Note: Before using this information and the product it supports, read the information in “Notices” on page xi.

First Edition (July 2013)

This edition applies to IBM Business Process Manager Version 8.0.

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## Part 1. Overview

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Preface

This IBM® Redbooks® publication describes how to build production topologies for IBM Business Process Manager V8.0. This book is an update of the existing book IBM Business Process Manager V7.5 Production Topologies, SG24-7976. It is intended for IT Architects and IT Specialists who want to understand and implement these topologies. Use this book to select the appropriate production topologies for an environment, then follow the step-by-step instructions to build those topologies.

Part 1 introduces IBM Business Process Manager and provides an overview of basic topology components, and Process Server and Process Center. This part also provides an overview of the production topologies described in this book, including a selection criteria for when to select a topology. IBM Business Process Manager security and the presentation layer are also addressed in this part.

Part 2 provides a series of step-by-step instructions for creating production topology environments by using deployment environment patterns. This process includes topologies that incorporate IBM Business Monitor. This part also describes advanced topology topics.

Part 3 covers post installation instructions for implementing production topology environments such as configuring IBM Business Process Manager to use IBM HTTP Server and WebSphere® proxy server.

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- IBM ITSO Technical Editor
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- IBM Redbooks Project Leader
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Overview

This part includes the following chapters:

- Overview of IBM Business Process Manager
- Business Process Manager, Business Monitor, and WebSphere Application Server
- IBM Business Process Manager security
- IBM Business Process Manager presentation layer
- Clustered topology choices
- Advanced topology choices
- IBM HTTP Server and WebSphere proxy server
Overview of IBM Business Process Manager

This chapter provides a general overview of IBM Business Process Manager, and contains the following sections:

- 1.1, “Business process management lifecycle” on page 4
- 1.2, “IBM Business Process Manager” on page 5
- 1.3, “IBM Business Monitor” on page 11
- 1.4, “IBM WebSphere Application Server” on page 12
1.1 Business process management lifecycle

Figure 1-1 shows the business process management (BPM) approach of the lifecycle of a business process.

**Note:** Throughout this book, the BPM acronym is only used as an abbreviation for the business process management discipline. It is *not* used to specify the IBM Business Process Manager product.

As shown in Figure 1-1, the lifecycle of a business process consists of the following stages:

- Discover and document
- Plan
- Implement
- Deploy
- Manage and optimize

If a process is being used, there are always actions that are related to it. Process improvement activity related to the process lifecycle does not stop after installing it. The process must also be managed.

The first stage of the lifecycle is used to identify the requirements for a business process and analyze how the process can be modeled.
The plan and implement phases are when the actual development of the business process occurs.

In the deploy phase, the newly developed business process is distributed to the environment where it is executed and used by a business organization.

The manage phase concentrates on process improvement activities that are related to the business process, such as optimizing and initiating updates to the process.

For more information about using the BPM methodology in your company and implementing a business process with a BPM suite, see Scaling BPM Adoption: From Project to Program with IBM Business Process Manager, SG24-7973.

1.2 IBM Business Process Manager

IBM Business Process Manager is a comprehensive and consumable BPM suite that provides visibility and management of your business processes. IBM Business Process Manager supports the whole BPM lifecycle approach. IBM Business Process Manager also includes tools and run times for process design, execution, monitoring, and optimization. Process owners and business owners can use IBM Business Process Manager to directly improve their business processes.

A highly integrated environment that scales smoothly and easily from initial project to enterprise-wide program, IBM Business Process Manager is designed for easy deployment. It is ready for use, and can be deployed in an easily customizable configuration. IBM Business Process Manager helps to provide rapid time to value and improved user productivity.
Figure 1-2 shows an overview of the IBM Business Process Manager functionality.

1.2.1 IBM Business Process Manager configurations

There are three versions of the IBM Business Process Manager. Each version is designed to match an increased level of functional complexity:

- **IBM Business Process Manager Express** is designed for small BPM projects, and is configured to operate with few users or a single server with no clustering. This version of IBM Business Process Manager also offers a low entry price and an easy installation routine.

- **IBM Business Process Manager Standard** is used for typical BPM projects, and is designed for multi-project improvement programs that have a high business involvement. Additionally, the standard configuration offers an improved user productivity and basic system integration support.
IBM Business Process Manager Advanced offers the complete set of advanced BPM capabilities, extending the support for high-volume process automation with high quality of service. The advanced configuration also offers a built-in service-oriented architecture (SOA) components for extensive enterprise-wide service integration and orchestration. The advanced configuration also includes all of the capabilities of WebSphere Enterprise Service Bus.

Table 1-1 provides an overview of the differences between all three editions on the application and service level.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>WebSphere Application Server Administration, Service Integration Bus, Naming, Security</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Supports WebSphere clustering High Availability Manager</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>IBM Business Process Manager Process Server Process Portal, Process Admin, Repository</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Performance Data Warehouse</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Service Component Architecture Failed Event Manager</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Business Space Business Space Manager, REST Services Gateway, various widgets</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Business Process Choreographer Business Process Choreographer or Human Task Manager Containers, Business Process Choreographer Tools</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Common Event Infrastructure Event Service</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
For more information, see the following resources:

- 2.6, “IBM Business Process Manager Environment concepts” on page 25
- IBM Business Process Manager configurations:
  
  http://publib.boulder.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.main.doc/topics/cbpm_configurations.html

- IBM Business Process Manager configuration capabilities:
  

### 1.2.2 IBM Business Process Manager architecture

IBM Business Process Manager consists of several components:

- Process Center including the Business Process Manager Repository
  
  For more information, see 1.2.3, “Overview of Process Center” on page 9.

- Process Server
  
  For more information, see 1.2.4, “Overview of Process Server” on page 10.

- IBM Process Designer

- IBM Integration Designer
In IBM Business Process Manager, processes are authored in the Process Center, which governs the entire lifecycle of the process. The business processes can be developed (and authored) by using the IBM Process Designer and IBM Integration Designer. These processes are then published to the Process Server for runtime operation.

1.2.3 Overview of Process Center

The Process Center provides the repository that is used for BPM and the tools that are used to govern the lifecycle of business processes.

Lifecycle management includes the deployment of processes to Process Server run times, and creating and maintaining snapshot data. In Process Center, a tool known as the Process Center Console allows you to maintain the repository,
deploy process applications to Process Server environments, and manage running instances of process applications in configured environments.

The Process Center includes an Process Server (the playback server) and performance data warehouse. These allow users to work in the authoring environments to run processes and store performance data for testing and playback purposes. For more information, see 2.3, “Repository components and concepts” on page 15.

The repository in the Process Center is where the authored artifacts are saved. IBM Business Process Manager uses these authoring environments:

- **IBM Process Designer** is an Eclipse-based tool that is used by business process authors. IBM Process Designer is available in all configurations of the product, and allows you to model and implement business processes as process applications. IBM Process Designer includes extra tools, the Process Inspector, and the Process Optimizer. This tools are for interacting with processes running on the Process Center Server (playback server) or a connected Process Server deployment target.

