/>		
Threshold	<input type="button" value=">"/> <input type="button" value="▼"/> <input type="text" value="Type in a number"/>				
<input type="button" value="Apply"/> <input type="button" value="Clear"/>					

Problem determination

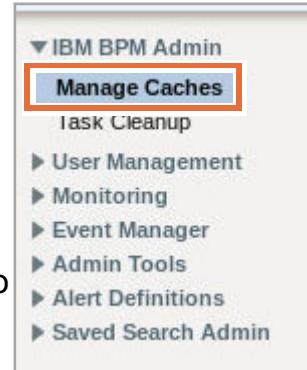
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Figure 14-46. Optimizing Performance (4 of 5)

The alert definitions pages in the Process Admin Console display the alert definitions. They do not display whether alerts are triggered.

Optimizing Performance (5 of 5)

- You can use the Manage Caches page in the Process Admin Console to view all caches and their status and reset each cache.
- For performance reasons, IBM Business Process Manager caches some information about the Process Server.
 - The caches for IBM BPM, refresh automatically and so resetting these caches should be required only when an issue exists that a reset might rectify.



IBM BPM Admin > Manage Caches

Name	Description	CA	UCA	UCP	Last A.	Status	Actions
E@GroupInfoCache	Stores UserGroup objects by GroupName and GroupId	7,702	0	0%	1:54 AM	ON	(Show) (Reset)
E@UserInfoCache	Stores UserInfo objects by UserName and UserId	558,161	18	0%	1:55 AM	ON	(Show) (Reset)
GroupCache	Caches group information and list of groups with information.	0	0	Inf	7:00 PM	ON	(Show) (Reset)

Problem determination

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Figure 14-47. Optimizing Performance (5 of 5)

14.7. Troubleshooting database-related problems

Troubleshooting database-related problems

Problem determination

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Figure 14-48. Troubleshooting database-related problems

Why is database for IBM BPM important?

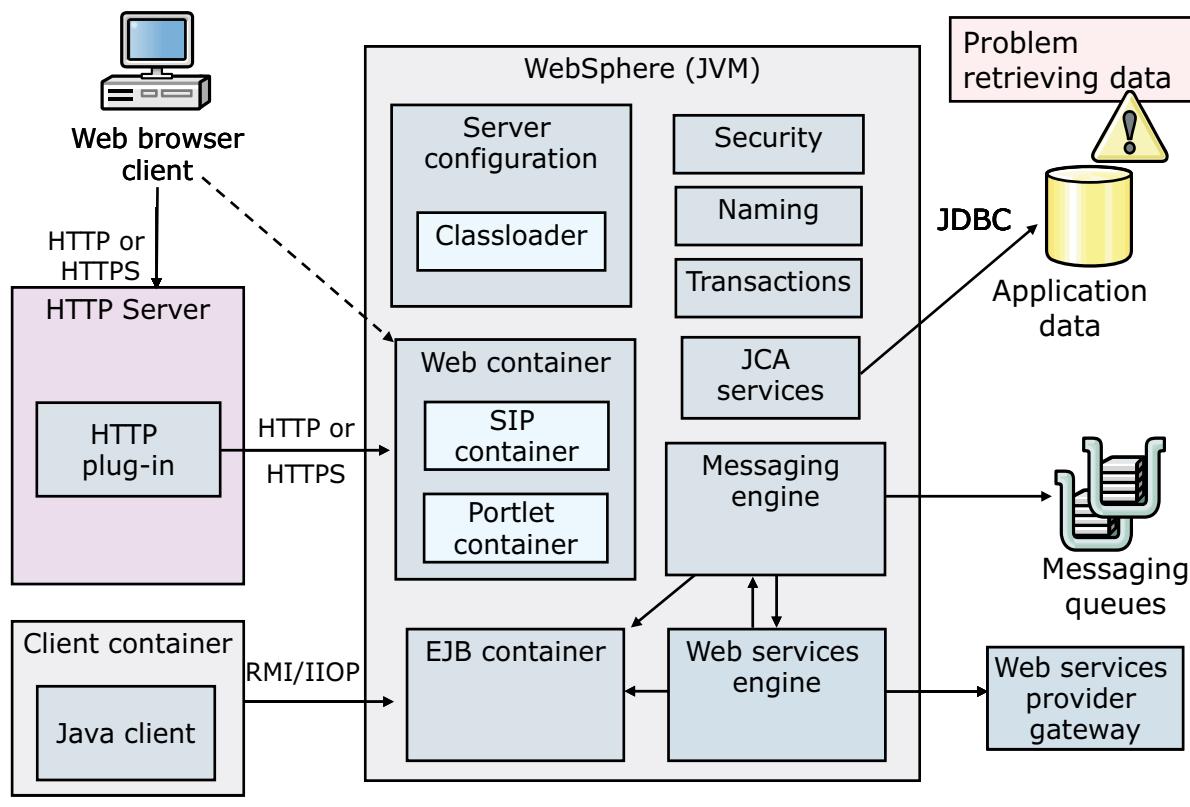
- Nearly all customer data and IBM BPM internal processing is stored in the database
- If you want to troubleshoot a problem that rarely occurs or happens on a high load production system, you might not be in a position to gain information with a trace
- The database information is always there, and you can gain insights that might not be achievable with other means
- The database information is just one part
 - Sometimes a trace can be more useful, depending on the problem scenario

Problem determination

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Figure 14-49. Why is database for IBM BPM important?

WebSphere database connection problems



Problem determination

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Figure 14-50. WebSphere database connection problems

WebSphere diagnostic tools provide services to help troubleshoot database connection problems. Additionally, the IBM website provides flexible searching capabilities for finding documented solutions to database-specific connection problems.

For a comprehensive list of database-specific troubleshooting tips, see the WebSphere Application Server product support page. In the **Search Support** field, type a database vendor name among your search terms.