- **IBM Integration Designer** is an Eclipse-based tool that is used by IT developers. IBM Integration Designer is only available in the advanced configurations of the product. IBM Integration Designer is used to author complex integrations and fully automated processes that support process applications designed in the IBM Process Designer. IBM Integration Designer has a fully integrated testing environment that uses test cases and test suites. IT developers can build reusable SOA services, orchestrate those services, and access back-end systems.

For more information about the authoring environments, see 2.4, “Design components and concepts” on page 18.

### 1.2.4 Overview of Process Server

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

You can use Process Server to run processes as you build them. Process Server runs processes and services that authors build by using the Authoring Environments. Process Server handles a process's access to external applications, the Coaches (the graphical user interfaces for process participants), and the business logic. Every process component is loaded and run in Process Server at run time.
The Process Server also provides a number of tools, for example, the Process Admin Console, that enable the management of the Process Server and deployed applications.

A second tool is the Process Portal, which can be used to give individual users access to run and manage the tasks of the business processes. In addition, the Process Portal measures performance of business processes, teams, and individuals. The Process Portal delivers an accurate overview that covers all aspects of the governed running business processes.

For more information look at 2.5, “Runtime components and concepts” on page 22.

1.3 IBM Business Monitor

IBM Business Monitor is a comprehensive business activity monitoring (BAM) software that provides an up-to-date view of your business performance. IBM Business Monitor also provides predictions so that you can act before process problems occur. Personalized business dashboards process business events and data, and calculate key performance indicators (KPIs) and metrics.

IBM Business Monitor can collect events and data from a wide variety of sources. Sources can include business applications that are running in an IBM Business Process Manager Express, Standard, or Advanced Process Server runtime environment. In addition, IBM Business Process Manager environments, events and data can be routed to IBM Business Monitor from other sources. These sources include WebSphere Message Broker, WebSphere MQ Workflow, WebSphere Business Events, WebSphere Enterprise Service Bus, and IBM CICS®.

IBM Business Monitor also offers these functions:

- Linking strategic organization goals to operational metrics
- Handling in-flight processes
- Improving end-to-end process monitoring by capturing events from many middleware and application sources

For more information, see 2.7, “Monitoring components and concepts” on page 38.
1.4 IBM WebSphere Application Server

An application server provides the infrastructure for running applications that run your business. This server insulates the infrastructure from the hardware, operating system, and the network. The application server also serves as a transaction and messaging engine. An application server delivers business logic to users on various client devices.

The application server acts as middleware between back-end systems and clients. It provides a programming model, an infrastructure framework, and a set of standards for a consistent designed link between them.

IBM WebSphere Application Server provides the environment to run your solutions and to integrate them with every platform and system. They are integrated as business application services that conform to the SOA reference architecture.

IBM WebSphere Application Server is the IBM runtime environment for Java language-based applications.

For more information, see 2.8.1, “IBM WebSphere Application Server” on page 41.
Business Process Manager, Business Monitor, and WebSphere Application Server

This chapter provides an introduction to the IBM Business Process Manager approach to an end-to-end business process management suite, IBM Business Monitor as monitoring solution, and an IBM WebSphere Application Server concept. It also provides an overview of the concepts and components that support these environments.

This chapter includes the following sections:

- 2.1, “Introduction” on page 14
- 2.2, “IBM Business Process Manager environment” on page 14
- 2.3, “Repository components and concepts” on page 15
- 2.4, “Design components and concepts” on page 18
- 2.5, “Runtime components and concepts” on page 22
- 2.6, “IBM Business Process Manager Environment concepts” on page 25
- 2.7, “Monitoring components and concepts” on page 38
- 2.8, “Network deployment environment concepts” on page 41
- 2.9, “More product components” on page 46
2.1 Introduction

At the highest level, a IBM Business Process Manager environment contains the unified IBM Business Process Manager repository, the authoring environments, and the runtime execution environments. A typical IBM Business Process Manager environment includes authoring environments, a Process Center, and multiple Process Server environments.

Each Process Center environment and Process Server environment are built on an IBM WebSphere Application Server cell. An IBM Business Process Manager cell topology is a cell-level view of the nodes, servers, clusters, resources, and functional configuration for a specific cell. IBM WebSphere Application Server administration and functional capabilities support the IBM Business Process Manager components that are configured in each cell. In addition, the IBM Business Process Manager components are arranged within the cell to best meet the requirements.

2.2 IBM Business Process Manager environment

Business process management addresses end-to-end process management, and brings order to problems faced by distributed organizations. A IBM Business Process Manager environment supports an end-to-end story by using an system that containing a repository (Process Center), governance functions, authoring tools, multiple test environments (Process Server), and the production runtime environment (another Process Server).
Figure 2-1 illustrates a IBM Business Process Manager environment.

Figure 2-1   A high-level view of a IBM Business Process Manager topology

2.3 Repository components and concepts

At the heart of the business process management environment is a repository. Essentially, all other capabilities of a business process management environment are concerned with submitting assets into, managing assets within, or installing assets out of this repository. In IBM Business Process Manager, the repository is the Process Center. This section describes the Process Center. Specifically, in IBM Business Process Manager Advanced you can work without a repository. For more information about how this works, see 2.6.5, “Environment for IBM Business Process Manager Advanced without Process Center” on page 37.
The Process Center is the master repository for all process assets that are designed and developed within an organization to address and optimize business process issues.

The Process Center environment comprises a unified repository for all shared assets that are produced using the authoring environments (Figure 2-2).

![Process Center Diagram]

The following are among the shared assets:

- Process application models and their versioned snapshots. These are logical containers of functions that are packaged to address specific business issues.
- Reusable asset libraries and their versioned snapshots. These assets are called the Toolkit in IBM Business Process Manager.
- Service integrations modules.

The shared assets also include the following components:

- A web-based administration console that is a convenient location to create and maintain high-level containers such as Process Applications and Toolkits. It can also manage the installation of Process Application snapshots to Process Center environments, and manage user access permissions.
- The possibility to develop custom governance processes and assign them to individual Process Applications. Templates provide the basic resources for creating processes that govern installation or provide notifications of a change in the status of a snapshot.
- Built-in playback runtime or process execution functions for interactive unit testing of the designed assets before you install the versioned snapshots to a runtime Process Server environment.
A web-based Process Server Administration console that you can use to administer Process Servers in your environment, including the users and installed snapshots for each server. In addition, it provides tools to help you manage queues and caches, and also includes the Process Inspector, which is a tool to view and manage process instances for applications that are running on a specific Process Server.

Process Portal is where you can complete the tasks that result from running processes on the included Process Server. In addition, if you have the associated permission, you can use it to start and stop processes, manage and run tasks for each process, and view the performance of individuals, teams, and processes. For more information about Process Portal, see 4.2, “Process Portal” on page 82.