Creating a database connection: Common problems

- Typical problems that arise when configuring a database connection are:
 - Spelling or typographical errors when entering the parameter values
 - Client JAR files necessary to the JDBC provider are not present
 - Lack of user permissions on the database server
 - Connectivity problems because of network topology or a database that is not started

- The problems that are encountered when configuring a database connection are easy to fix if you know what to look for and where to look:
 - WebSphere provides immediate feedback when testing a connection
 - The `SystemErr.log` contains explicit information about the actual exception

[Problem determination](#)

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Figure 14-51. Creating a database connection: Common problems

The data source parameters are focused on the actual database access information such as the database name, server name, port number, and access credentials. The database values can usually be verified through a Telnet session to the database server as follows:

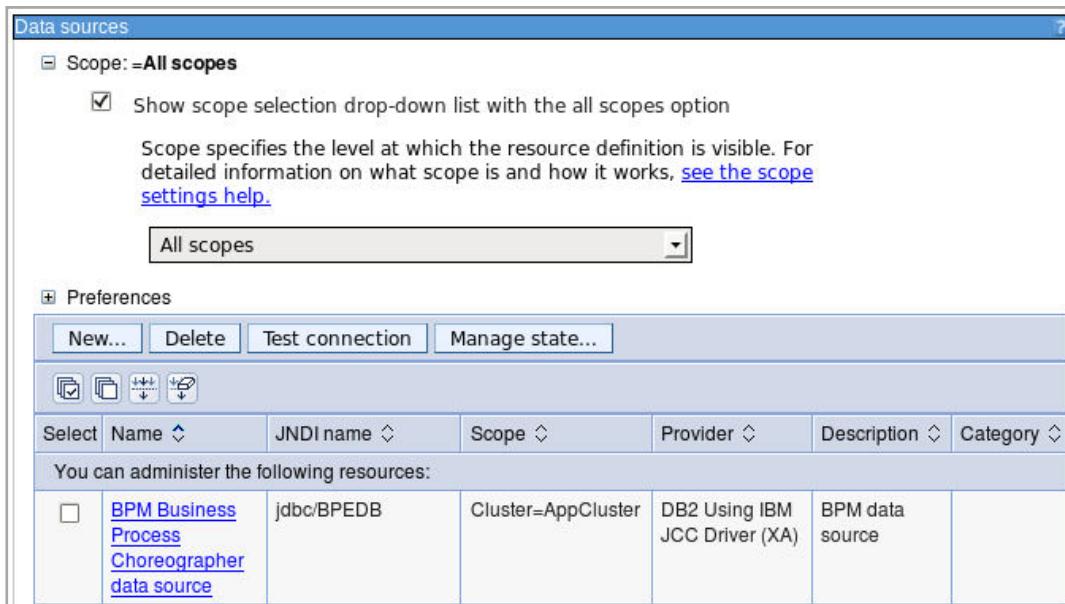
Steps for a simple Telnet test:

1. Telnet into the server by using the server name value that you are using for the data source.
2. Start a database session by using the JCA credentials.
3. Perform a sample of the operations that the application does, such as a simple query.
4. Disconnect from the server.

If you are successful in doing this simple test, then the data source parameters are probably correct. However, keep in mind that some differences can arise such as using a server short name as opposed to the fully qualified domain name. If the application server is on a different computer from where you are doing the Telnet test, host resolution issues might occur. Also, the Telnet test does not exercise the port number parameter. If the port is incorrect, then the data source fails. You can verify the port number that the database is listening on by exporting the instance parameters. Alternatively, you can contact your database administrator and request confirmation of the parameters.

Using the test connection service

- When the JDBC Provider and the data source are configured, browse to **Resources > JDBC > Data sources**
 - Select the data source and then click **Test connection**



Problem determination

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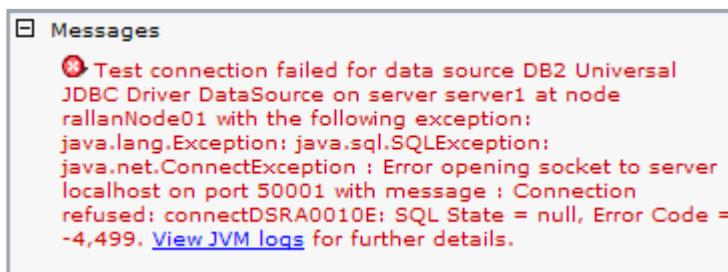
Figure 14-52. Using the test connection service

The administrative console offers the test connection option from the **Resources > JDBC > Data sources** pane.

Keep in mind that the data source cannot be tested until any updated values are applied and saved to the application server configuration files.

Data source database parameter problems: Identification

- The data source is the connection between the application server and the database
- Common configuration problems consist of:
 - Incorrectly specified database server parameters
 - Incorrect user authentication credentials
- Use the **Test Connection** service and examine the error message



- As this error message suggests, the JVM logs are a good place to begin the problem determination activity

[Problem determination](#)

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Figure 14-53. Data source database parameter problems: Identification

The `SystemErr.log` file holds the complete stack trace of the exceptions that occur when a data source connection test fails. The administrative console provides various views in the troubleshooting section of the left menu. Exceptions events can be viewed separately, or a portion of the log files can be viewed. Because the log files can become large, the administrative console includes a range filter for the number of lines that are displayed.

When inspecting the log files directly from the file system, it is important to remember that the log files from the node that contains the failure include the exceptions and trace information. For a JDBC connection, runtime exceptions are typically available from the log files of the deployment manager. However, if the JDBC provider scope is focused at the node or server level, it is necessary to inspect the logs on the node that raised the exception.

Data source database parameter problems: Diagnosis and resolution

```
3/8/13 11:13:22:458 MST] 0000000a SystemErr R
java.net.SocketException: Operation timed out: connect:could be
due to invalid address at
java.net.PlainSocketImpl.socketConnect(Native Method)
```

- The SystemErr.log indicates that the address provided was invalid for the connection
- A connectivity problem might be as a result of an incorrect database name, server name, or port number
 - The database administrator must be consulted to verify that database name is accurate
 - You can verify that the server name is correct by attempting a ping of the server or a Telnet session
 - The port number might be changed to something other than the default
 - If it is a DB2 database, the port number can be discovered through the DB2 Configuration Assistant or by exporting the instance parameters by using the DB2 Control Center

[Problem determination](#)

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Figure 14-54. Data source database parameter problems: Diagnosis and resolution

Determining the database name, server name, and port number varies depending on the database vendor. In a development environment, it is common for the development team to administer the database themselves. Therefore, access to the server and the configuration of the database are something that the developers can discover for themselves. Since administrators control server access in a production environment, it might be necessary to engage the database administrator to resolve the connectivity issue.

Unit summary

- Describe problem determination
- Identify resources for problem determination
- Describe tools for troubleshooting
- Describe how to configure logs and trace
- Explain how to use tracing to determine problems
- Describe common troubleshooting facilities
- Use High Performance Extensible Logging capabilities
- Use cross-component trace capabilities
- Identify common database configuration pitfalls

Problem determination

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Figure 14-55. Unit summary

Review questions

1. True or False: IBM Support Assistant is a free, stand-alone workbench that you can install on any workstation; and it can help you search products, support, and educational resources.
2. The default location for the WebSphere logs is:
 - A. <install_root>\profiles\logs
 - B. <install_root>\profiles\<profile_name>\logs
 - C. <install_root>\logs
3. True or False: Tracing cannot be started while the server is running.



Problem determination

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Figure 14-56. Review questions

Write your answers here:

- 1.
- 2.
- 3.

Review answers

1. True or False: IBM Support Assistant is a free, stand-alone workbench that you can install on any workstation; and it can help you search products, support, and educational resources.
The answer is True.
2. The default location for the WebSphere logs is:
 - A. `<install_root>\profiles\logs`
 - B. `<install_root>\profiles\<profile_name>\logs`
 - C. `<install_root>\logs`The answer is B.
3. True or False: Tracing cannot be started while the server is running.
The answer is False. Tracing can be started while the server is stopped or running.



Problem determination

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Figure 14-57. Review answers

Unit 15. Course summary

Estimated time

00:15

Overview

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

Unit objectives

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

[Course summary](#)

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Figure 15-1. Unit objectives

Course objectives

- Configure and administer a Process Center environment
- Configure and administer a Process Server environment
- Describe the purpose and business value of the tools included in IBM Business Process Manager Advanced V8.5.7: IBM Process Designer, IBM Integration Designer, IBM Process Server, IBM Process Center, and WebSphere Enterprise Service Bus
- Describe IBM Business Process Manager Advanced architecture, concepts, and terminology
- Describe the deployment considerations for IBM Business Process Manager Advanced components
- Describe the Process Server high availability topologies and their selection criteria
- Create a Process Center clustered environment by using the Deployment Environment wizard

[Course summary](#)

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Figure 15-2. Course objectives

Course objectives

- Create a customized properties file by using the IBM Business Process Manager Advanced Configuration Editor
- Create a Process Server clustered environment by using the BPMConfig utility
- Purge content in the Process Center environment
- Purge content in the Process Server environment
- Verify the functions of failover in a clustered environment
- Deploy and manage business applications
- Work with the administrative console and management tools

[Course summary](#)

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Figure 15-3. Course objectives

Course objectives

- Deploy applications to an offline and online Process Server environment
- Migrate process instances
- Implement SSL between the Process Center and Process Server environments
- Troubleshoot the environment

[Course summary](#)

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Figure 15-4. Course objectives

To learn more on the subject

- IBM Training website:
www.ibm.com/training

Course summary

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Figure 15-5. To learn more on the subject

References (1 of 2)

- The online version of the IBM Business Process Manager Advanced V8.5.7 IBM Knowledge Center is a good source of product information
 - http://www.ibm.com/support/knowledgecenter/SSFPJS_8.5.7/com.ibm.wbpm.main.doc/kc-homepage-bpm.html
- Business Process Management (BPM) enabled by SOA:
 - <http://www.ibm.com/software/info/bpm/>
- IBM Business Process Manager Advanced home page:
 - <http://www.ibm.com/software/integration/business-process-manager/advanced/>
- Numerous articles that are listed in IBM developerWorks
 - <http://www.ibm.com/developerworks/>

Course summary

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Figure 15-6. References (1 of 2)

References (2 of 2)

- IBM Redbooks
 - *IBM Business Process Manager V8.0 Production Topologies* (SG24-8135-00)
 - *IBM Business Process Manager Security: Concepts and Guidance* (SG24-8027-00)
 - *IBM Business Process Manager V8.5 Performance Tuning and Best Practices* (SG24-8126-00)
 - *WebSphere Application Server V8: Administration and Configuration Guide* (SG24-7971-00)
 - *WebSphere Application Server V8.5 Administration and Configuration Guide for the Full Profile* (SG24-8056-01)
 - *WebSphere Application Server Network Deployment V6: High Availability Solutions* (SG24-6688-00)
 - *Techniques for Managing Large WebSphere Installations* (SG24-7536-00)

[Course summary](#)

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Figure 15-7. References (2 of 2)

IBM BPM education

- More education courses are available for IBM Business Process Manager administrators
- IBM Business Process Manager V8.5 Performance and Tuning (WB868)
 - SPVC course code ZB868
- IBM Business Process Manager V8.5 Problem Determination (WB869)
 - SPVC course code ZB869

[Course summary](#)

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Figure 15-8. IBM BPM education

Enhance your learning with IBM resources

Keep your IBM Cloud skills up-to-date

- 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

Course summary

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Figure 15-9. Enhance your learning with IBM resources

Unit summary

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

[Course summary](#)

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Figure 15-10. Unit summary

Course completion

You have completed this course:

Administration of IBM Business Process Manager Advanced
V8.5.7

Any questions?



[Course summary](#)

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Figure 15-11. Course completion

Appendix A. IBM BPM on Cloud

Estimated time

00:30

Overview

In this unit, you learn about BPM on Cloud.

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

IBM BPM on Cloud

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Figure A-1. Introduction to IBM BPM on Cloud