The Performance Data Warehouse (PDW) function collects and tracks business process statistics. It is used for process reporting and feedback into the process improvement and optimization stages of the process lifecycle. PDW also provides a web-based Performance Server Administration console for managing and maintaining operational functionality.

Resources: For more information about Process Center, see the website at: 
2.4 Design components and concepts

A key part of an end-to-end business process management environment is the design and development of artifacts, described as design assets, and the tools that are used to create these assets. The assets that are created in the authoring environments are stored and managed in the Process Center repository.

2.4.1 Authoring environments

IBM Business Process Manager offers two authoring environments:

- IBM Process Designer
- IBM Integration Designer

Use IBM Process Designer to efficiently model business processes that involve human tasks, web services, enterprise data sources, and messaging. Use IBM Integration Designer to build services, focused on system automation and high-throughput transactions, that are self-contained or that start other existing services. These services can include web services, enterprise resource applications, and applications that run in CICS and IBM IMS™.

IBM Process Designer is available in all editions of the product. In addition to IBM Process Designer, IBM Business Process Manager Advanced also uses IBM Integration Designer.

**Resources:** For more information about IBM Process Designer and IBM Integration Designer details, see the website at:

http://publib.boulder.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.main.doc/topics/cbpm_ae.html

**IBM Process Designer**

IBM Process Designer enables development of business processes. With this easy-to-use graphics-oriented tool, you can create a sequence of actions that compose a business process. You can also redesign that process over time as business requirements evolve.

IBM Process Designer is obtained by downloading and installing a package from an Process Center environment on a developer's local system.

Typically, Business Process Modeling Notation (BPMN) assets are produced within the IBM Process Designer.
IBM Integration Designer

IBM Integration Designer aids editors and developers in creating complex automated processes and services.

IBM Integration Designer provides functionality to create integrations to large, complex systems or services that provide data for the business process, if one or more activities require access. Using a simple interface, an activity in IBM Process Designer can call a service that is created in IBM Integration Designer.

IBM Integration Designer is offered as a separate product download.

Typically, Business Process Execution Language (BPEL) assets are produced within the IBM Integration Designer.

2.4.2 Design assets

Design assets are created by using IBM Business Process Manager authoring environments, IBM Process Designer, and IBM Integration Designer.

A process model or definition is the major unit of logic in IBM Business Process Manager. A Process Application is the container for all components of a process definition, which include:

- Services, activities, and gateways
- Timer, message, and exception events
- Sequence lines, rules, and variables

When you model a process, you are creating reusable business process definitions (BPDs).

You can use process components to define the process workflow for users, creating logic inside a Process Application and integrating with other enterprise applications, services, and data sources. To understand what occurs inside a
process at run time, it is important to understand the components that make up a process at design time.

The same process model is used or shared between the runtime Process Server environment and the design-time Process Center environment.

Design assets are contained and distributed in Process Applications that are managed in the Process Center repository. Figure 2-3 illustrates a number of Process Applications and the snapshots associated with each one.

![Diagram of IBM Process Center Repository with Process Applications and Snapshots](image)

*Figure 2-3  Process applications and their associated snapshots exist in the Process Center repository*
The following section describes some of the key high-level design assets.

**Process Applications**
Process Applications are containers for the process models and supporting implementations that IBM Business Process Manager analysts, consultants, and developers create by using IBM Process Designer.

**Snapshots and tracks**
Tracks, also known as branches, are optional subdivisions in a Process Application based on project tasks or Process Application release versions. You can determine whether more tracks are necessary for each Process Application, and enable them at any time.

Snapshots record the state of the items within a Process Application or track at a specific point in time. From the Process Center console, you can create snapshots of your Process Applications. You can *only* install specific snapshots of your Process Applications to Process Servers in staging, test, and production runtime environments.

**Toolkits**
Toolkits are packaged reusable, versioned, shared libraries of functions.

Toolkits are created to enable IBM Process Designer users to share common library items across Process Applications. Toolkits are used by Process Applications by creating dependencies between toolkits and Process Applications. When a Process Application is installed to a runtime Process Server, all required dependencies and their specific snapshot versions are also installed.

**Resources:** For more information, see the following website:

**Advanced integration services**
Advanced Integration services are packaged as discreet, self-contained modules that are incorporated into a Process Application. These are developed by using
either the IBM Process Designer or the IBM Integration Designer authoring environments.

**Resources:** For more information about Advanced Integration services, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.auth.stp.doc/topics/cbpm_stpovw.html

### 2.5 Runtime components and concepts

The artifacts stored in the Process Center repository are installed to and run in runtime Process Server environments.

#### 2.5.1 Process Server

A Process Server provides a single runtime and execution environment. This environment can support a range of business processes, service orchestration, and integration capabilities for installed and released Process Application snapshots. Figure 2-4 shows the high-level capabilities.

![Process Server](image)

There are these types of runtime Process Server:

- **Online or connected**
  
  An online runtime Process Server configured during an IBM Business Process Manager installation is automatically discovered and displayed in the web-based Process Center console.

- **Offline**
  
  An offline server is a runtime Process Server that is not connected to a Process Center. Offline servers can still be used when you are installing snapshots of Process Applications. However, the method for installing...
Process Application snapshots to an offline Process Server differs from the method for installing Process Application snapshots to an online Process Server.

**Resources:** For more information about online and offline Process Server, see the following website:

http://publib.boulder.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.admin.doc/topics/deploying_introduction.html

Process Server also include the following components:

- **Runtime or process execution functionality released versioned snapshots**
  
  This component also provides a web-based Process Server Administration console, Process Portal for user tasks, Business Space, and Business Process Choreographer Explorer.

- **The Performance Data Warehouse functionality that collects and tracks business process statistics**
  
  This component is used for process reporting and feeding into the process improvement and optimization stages of the process lifecycle. It also provides a web-based Performance Server Administration console for managing and maintaining operational functionality.

**Resources:** For more Process Server details, see the following websites:


2.5.2 Runtime environment

A runtime environment consists of one or more Process Server environments (Figure 2-5).

![Diagram showing Process Designer, Process Center Governance of Entire BPM Life Cycle, and Process Servers in Test, Staging, and Production environments.]

There are three types of runtime environments that are installed and configured in a typical setup:

- **Test**
  
  Using the Process Center console, install your Process Applications to the Process Server in your test environment to implement formal quality assurance and functional tests. For online Process Server, the Process Inspector is used to help verify and resolve issues.

- **Staging**
  
  Using the Process Center console, install your Process Applications to the Process Server in your pre-production environment to implement system integration and non-functional quality assurance tests. For online Process Server, the Process Inspector is used to help verify and resolve issues.
Production

This environment is the Process Server environment for final production releases of Process Application snapshots. After the issues reported during formal testing are resolved, the Process Center console is usually used to install the Process Application snapshots to a Process Server environment designated for production use. For online Process Server, the Process Inspector is used to help verify and resolve issues in the production environment.

**Resources:** For more information about the runtime environment, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.admin.doc/topics/install_runtime.html

For online runtime Process Server environments, it is possible to connect the Process Inspector. This capability is not currently available for offline runtime Process Server environments.

**Resources:** For more information about Process Server and Process Inspector, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.admin.doc/topics/admin_apps_in_runtime.html

### 2.6 IBM Business Process Manager Environment concepts

This section addresses the following topics:

- Process Center and Process Server combinations
- Advanced topic: Satellite Process Center and Process Server combination
2.6.1 Process Center and Process Server combinations

A IBM Business Process Manager environment can consist of the combinations of Process Centers and Process Server Environments that are listed in Table 2-1.

Table 2-1 Valid Process Center and Process Server environment combinations

<table>
<thead>
<tr>
<th>Process development combinations</th>
<th>Process Center environment (development and repository)</th>
<th>Process Server environment (runtime and execution)</th>
<th>IBM Process Designer (BPMN Process Application design)</th>
<th>IBM Integration Designer (BPEL Process Application design)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process development for process models using IBM Business Process Manager Advanced</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Process development for process models using IBM Business Process Manager Standard</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Process development for process models using IBM Business Process Manager Advanced without a Process Center</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Environment combination 1 and 2: Process Center Environment and Process Server Environment

This is the default environment combination where there is one central Process Center environment installed to a number of associated Process Server environments, with either just IBM Process Designer, or both IBM Integration Designer and IBM Process Designer.
This environment is typically set up in an online Process Server configuration. Figure 2-6 illustrates the IBM Business Process Manager Standard server and database components in each environment. The Process Center (Dev) in the "Hub" is the repository. The numbers in Figure 2-6 depict the development and installation lifecycle of a Process Application snapshot within the environment:

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

**Environment combination 3: Process Server Environment**

This IBM Business Process Manager environment combination contains no central, sole Process Center. Artifacts that are developed within the IBM Integration Designer are installed directly to a number of Process Server environments, not through the Process Center repository.
2.6.2 Advanced topic: Satellite Process Center and Process Server combination

The following considerations can be used to qualify the application of the advanced architectural pattern, Satellite Process Center, and Process Server mentioned in this section:

- Currently, for an offline Process Server environment, it is not possible to use the process inspector functions for troubleshooting issues.

- The Satellite Process Center and Process Server pattern can be useful when the following considerations apply to your usage requirements:
  - There is a requirement for network separation, possibly including geographical separation, between IBM Business Process Manager environments. When the Process Servers are online to their Process Center environments, the Process Server and the Process Center must be within the same network and geographic boundary. Therefore, for the Process Server environments to be separated from each other but still online to a Process Center, a Process Center must be available in each network or geographically separated environment.
  - You want to use the Process Center installation capabilities between this server combination.

- This configuration provides separate or isolated line-of-business development environments. These environments submit implemented business processes to a corporate center of excellence for further release testing, and finally production release. This process can, for example, use the feeder Satellite Process Center and Process Server pattern.

- The possible license implications and costs of introducing extra Process Center servers are not an obstacle to applying the design pattern.

A Process Center environment usually provides a number of functions, including a repository for design assets and a mechanism for packaging and installing those assets to a runtime environment for execution. A runtime environment consists of at least one Process Server environment. Using the Satellite Process Center and Process Server pattern, a runtime environment can consist of a number of Process Server environments (Figure 2-11 on page 34), effectively creating a cluster farm environment of Process Servers.
Figure 2-7 illustrates the usual functions that are provided by a Process Center. This demonstrates the functional split between the different types of Satellite environments that include at least a Process Center environment, and one or more Process Server environments.

<table>
<thead>
<tr>
<th>IBM Process center functionality</th>
<th>Default Setup Only one IBM Process Center</th>
<th>Satellite setup Multiple IBM Process Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Process development</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Process repository</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3. Process deployment</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4. Process import</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5. Process export</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>6. Process execution space (unit test or run)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7. Operations and administration management</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8. Security configuration</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Figure 2-7  Functional split of satellite Process Center

The term satellite is used to describe the secondary Process Center that effectively acts as an extension to the central Process Center.

Because of specific restrictions (for example, specific networking restrictions, geographical separation of different process development teams, building a utility system platform, and the lack of the process inspector component for the offline runtime Process Server), it is not always possible to rely on a central, sole Process Center. The need to distribute and restrict the functionality of the Process Center has given rise to the Satellite IBM Business Process Manager environment system design pattern (Figure 2-11 on page 34).

There are currently three types of Satellite IBM Business Process Manager environment patterns that can be used to solve specific client system architecture requirements. To transfer assets between these Satellite IBM Business Process Manager environments, use the import and export capabilities of the Process Center.

New in IBM Business Process Manager V8.0, you can share toolkits with other users, even if those users are working in a different Process Center. You no
longer must first export the toolkits from one Process Center and then import them into another Process Center.

After a toolkit is shared, events are synchronized and snapshots are released automatically. The sharing Process Center is notified when a shared toolkit is being used on the registered Process Center. The subscribing Process Center is notified of new released snapshots and the state of the shared toolkits. The shared toolkit is downloaded to the subscribing Process Center as a read-only copy. The subscriber cannot modify or share the subscribed toolkit. This approach is usually used for development environments only.

The separate IBM Business Process Manager environments that make up the overall multiple Process Center design (Figure 2-11 on page 34) are described in the following sections.

**Master IBM Business Process Manager environment**

The Master IBM Business Process Manager environment has the same capabilities as the default, sole IBM Business Process Manager environment (Figure 2-7 on page 29). This environment also has one or more connected Process Servers primarily for the testing lifecycle (Figure 2-8 on page 31). They are used as the master repository, for developing Process Applications, and for releasing sanctioned Process Applications snapshots to production. Most likely, the servers that are installed in this environment can apply to the four-cluster, Remote Messaging, Remote Support, and Web deployment environment pattern that is detailed in Chapter 5, “Clustered topology choices” on page 93.
Figure 2-8 shows the IBM Business Process Manager environment. The numbers in this figure depict the development and installation lifecycle of a Process Application snapshot within the environment:

1. The Process Application snapshot is imported or modified to meet compliance for corporate Business Process implementation and governance.
2. The Process Application snapshot is released for functional testing.
3. The Process Application snapshot is released for staging or pre-production testing.

**Deployment Satellite IBM Business Process Manager environment**

The Deployment Satellite IBM Business Process Manager environment is primarily concerned with supporting an isolated environment for production. The environment in question can be separated by the network, physical geography, or at some system level. It is only a recipient for installing tested and signed-off snapshot versions of a Process Application. Having the Process Server connected to a restricted Process Center ensures that any issues in this environment can use the Process Inspector for troubleshooting. This configuration typically uses the four-cluster, Remote Messaging, Remote Support, and Web deployment environment pattern that is detailed in Chapter 5, “Clustered topology choices” on page 93. Figure 2-9 on page 32 shows the Deployment Satellite IBM Business Process Manager environment. This environment ensures that any unit installation and unit testing carried out on the satellite Process Center can replicate the conditions in the target Process Server runtime environment.
The numbers in Figure 2-9 depict the development and installation lifecycle of a Process Application snapshot within the environment:

1. The Process Application snapshot is imported only from the main central repository.
2. The Process Application snapshot is released for production distribution.