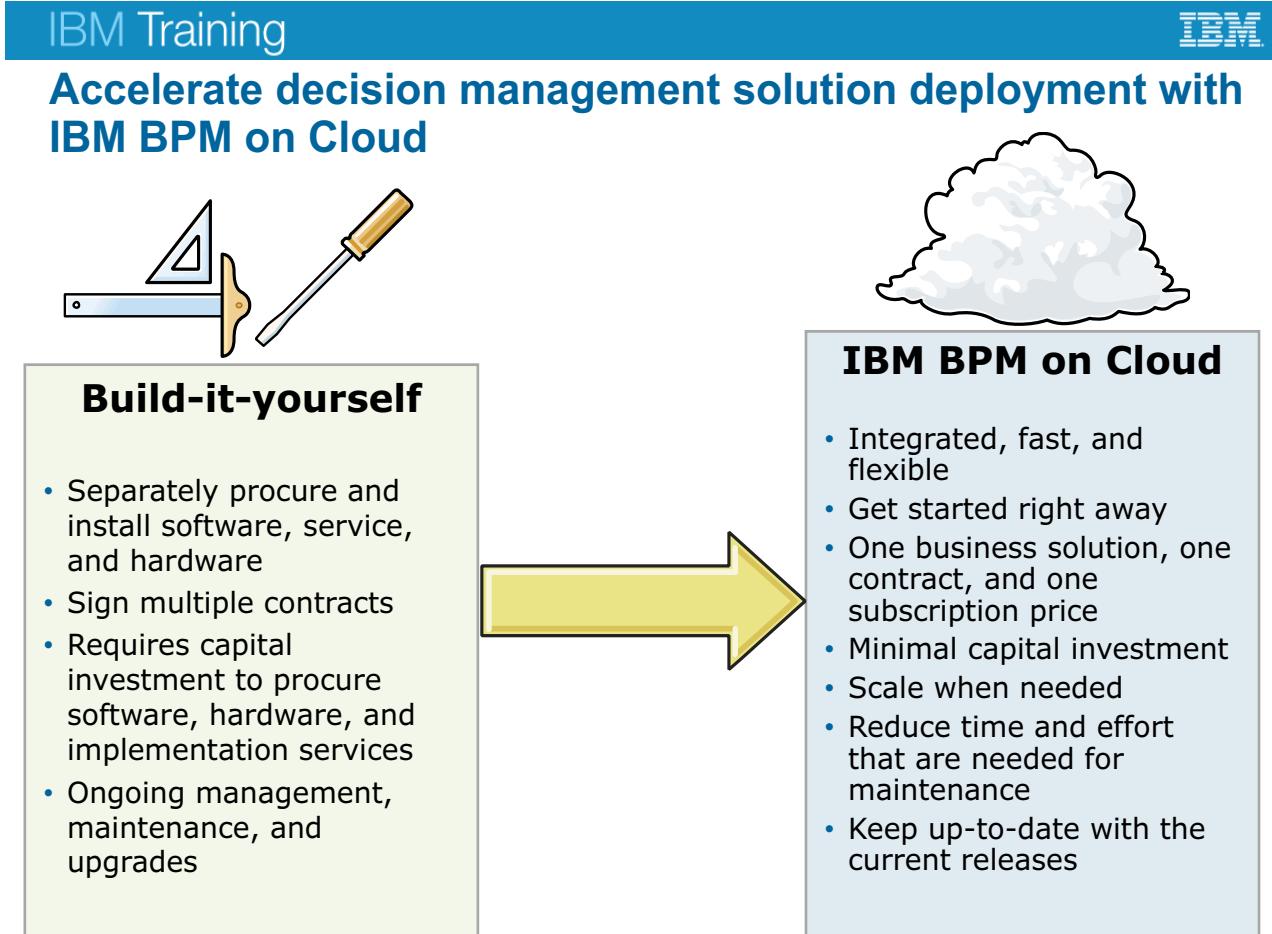
Popular use cases for IBM BPM on Cloud

- Pilot project
 - Providing the business value
 - Try out a newer version of IBM BPM
- Development
 - An organization can manage a production solution on-premises
 - Needs to get started fast to meet your go live dates
- Instead of an on-premises solution
 - Organizations with small or no IT department
 - Urgency for implementation
 - Prefer Cloud solutions to on-premises

IBM BPM on Cloud

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Figure A-2. Popular use cases for IBM BPM on Cloud



IBM BPM on Cloud

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Figure A-3. Accelerate decision management solution deployment with IBM BPM on Cloud

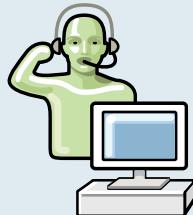
IBM Training



BPM on Cloud customer focus: Manage and automate decisions

IBM manages:

- Uptime
- Monitoring
- Backup
- High availability
- Disaster recovery
- Updates
- Maintenance
- 24 x 7 support
- Tuned configuration

**Customers manage:**

- Application development
- Application integration
- Application support



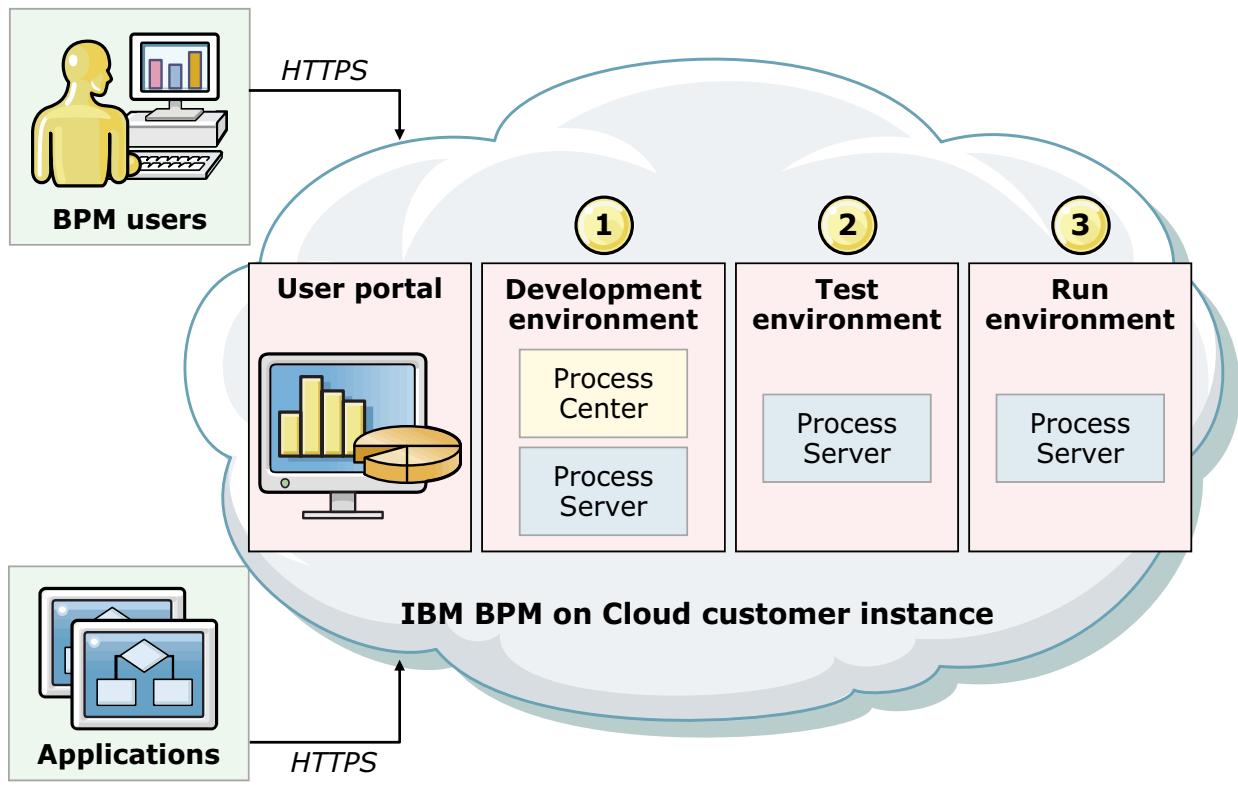
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Figure A-4. BPM on Cloud customer focus: Manage and automate decisions



IBM BPM on Cloud: Three runtime environments



IBM BPM on Cloud

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Figure A-5. IBM BPM on Cloud: Three runtime environments

Considerations for IBM BPM on Cloud

- All styles of processes can run on IBM BPM on Cloud
 - Ideal: Human workflows, case style processes, process with a mix of human and system interaction
 - Recommend testing: System orchestration processes where all the systems are on-premises
- Distance between the cloud data center and your data center might matter
 - Consider the developer experience with Process Designer and user responsiveness
- The number of integration touch points you have in a single process and be sure that your network is able to handle this
- There is no unlimited capacity and capacity is based on the number of users purchased, not the processor value unit
 - The configuration capacity can be adjusted easily, but might involve the purchase of more users
- How much control you want to have over your environment. Do you want to heavily customize the deployment? Do you want to use your own database?

IBM BPM on Cloud

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Figure A-6. Considerations for IBM BPM on Cloud

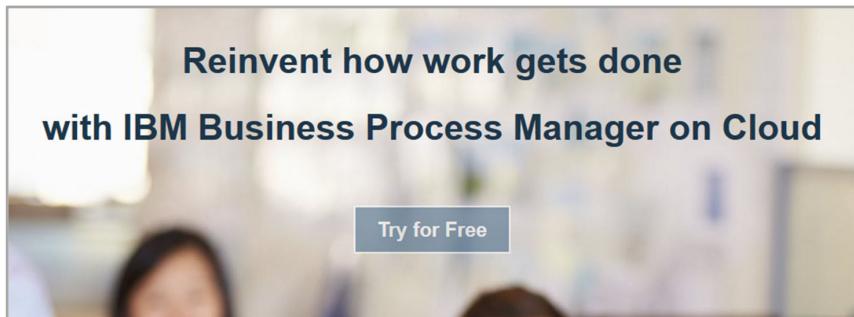
Access to the infrastructure

- The IBM operational team monitors and manages the IBM BPM infrastructure
 - Including virtual machines, operating systems, and IBM BPM and database configuration
- Client users do not have access to the infrastructure
 - Including the file system, administrative console, direct access to the IBM BPM databases by using database tools
- IBM BPM on Cloud provides alternatives by using self-service administration capabilities
 - Such as access to log files for diagnostics (UI and REST API), management of data sources and certificates, restarting the Process Center server, and more
- What IBM does not yet have administration for, the IBM operational team can assist you with the tasks
 - Such as customizing the Process Portal



IBM BPM on Cloud free trial

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



IBM BPM on Cloud

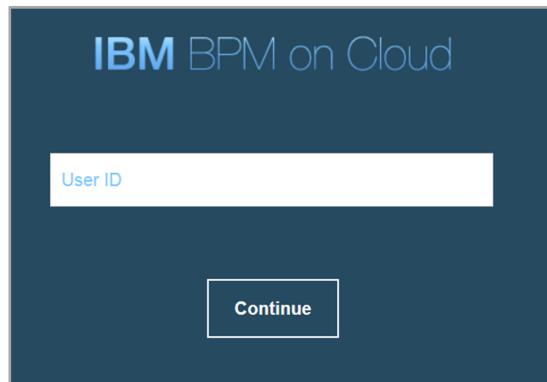
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Figure A-8. IBM BPM on Cloud free trial



Activating access and logging in to IBM BPM on Cloud

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



IBM BPM on Cloud

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Figure A-9. Activating access and logging in to IBM BPM on Cloud



IBM BPM on Cloud self-learning experience

- BPM 101: Learn the basics of IBM BPM with business process conceptual information
- Tutorials: A walk-through how to use key capabilities with IBM BPM on Cloud
- Samples: A collection of eight industry process examples that you can use to get started

A screenshot of the IBM BPM on Cloud self-learning experience interface. The top navigation bar includes 'IBM BPM on Cloud', 'LEARN' (which is highlighted in green), 'WORK', 'ADMIN', and 'BII'. Below the navigation is a large blue header area with a network icon and a bee icon. The main title 'Welcome to IBM BPM on Cloud' is centered, with a link 'TAKE ME TO PROCESS CENTER' above it. A checkbox option 'Watch this guided tour to understand the core capabilities' is present. Below the title, there's a cloud icon. The central section asks 'How would you like to learn?' and lists three options: 'BPM101' (with a video camera icon), 'Tutorials' (with a book icon), and 'Samples' (with a gear and code icon). Each option has a brief description below it.

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Figure A-10. IBM BPM on Cloud self-learning experience

IBM Training

IBM BPM on Cloud user portal (1 of 2)

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

Development Environment						
Process Center 	REST UI 	Process Portal 	Process Admin Console 			
Install and run process applications, store performance data, and manage running instances of process applications on the Process Center servers. Launch More info Available Downloads (2) IBM® Process Designer IBM® Integration Designer						
Prototype IBM BPM REST resources and their associated parameters Launch More info						
Collaborate on tasks and view the performance of individuals, teams, and processes on dashboards. Launch More info						
Manage the Process Center server and the process servers in your runtime environments. Launch More info						
Tech Preview: Responsive Federated Portal 	Business Process Choreographer Explorer 	Business Rules Manager 				
Technical demonstrations of Responsive Federated Portal and Responsive Coach Toolkit as a sample Launch More info						
Monitor and manage BPEL processes. The BPC Explorer provides a number of views that show process and task metadata Launch More info						
Manage business rules Launch More info						

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Figure A-11. IBM BPM on Cloud user portal (1 of 2)



IBM BPM on Cloud user portal (2 of 3)

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

Test Environment

Process Portal  Collaborate on tasks and view the performance of individuals, teams, and processes on dashboards. Launch More info	Process Admin Console  Manage the Process Center server and the process servers in your runtime environments. Launch More info	Tech Preview: Responsive Federated Portal  Technical demonstrations of Responsive Federated Portal and Responsive Coach Toolkit as a sample Launch More info	Business Process Choreographer Explorer  Monitor and manage BPEL processes. The BPC Explorer provides a number of views that show process and task metadata Launch More info
Business Rules Manager  Manage business rules Launch More info			

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Figure A-12. IBM BPM on Cloud user portal (2 of 3)



IBM BPM on Cloud user portal (3 of 3)

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

Process Runtime Operating Environment

Process Portal  Collaborate on tasks and view the performance of individuals, teams, and processes on dashboards. Launch More info	Process Admin Console  Manage the Process Center server and the process servers in your runtime environments. Launch More info	Tech Preview: Responsive Federated Portal  Technical demonstrations of Responsive Federated Portal and Responsive Coach Toolkit as a sample Launch More info	Business Process Choreographer Explorer  Monitor and manage BPEL processes. The BPC Explorer provides a number of views that show process and task metadata Launch More info
Business Rules Manager  Manage business rules Launch More info			