**Feeder Satellite**

The Feeder Satellite IBM Business Process Manager environment is primarily concerned with supporting a local or isolated development environment for a small department or team who are working on a specific process project. The isolated development environment can be separated by the network, physical geography, or at a system level from the master satellite zone. It is only a provider for supplying code-complete, unit-tested, and signed-off snapshot versions of a Process Application. Having an Process Server connected to a restricted Process Center ensures that any issues in this environment can use the Process Inspector for troubleshooting. After the specific development cycle is complete, the environment can be recycled and returned to a general pool of development environments. This system maximizes efficiency, minimizes hardware costs and maintenance, and provides the business agility required to continually improve processes and manage project costs. Typically, apply the single cluster deployment environment pattern, detailed in 5.2, “Single Cluster topology” on page 95, or even the stand-alone server deployment environment pattern.
Figure 2-10 shows the Feeder Satellite IBM Business Process Manager environment. The numbers depict the development and installation lifecycle of a Process Application snapshot within the environment:

1. The Process Application snapshot is created by the local line-of-business.
2. The Process Application snapshot is released for local functional and unit testing before submission to the main central Process Center repository.
Figure 2-11 shows a sample combined environment overview with all the Satellite IBM Business Process Manager environments combined. The combinations in Figure 2-11 effectively provide a flexible solution to the challenges that arise when you design an enterprise architecture for a complex, geographically separated, and distributed system.

![Diagram](image)

**Figure 2-11 Combined Satellite IBM Business Process Manager environments**

### 2.6.3 Environment for IBM Business Process Manager Advanced

For IBM Business Process Manager Advanced, a typical IBM Business Process Manager environment includes one Process Center, multiple instances of authoring environments (both IBM Process Designer and IBM Integration Designer), and multiple runtime environments (Process Server).
Figure 2-12 illustrates an example IBM Business Process Manager Advanced environment with multiple authoring environments and multiple runtime environments that are centered around a single Process Center. This example includes three Process Server runtime environments. Each of these Process Servers can be used in a different capacity. One Process Server can be used for testing, another for staging, and the final Process Server for production.

The specific number of instances of the authoring tools or Process Center runtime environments does not matter to the definition of this pattern. For example, there are three Process Servers illustrated in Figure 2-12. However, even if there are many more Process Server runtime environments configured as installation targets for this Process Center, it can still be the same basic pattern.

### 2.6.4 Environment for IBM Business Process Manager Standard

Although this book focuses on IBM Business Process Manager Advanced, the basic tenets that are described for the IBM Business Process Manager environment apply to both the Standard and Advanced configurations of the
For IBM Business Process Manager Standard, a typical IBM Business Process Manager environment includes one Process Center, multiple instances of IBM Process Designer, and multiple runtime environments (Process Server).

Figure 2-13 illustrates an example IBM Business Process Manager Standard environment with multiple IBM Process Designer and multiple runtime environments centered around a single Process Center. This example shows three Process Server runtime environments. Each Process Server can be used in a different capacity. One Process Server can be used for testing, another for staging, and the final Process Server for production.

The specific number of instances of the authoring environment tools or Process Server runtime environments does not matter to the definition of this pattern. For example, Figure 2-13 illustrated three Process Servers. However, even if there are many more Process Server runtime environments configured as installation targets for this Process Center, it can still be the same basic pattern.

The runtime functionality provided in the Standard configuration is a subset of the functionality that is provided in the Advanced configuration. For more information
about the differences between the two configurations, see 1.2.1, “IBM Business Process Manager configurations” on page 6.

2.6.5 Environment for IBM Business Process Manager Advanced without Process Center

For IBM Business Process Manager Advanced, there are two scenarios concerning the utilization of Process Center:

- The environment is enabled for Process Center.
  
  This is a full and holistic view of the IBM Business Process Manager environment. This view applies to both Advanced and Standard editions. Everyone is encouraged to use the capabilities that are provided in a full IBM Business Process Manager environment.

- The environment is a progression of WebSphere Process Server.
  
  This is a subset of the full IBM Business Process Manager environment. This view is pertinent only to IBM Business Process Manager Advanced edition (Figure 2-14).

![Figure 2-14 IBM Business Process Manager environment using only the IBM Integration Designer authoring environment and Process Server runtime environments](image)

Using the IBM Integration Designer as the only authoring environment is possible. In this scenario, the Process Center repository is not used. The artifacts that are created in IBM Integration Designer are not associated with Process Applications and are not included in a Process Center repository. The artifacts
are exported from IBM Integration Designer and installed directly to the Process Server runtime environments.

Because this scenario does not include the IBM Business Process Manager repository of Process Center, you must use your own separate managed code repository system and lifecycle management procedures.

The expectation is that user changing to an IBM Business Process Manager environment will use an IBM Business Process Manager topology that does not include an Process Center for some time. However, this is ultimately a transitional configuration. The use of Process Applications and the Process Center repository are introduced as projects permit at an appropriate future time.

### 2.7 Monitoring components and concepts

Another key part of an end-to-end business process management environment is the ability to monitor and measure your processes. Business monitoring measures business performance, monitors real-time and completed processes, and reports on business operations. Business monitoring also provides information that helps you identify business problems, correct exceptions, and change processes to improve process efficiency and increase business competitiveness.

#### 2.7.1 IBM Business Monitor

IBM Business Monitor is a comprehensive business activity monitoring (BAM) software that provides an up-to-date view of your business performance. It also provides predictions so that you can take action before problems occur. Personalized business dashboards process business events and data, and calculate key performance indicators (KPIs) and metrics.

You can use IBM Business Monitor to correlate events from IBM Business Process Manager and a broad range of IBM middleware for end-to-end monitoring. Those products include WebSphere Enterprise Service Bus (ESB), WebSphere Message Broker, IBM WebSphere ILOG® JRules, WebSphere Business Events, IBM WebSphere DataPower® X150, WebSphere Sensor Events, WebSphere Adapters, CICS, and IBM FileNet®.

**Monitor models**

A monitor model is a container that holds information about the business performance management aspects of a business model, including the business measures that are required for monitoring. Decide which processes to monitor,
whether to monitor the subprocesses, and what business measures to use. You also create a monitor model, generate Java Platform, Enterprise Edition (JEE) applications, and deploy the model to IBM Business Monitor. The model contains all the defined business measures (metrics, KPIs, counters, and stopwatches) in the process and its subprocesses.

**Contexts**
Monitor models contain contexts that define the information to be collected at runtime. Each monitor model contains at least one monitoring context. The monitoring context defines all of the information that can be collected about an entity as the system is running. The monitoring context also contains the metrics, counters, and stopwatches for holding the information. KPI contexts are optional. The KPI context defines all of the data that can be collected about a KPI or set of related KPIs. You can nest monitoring contexts, but you cannot nest KPI contexts.