IBM BPM on Cloud

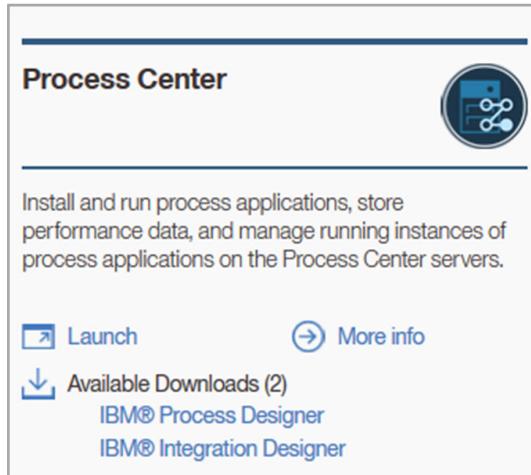
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Figure A-13. IBM BPM on Cloud user portal (3 of 3)



Using the IBM Process Designer (1 of 3)

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



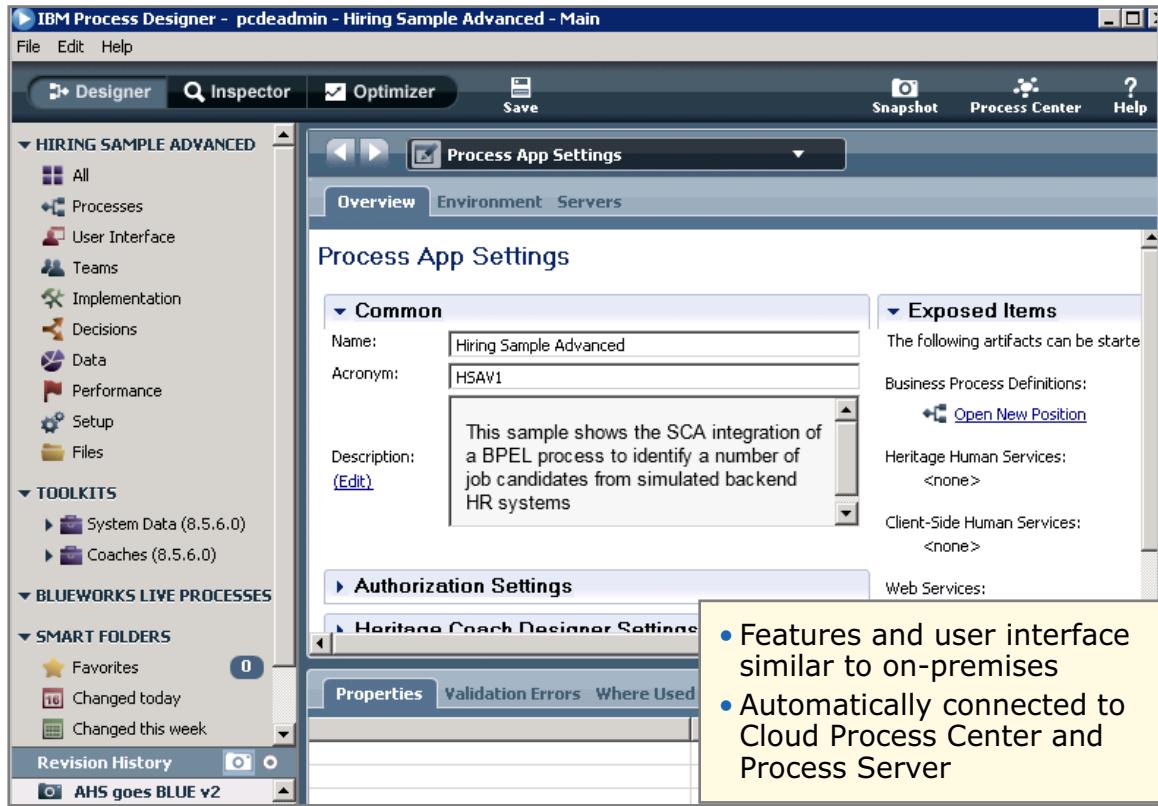
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Figure A-14. Using the IBM Process Designer (1 of 3)

IBM Training

Using the IBM Process Designer (2 of 3)



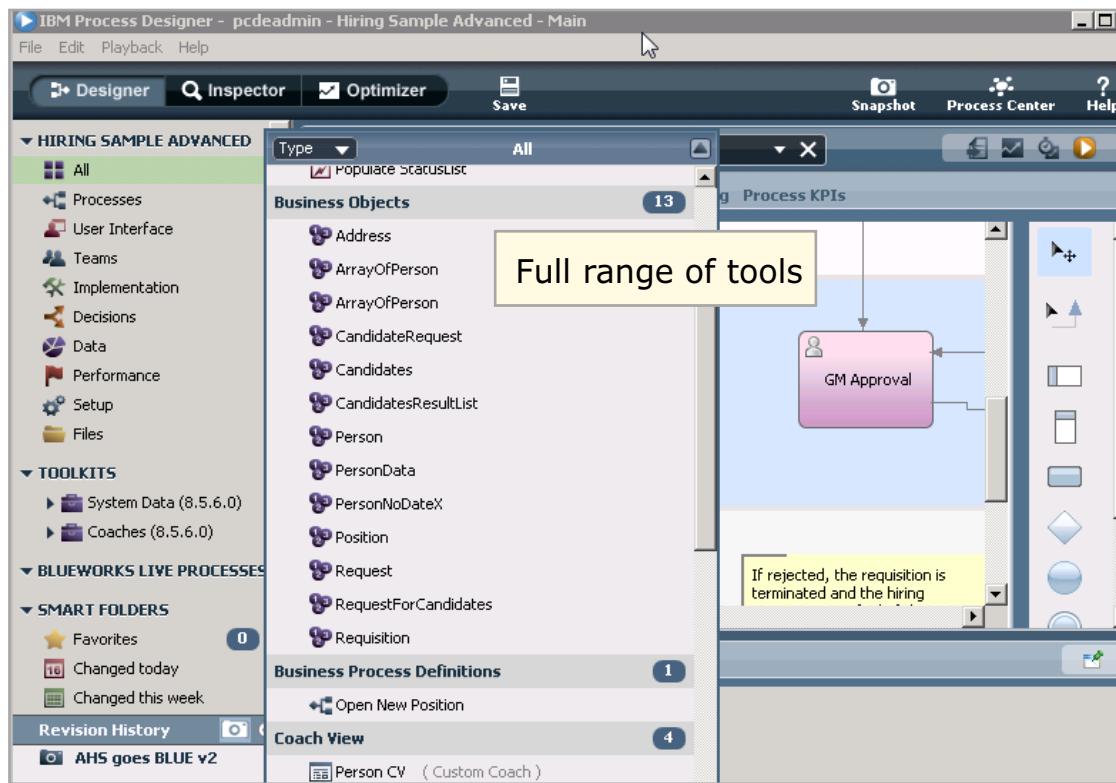
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Figure A-15. Using the IBM Process Designer (2 of 3)



Using the IBM Process Designer (3 of 3)