**Monitoring context instances**
A monitoring context instance is a single instance of the information (metrics) collected in a monitoring context. A monitoring context instance is commonly referred to as an instance.

**Business measures**
Business measures describe the performance management aspects of your business that are required for real-time business monitoring. When you want to monitor a certain area of your business to assess its efficiency, identify problems, and improve performance, first determine the performance indicators that will give you the information that you need. These performance indicators include metrics, KPIs, counters, and stopwatches.

Evaluating the business measures of your processes is crucial for achieving your business objectives. The values of these business measures can provide extensive information about performance.

- **Key performance indicators (KPIs)**
  KPIs are quantifiable measurements of the improvement or deterioration in the performance of an activity critical to the success of a business. You can use them to measure essential activities of your business so that you can see how these activities influence business results.

  KPIs are typically aggregations of values across many instances, where the aggregation function can be average, maximum, minimum, sum, count (number of occurrences), or standard deviation.
Metrics
A metric is a holder for information, typically a business performance measurement, in a monitoring context. A metric can be used to define the calculation for a KPI, which measures performance against a business objective.

Counters and stopwatches
KPIs often depend on elapsed time, or on the number of occurrences of some situation or event. Stopwatches are specialized metrics that track elapsed time.
Counters are specialized metrics that count occurrences.

Triggers
A trigger is a mechanism that detects an occurrence and can cause extra processing in response. Triggers also determine when outbound events are sent.

2.7.2 Monitor action services
Monitor action services is a component of IBM Business Monitor that starts responses to defined situation events emitted by IBM Business Monitor and other applications. The actions that are run are based on user-defined action templates. For example, IBM Business Monitor action services might respond by sending dashboard alerts or email notifications when it receives defined situation events.

2.7.3 Monitor scheduled services
IBM Business Monitor uses several scheduled services. Because multiple services require scheduled execution, you can configure and use the Monitor scheduled services component to control when and how often you run some services.

You can run these tasks by using the Monitor scheduled services component:

- Suspend and resume services
- Indicate how often to run a service
- View the status, duration, and last completion time of the scheduled service at the model or model version level

You can assign a priority to each scheduled service.
You can view and schedule the following Monitor data services:

- Data Movement Service
  Before scheduling this service, you must enable it.
- KPI History Calculation
  This service runs once every hour.
- KPI Prediction Calculation
  This service runs once every hour.
- Dynamic Alert Evaluation
- Cube Summary Table (MQT) refresh
  Before scheduling this service, you must enable it.
- IBM Cognos® Cache Clearing
- Purge and Archive Instance Data

**Resources:** For more information about IBM Business Monitor, see the following website:


### 2.8 Network deployment environment concepts

IBM Business Process Manager is built on IBM WebSphere Application Server, and takes advantage of the structures, functions, and services that are provided by IBM WebSphere Application Server.

This section defines basic concepts that are provided in a IBM WebSphere Application Server network deployment environment.

#### 2.8.1 IBM WebSphere Application Server

An IBM WebSphere Application Server is a Java virtual machine (JVM) that runs user applications. IBM WebSphere Application Server uses Java technology to extend web server capabilities to handle web application requests. An IBM WebSphere Application Server makes it possible for a server to generate a dynamic, customized response to a client request.
With the Network Deployment platform, more advanced topologies provide workload management, scalability, high availability, and central management of multiple application servers.

You can build a distributed server configuration to enable central administration, workload management, and failover. In this environment, you integrate one or more application servers into a cell that is managed by a central administration instance, which is called a deployment manager. The application servers can be on the same machine as the deployment manager, or on multiple separate machines. Administration and management are handled centrally from the administration interfaces of the deployment manager.

### 2.8.2 IBM WebSphere Application Server network deployment environment cell structure

An IBM WebSphere Application Server environment uses a cell structure. When you build a cell topology, you must understand the parts of this structure and how they are related to each other.
Figure 2-7 illustrates the basic parts of a cell structure.

![Cell Structure Diagram]

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

**Deployment manager**
A deployment manager is the central point of administration of a cell. A deployment manager is a specific type of IBM WebSphere Application Server whose primary task is the management and configuration of the cell in which it exists.

You can administer the cell by using either the IBM WebSphere Application Server Integrated Solutions Console or command-line scripting (wsadmin). Both
communicate with the deployment manager (not directly to the IBM WebSphere Application Server). The deployment manager communicates with node agents, which communicate with IBM WebSphere Application Servers on the nodes. This configuration allows central administration of the cell through the deployment manager. The deployment manager maintains the master repository of configuration information and other artifacts for the cell.

A deployment manager is implemented as a JVM.

**Nodes**

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

**Node agents**

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

**Clusters**

Clusters are sets of servers that are managed together and participate in workload management. Clusters enable enterprise applications to scale beyond the amount of throughput achievable with a single IBM WebSphere Application Server. Clusters also enable enterprise applications to be highly available if requests are automatically routed (through the IBM HTTP Server Plug-in, which is addressed in Chapter 7, “IBM HTTP Server and WebSphere proxy server” on page 125) to the running servers in the event of a failure.

The members of each cluster can be distributed across multiple nodes (referred to as horizontal clustering). Such clusters can increase throughput and provide resilience to both application server and hardware failure.

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

In addition to the basic cell structure, this section describes extra concepts that are provided in a IBM WebSphere Application Server network deployment environment.

Profiles
A profile is a collection of files that defines a runtime environment.

Installing the product onto a system places the product binary files onto the file system. After the product is installed, creating a profile generates a collection of files specific to the profile type. There are several profile types:

- Deployment Manager profile
- Custom profile
- Stand-alone Server profile

A profile is created through the `manageprofiles` command or the Profile Management Tool graphical user interface.

A profile corresponds to a node. In a network deployment environment, you create a deployment manager profile and a number of custom profiles.

The `<app_server_root>/profiles` directory is the default directory in which the profiles are created.

Service integration bus
IBM WebSphere Application Server includes a default messaging provider that uses the service integration bus as the messaging system.

The service integration bus provides a managed communications framework that supports various message distribution models, reliability options, and network topologies. This bus provides support for traditional messaging applications, and enables the implementation of SOAs within the IBM WebSphere Application Server environment.
There are a number of key concepts that are related to the service integration bus:

- **Bus member**
  
  A bus member is an application server or a cluster that has been added to a bus. This automatically defines a number of resources on the bus member in question. A key resource that is automatically defined is the messaging engine.

- **Messaging engine**
  
  A messaging engine is a component, running inside a server, that manages messaging resources for a bus member. Applications are connected to a messaging engine when they access a service integration bus.

**Resources:** For more information about IBM WebSphere Application Server, see *IBM WebSphere Application Server V8 Concepts, Planning, and Design Guide*, SG24-7957.