IBM BPM on Cloud

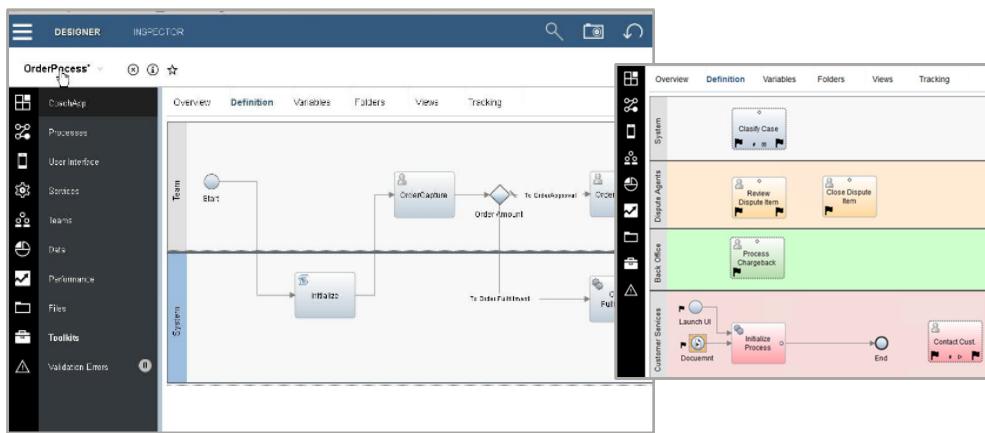
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Figure A-16. Using the IBM Process Designer (3 of 3)



Web-based Process Designer

- Modern visual design based on IBM Design Language
- Combined model for process and case work patterns
- Enhanced coach development with mobile coach views, visual themes, grid layout, and client-side human services
- Customize the Process Portal, based on coach dashboards
- New process app analysis cloud



IBM BPM on Cloud

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Figure A-17. Web-based Process Designer

The Process Portal has been completely re-designed. It is responsive, so it can be used on desktop, tablet, or mobile supporting iOS and Android devices. Field workers can now access their tasks from virtually anywhere with appropriate network access.

The portal can be used with a single process server or with the process federation server. Federation enables migration, isolation, and scalability. BPEL tasks are federated enabling customers to move to BPMN while protecting their existing investment.

Saved searches are now available for individuals and teams.

The portal is 100% coach based, so it can be easily customized. Configuration options allow administrators to enable and disable specific aspects such as social capabilities.

The screenshot shows the IBM Process Center Console interface. At the top, there's a blue header bar with the text "IBM Training" on the left and the "IBM" logo on the right. Below the header is a main title "Using the IBM Process Center Console (1 of 3)". Underneath the title is a bullet point list: "• Familiar interface". The main content area is a web-based dashboard titled "Process Apps". It features a navigation bar with tabs for "Process Apps", "Toolkits", "Servers", and "Admin". On the right side of the navigation bar are links for "Preferences | Logout" and a search bar. The main content area has a "Sort By" dropdown set to "Recently Updated" with options "All", "Favorites", and "Archived". There are two listed items: "Hiring Sample Advanced (HSAV)" and "Account Verification Skeleton (AVS)". Each item has a small icon, a name, a star rating, and a question mark icon. Below each item is a note about its last update. To the right of the items is a button labeled "Open in Case Designer". On the far right of the dashboard is a vertical sidebar with several options: "Create New Process App", "Import Process App", "Download Process Designer", "Download MobileFirst Adapter", and "Launch Getting Started". The bottom right corner of the dashboard displays the "IBM | Process Center" logo.

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Figure A-18. Using the IBM Process Center Console (1 of 3)



Using the IBM Process Center Console (2 of 3)

- Cloud-based Case Designer

IBM BPM on Cloud

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Figure A-19. Using the IBM Process Center Console (2 of 3)



Using the IBM Process Center Console (3 of 3)

- Snapshots, export, install familiar

A screenshot of the IBM Process Center Console interface. At the top, there's a navigation bar with tabs: Process Apps, Toolkits, Servers, and Admin. Below that is a sub-navigation bar for the 'Account Verification Skeleton (AVS)' application, with tabs for Snapshots, History, Manage, and Governance. The main area shows two snapshots listed: 'Current' (last changed on 2/4/16) and 'Skeleton Rewired (SR)' (created on 2/4/16). The 'Skeleton Rewired (SR)' snapshot is highlighted as '(New)'. A modal dialog box titled 'Install Snapshot to Server' is open, prompting the user to select a server to install the snapshot. It lists two servers: 'TEST ProcessServer (10.76.89.120)' and 'RUN ProcessServer (10.76.89.121)'. The 'TEST' server is selected, indicated by a green checkmark next to its name. A sorting dropdown at the top right of the main area says 'Sort Snapshots By Date'.

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Figure A-20. Using the IBM Process Center Console (3 of 3)



Using the IBM Process Portal

- Users shown familiar Work, Tasks, Coaches interface

The screenshot shows the IBM Process Portal interface. At the top, there are tabs for 'My Work', 'PROCESS...', 'TEAM PERFORMANCE', and 'PROCESS PERFORMANCE'. Below the tabs, the 'My Work' section is active, showing 'My Tasks' and 'Overdue (9)'. One task is highlighted: 'Step: Enter Applicant' with a red exclamation mark icon. The main content area is titled 'Step: Submit job requisition'. It contains several data entry fields:

- Requester:** Request number (1140), Hiring Manager (Roland Peisl)
- Requested job position:** Employment status, Department, Number of employees required (1)
- Requested job start date and location:** Planned date of job start (2/4/2016), Location
- Position data:** Position type, Job title (Head of Product Development)
- Make your decision:** A blue 'Next' button.

IBM BPM on Cloud

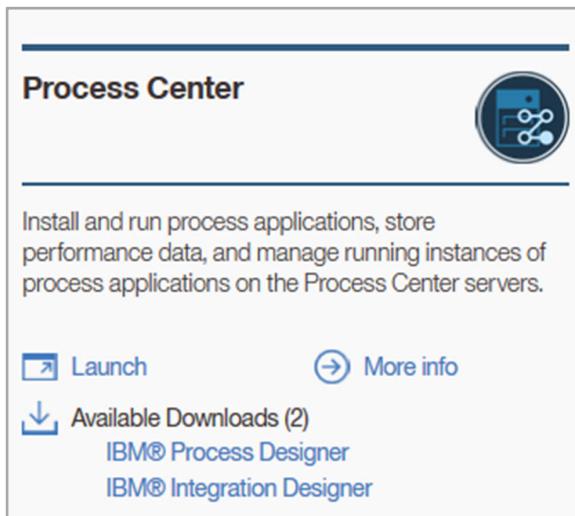
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Figure A-21. Using the IBM Process Portal