### 2.9 More product components

The IBM Business Process Manager environment uses Process Server and Process Center environments. Each Process Server or Process Center is a IBM WebSphere Application Server cell.

Some of the components might be familiar from general use in IBM WebSphere Application Server cells, whereas others are unique to IBM Business Process Manager or IBM Business Monitor.
2.9.1 Database tables and schemas

IBM Business Process Manager and IBM Business Monitor are configured to use multiple sets of database tables and schemas. The following sets of tables are used to hold, store, and track information:

► Process Server tables
   The Process Server tables are used to hold, store, and track the data for the Process Application repository, and include all BPD information.
   The Process Server tables are used for both Process Server and Process Center cells.

► Performance Data Warehouse tables
   The Performance Data Warehouse tables support the Performance Data Warehouse server component.

► Common database tables (Common or CMNDB tables)
   The common database tables are a group of tables that are used as a repository for various components, including Mediations, Relationships, Event Sequencing, and Failed Event Manager. There is one set of common database tables per cell. This set of tables must be created before starting the IBM Business Process Manager Advanced deployment manager.

► Business Process Choreographer tables (BPEDB tables)
   The BPEDB tables are used by the Business Flow Manager and the Human Task Manager, and contain all BPEL process template and instance information. These tables must be created before starting Business Process Choreographer components. There is one set of these tables for each Business Process Choreographer deployment target.

► Business Process Reporting tables (OBSRVDB)
   This set of tables can be created in a dedicated database, but are typically created as an extra schema in the same database as the BPEDB tables if event collection is not heavily used. These tables are used by the Business Process Choreographer Explorer reporting function to store event information from the Common Event Infrastructure (CEI) bus in an event collector table.

► Business Space tables (BSPACE tables)
   The BSPACE tables are used by the Business Space applications to store configuration data for the various user profiles, space definitions, and page definitions.

► Monitor tables (MONITOR tables)
   The MONITOR tables are used by IBM Business Monitor to store the IBM Business Monitor configuration, monitor model metadata, and monitored
data. These tables must be created before starting the IBM Business Monitor deployment manager.

- IBM Cognos tables (COGNOSCS tables)
  IBM Business Monitor requires a set of tables that are used by Cognos. The IBM Cognos Business Intelligence configuration is stored in these tables.

- Messaging engine tables (MEDB tables)
  Each messaging engine requires a unique set of database tables. There are multiple messaging engines in any IBM Business Process Manager environment. There are messaging engines for use by the Process Server bus, the Performance Data Warehouse bus, the Service Component Architecture (SCA) system and application buses, the CEI bus, the business monitor bus, and the Business Process Choreographer bus. Because each messaging engine needs a separate set of tables, these tables are often created using separate schemas within the same database.

- Common Event Infrastructure tables (EVENT tables)
  The EVENT tables contain the persisted Common Base Events (CBEs).
  The EVENT tables can be used during development to verify the content of CBEs. In a production environment, the persistence of events into this database is typically disabled because of performance implications.

When the entire collection of tables is considered, the arrangement of sets of tables per database has some flexibility. The arrangement that is best for your environment depends on the type of database and your requirements.

For more information about the database tables, see 9.2, “Creating database tables and schema for IBM DB2” on page 163.

### 2.9.2 Service integration buses

A service integration bus supports applications using message-based and service-oriented architectures. A bus is a group of interconnected servers and clusters that are added as members of the bus. Applications connect to a bus at one of the messaging engines that are associated with its bus members. IBM Business Process Manager and IBM Business Monitor are configured to use multiple service integration buses.

- Process Server bus
  This bus is used for transmitting messages internally for Process Server functions.
- **Performance Data Warehouse bus**
  This bus is used for transmitting messages internally for Performance Data Warehouse functions.

- **SCA system bus**
  This bus is used to host queue destinations for SCA modules. The SCA runtime uses these queue destinations to support SCA asynchronous interactions between components and modules.

- **SCA application bus**
  The SCA Application Bus is a default bus that provides a service integration bus for use by modules where no SCA service integration logic is needed. For example, the default behavior is to use this bus to support the asynchronous communication of the WebSphere Business Integration Adapters or application components deployed with Java Message Service (JMS) bindings.

- **Business Process Choreographer bus**
  This bus is used for transmitting messages internally in the Business Flow Manager.

- **Common Event Infrastructure bus**
  This bus is used to transmit CBEs asynchronously to a CEI server, and can be used to distribute CBEs from CEI to Event Group destinations.

- **Monitor bus**
  This bus is used in the processing of events that are delivered to various JMS queues associated with monitor models. If table-based event delivery (formerly known as *queue bypass*) is configured, IBM Business Monitor connects directly to the Monitor database. However, the bus is still required for these destinations:
  - The error queue destination for events that a monitor model failed to process
  - The *JMS emitter* queue destination for JMS TextMessages that are to be transformed into CBEs and then further routed through the Common Event Infrastructure

### 2.9.3 Business Performance Data Warehouse

The Business Performance Data Warehouse component collects and aggregates process data from running processes. You can use these data to improve your business processes.
2.9.4 Business Process Choreographer

Business Process Choreographer container is an enterprise workflow engine that supports BPEL business processes and human tasks with transactions. The core of the Business Process Choreographer configuration consists of the following components:

- Business Flow Manager (BFM)
  This component runs and manages business processes that are written in BPEL.

- Human Task Manager (HTM)
  This component manages human tasks. The Business Process Choreographer Explorer can be used to dynamically change the behavior of human tasks, such as transferring ownership of a task or assigning an expiration date at run time. The HTM also allows for programmatic control of the human task flow.

2.9.5 Business Rules Manager

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 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.

2.9.6 Common event infrastructure

A business event is a significant occurrence in a business process that warrants monitoring over time. A business process component can be configured to generate an event. These events are then used to evaluate whether an aspect of the business reaches predefined goals. IBM Business Process Manager uses the CEI for basic event management services and IBM Business Monitor uses the CEI as a source of events that are analyzed historically. Events can be published to the CEI server for possible distribution to JMS queues and topics. If enabled for non-production environments, events might also be persisted to a database.
2.9.7  Business Space powered by WebSphere

Business Space powered by WebSphere is a browser-based graphical user interface that allows the customization of content. This interface provides a common presentation layer for application users to manipulate the web interfaces of IBM Business Process Manager applications.

2.9.8  IBM Cognos

IBM Business Monitor uses a fully integrated IBM Cognos Business Intelligence Server Version 10.1.0.1 for analysis and reporting on historical data. In IBM Business Monitor, new embedded technology from IBM Cognos Business Intelligence provides an updated graphical interface. Also new in IBM Business Monitor is the use of IBM Cognos Business Intelligence self-learning in-memory caching.

2.9.9  IBM HTTP Server and plug-in

The IBM HTTP Server is a web server that is based on Apache HTTP Server with IBM enhancements. The IBM HTTP Server plug-in provides (among other functions) a load-balancing capability that can be closely integrated with the IBM Business Process Manager cell topology.