Using the IBM Integration Designer

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



IBM BPM on Cloud

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Figure A-22. Using the IBM Integration Designer

Connectivity to IBM BPM on Cloud

- Inbound calls into IBM BPM on Cloud instance
 - All inbound connectivity is HTTP/SSL
 - Requires user identity such as basic User Auth Header
- Outbound calls from IBM BPM on Cloud instances
 - Suggest a HTTP/SSL or VPN for secure communication
 - Use the built-in certificate admin to manage your certificates for services you connect to the environment
- VPN Setup (VPN service is included with IBM BPM on Cloud)
 - IBM operational team can assist you with set up
 - You need access to the client network experts to configure the client side

IBM BPM on Cloud

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Figure A-23. Connectivity to IBM BPM on Cloud

Finding help for IBM BPM on Cloud

- IBM Knowledge Center for IBM BPM on Cloud
http://www.ibm.com/support/knowledgecenter/SS964W/ditamaps/product_welcome_oncloud.html
 - Complete product documentation for IBM BPM on Cloud, including a “Getting Started” tutorial
 - IBM BPM on Cloud user portal also has direct links to the documentation
- IBM BPM 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

IBM BPM on Cloud

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Figure A-24. Finding help for IBM BPM on Cloud

Appendix B. List of abbreviations

AIS	Advanced Integration services
AIX	Advanced IBM UNIX
AMI	Application Messaging Interface
APAR	authorized program analysis report
API	application programming interface
ARM	Application Response Measurement
ASCII	American Standard Code for Information Interchange
AST	Application Server Toolkit
B2B	business-to-business
BAL	Business Action Language
BFM	Business Flow Manager
BLA	business-level application
BO	business object
BPC	Business Process Choreographer
BPCIVT	Business Process Choreographer Installation Verification Test
BPD	business process definition
BPE	business process engine
BPEL	Business Process Execution Language
BPM	business process management
BPMN	Business Process Model and Notation
BRM	Business Rules Manager
BSM	business state machine
CA	certificate authority
CEI	Common Event Infrastructure
CGBI	core group bridge interface
CGBS	core group bridge service
CICS	Customer Information Control System
CIFS	Common Internet File System
COBOL	Common Business Oriented Language
COE	Center of Excellence

CORS	cross-origin resource sharing
CPU	central processing unit
CVS	Concurrent Versions System
DCS	Distribution and Consistency Services
DDL	Data Definition Language
DDT	database design tool
DMZ	demilitarized zone
DNS	Domain Name System
DRS	data replication service
EAI	Enterprise Application Infrastructure
EAR	enterprise archive
EE	Enterprise Edition
EIS	Enterprise Information System
EJB	Enterprise JavaBeans
EM	Event Manager
EPV	exposed process value
ESB	enterprise service bus
FFDC	first-failure data capture
FQDN	fully qualified domain name
FTP	File Transfer Protocol
GC	garbage collector
GUI	graphical user interface
HA	high availability
HACMP	High-Availability Cluster Multi-Processing
HAM	high availability manager
HPEL	High Performance Extensible Logging
HTM	Human Task Manager
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IBM	International Business Machines Corporation
IIOP	Internet Inter-ORB Protocol
ILO	instructor-led online
ILT	instructor-led training
IMS	Information Management System

I/O	input/output
IP	Internet Protocol
ISC	Integrated Solutions Console
ISMP	Install Shield MultiPlatform
IT	information technology
IVT	installation verification test
J2C	J2EE Connector architecture
J2EE	Java 2 Platform, Enterprise Edition
JAAS	Java Authentication and Authorization Service
JAR	Java archive
Java EE	Java Platform, Enterprise Edition
JCA	Java Connector Architecture
JDBC	Java Database Connectivity
JDK	Java Development Kit
JEE	Java Enterprise Edition
JMS	Java Messaging Service
JMX	Java Management Extensions
JNDI	Java Naming and Directory Interface
JSF	JavaServer Faces
JSON	JavaScript Object Notation
JSP	JavaServer Pages
JSSE	Java Secure Socket Extensions
JVM	Java virtual machine
KPI	key performance indicator
LDAP	Lightweight Directory Access Protocol
LOB	line of business
LSD	location service daemon
LTPA	Lightweight Third Party Authentication
LTS	long-term support
MDB	message-driven bean
ME	messaging engine
MEDB	messaging engine database
MQ	Message Queue
MQI	Message Queue Interface

ND	Network Deployment
NFS	Network File System
OASIS	Organization for the Advancement of Structured Information Standards
ODM	IBM Operational Decision Manager
ODR	on-demand router
ORB	Object Request Broker
PaaS	platform as a service
PC	Process Center
PD	problem determination
PDW	Process Data Warehouse
PFS	Process Federation Server
PHD	Portable Heap Dump
PMI	Performance Monitoring Infrastructure
PMR	problem management report
PMT	Profile Management Tool
POC	Proof-of-concept
POJO	plain old Java object
QA	quality assurance
QCF	queue connection factory
QoS	quality of service
RA	resource adapter
RAID	Redundant Array of Independent Disks
RAM	random access memory
RAR	resource adapter archive
REST	Representational State Transfer
RMI	Remote Method Invocation
RMI/IOP	Remote Method Invocation over Internet InterORB Protocol
RMLT	resource manager local transaction
RMM	Reliable Multicast Messaging
SAM	Security Access Manager
SAN	storage area network
SAS	Secure Association Service
SCA	Service Component Architecture
SCDL	Service Component Definition Language

SDO	Service Data Object
SIBus	Service integration bus
SMO	service message object
SMTP	Simple Mail Transfer Protocol
SOA	service-oriented architecture
SOAP	A lightweight, XML-based protocol for exchanging information in a decentralized, distributed environment. SOAP can be used to query and return information and invoke services across the Internet.
SPI	service provider interface
SQL	Structured Query Language
SR	service request
SSL	Secure Sockets Layer
SWAM	Simple WebSphere Authentication Mechanism
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TM	transaction manager
UCA	undercover agent
UI	user interface
UML	Unified Modeling Language
UNIX	Uniplexed Information and Computing System
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
UTE	unit test environment
UUID	Universally Unique Identifier
VMM	virtual member manager
WAR	Web archive
WLM	workload management
WS-BPEL	Web Services Description Language
WSDL	Web Services Description Language
XCT	cross-component trace
XML	Extensible Markup Language
XSL	Extensible Stylesheet Language
XSLT	Extensible Stylesheet Language Transformation
z/OS	zSeries Operating System

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=a003096>

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/IBMCLOUDedu

- **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

- **YouTube:**

- See the IBM Training YouTube channel to learn about IBM training programs and courses.
- Find IBM Training at: youtube.com/IBMTTraining

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



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