The HTTP Server distributes load among cluster members. IBM HTTP Server is designed to handle HTTP load from thousands of users, and is a key component for high-volume scenarios.

The IBM Business Process Manager cell topologies that are described in this book use this load-balancing function to route requests from Business Space widgets to the Representational State Transfer (REST) gateway services, from the Business Process Choreographer Explorer UI to the BPEContainer and HTMContainer REST services. Essentially, this function separates the web UI interfaces from the back-end data requests by acting as an HTTP sprayer.

2.9.10  WebSphere proxy server

The WebSphere proxy server is used to classify, prioritize, and route HTTP and SIP requests to servers in the enterprise and cache server content. The WebSphere proxy server can be used in the IBM Business Process Manager cell topologies in a similar way to IBM HTTP Server and the plug-in, as described in Chapter 7, “IBM HTTP Server and WebSphere proxy server” on page 125.
IBM Business Process Manager security

This chapter provides information about security of an organization’s business process management (BPM) program, common security holes that often occur in this field, and techniques for rectifying these holes. It describes preferred practices and common security hardening exercises that you can use to achieve a reasonably well-secured BPM installation.

Many of the practices that are described apply equally to generic Java Platform and Java Platform, Enterprise Edition applications, and to BPM. However, it focuses on aspects that typically do not receive adequate consideration. Also, it addresses equally the IBM Business Process Manager Standard and IBM Business Process Manager Advanced editions, although there are topics inherent in IBM Business Process Manager Advanced that are out of scope for this book. This chapter is comprehensive on any topic, technology, or philosophy. IBM offers training and consulting services that can help you to understand and evaluate the implications of these topics in your own organization.

This chapter includes the following sections:

- 3.1, “Importance of IBM Business Process Manager security” on page 54
- 3.2, “Installation” on page 59
- 3.3, “Authentication” on page 69
- 3.4, “Authorization” on page 77
3.1 Importance of IBM Business Process Manager security

Consider the fundamental need to secure your IBM Business Process Manager systems. IBM Business Process Manager is based on Java Platform, Enterprise Edition technologies, and is delivered largely through HTTP protocols. Therefore, it has the same security requirements as any other Java Platform, Enterprise Edition enterprise-ready application. Authentication, authorization, and protection of sensitive data are all topics that are common to any Java Platform, Enterprise Edition application, so many casual observers can stop their inquiry there.

However, IBM Business Process Manager, in many ways, is not just another Java Platform, Enterprise Edition application. When you look at an organization’s existing software systems, you typically find applications that are built for a single purpose. The successful hacking of these applications can expose the process’ data. But it is hard to conceive of how such a breach might expose the actual business steps, decision points, or overall operational strategy of a department’s business functions.
Figure 3-1 shows a typical single-purpose application.
However, IBM Business Process Manager encapsulates more than just a process' data. IBM Business Process Manager process applications capture the essence and details of a department's way of doing business. It paints easy-to-understand flowcharts of process steps, which employee groups are entitled to run particular steps, the decision points, and details of how those decisions are evaluated as shown in Figure 3-2.

Figure 3-2  Incorporating IBM Business Process Manager
3.1.1 IBM Business Process Manager users have access

Furthermore, consider the universe of users who have access to IBM Business Process Manager. As IBM Business Process Manager spreads throughout your enterprise, thousands of users, possibly tens of thousands of users, might be expected to use some aspect of IBM Business Process Manager. These users have network access and valid credentials. They know which processes, if compromised, can be most disruptive to your business. They know which data, if delivered outside of the corporate firewalls, can be most valuable. They might also want to bypass security policies for their personal benefit (for example, when they are claiming travel expenses).

The most common security hole that is seen is an over-reliance on corporate firewalls. However, several sources agree that most security breaches are instigated from within.

Rethink your attitudes towards security. Even if you decide to trust one hundred percent of the employees who have access to your internal networks, can you be certain that all actions they take are consistent with your security policies? What about email or browser exploits, which can serve as an entry point to your corporate network? What about free software that can include non-trusted code? What about CDs, DVDs, and USB drives that your employees might insert into their notebook computers? What about external consultants who can connect to your corporate network? Can you ensure that one hundred percent of these devices have been thoroughly scrutinized?

Keep in mind that there is no way that anyone can ensure a completely secure environment.

However, considering the issues that are detailed in this chapter will, at least, drastically reduce the number of potential attacks against your IBM Business Process Manager systems.
3.1.2 Unique security considerations

In addition to these philosophical arguments, some practical considerations must be addressed concerning IBM Business Process Manager security. IBM Business Process Manager has a unique hub and spoke deployment model that is built on the normal J2E deployment model, but extends it in ways that are specific to IBM Business Process Manager as shown in Figure 3-3.

![Process Manager deployment model](image)

IBM Business Process Manager has a unique instance-based authorization model that adds significant functions beyond the normal J2E authorization techniques. IBM Business Process Manager is delivered atop WebSphere Application Server. WebSphere Application Server includes a sophisticated Virtual Member Manager that you can use to access corporate Lightweight Directory Access Protocol (LDAP) and other user and group repositories. Many applications use this group information to perform a high-level authorization. However, the IBM Business Process Manager model extends this in ways that must be understood so you can fully evaluate the security implications.

Finally, the ways in which IBM Business Process Manager connects to external systems (such as web services and message queues) differ depending on which IBM Business Process Manager product you are running (IBM Business Process Manager Standard or Advanced), which version you are running (V7.5, 7.5.1, V8.0, V8.0.1) and what type of integration you are using (outbound versus inbound web service calls). For more information about all of these topics, see *IBM Business Process Manager Security: Concepts and Guidance*, SG24-8027.
3.2 Installation

Security begins before the software is installed. How your IBM Business Process Manager servers fit into your enterprise requires careful consideration, with an eye towards security implications at every touch point.

- How many IBM Business Process Manager deployment environments will you have?
  - Will each be protected by a firewall?

- Which of your IBM Business Process Manager deployment environments will be protected by DMZs?
  - Will they be protected by proxies or dedicated web servers?

- How will you secure your network traffic?

- How many certificate authorities will you trust?

- How will you secure your data at rest?

- How will you secure web service calls?

In addition to these generic questions, you also have IBM Business Process Manager specific questions:

- How many user repositories will the IBM Business Process Manager servers access?

- Does each IBM Business Process Manager deployment environment support a different user repository?

The installation of your IBM Business Process Manager software and the decisions surrounding the installation are the first steps in security. The IBM Business Process Manager installation’s security relies on this foundation.

3.2.1 IBM Business Process Manager and WebSphere Application Server concepts

Portions of the IBM Business Process Manager suite came from a product acquired by IBM called Lombardi Teamworks®. Others came from what previously was called IBM WebSphere Process Server. Although both products shared a common goal of automating and facilitating the management of business processes, they had different focuses. The similarities are, for the most part, encapsulated in IBM Business Process Manager Standard, and the differences are packaged in IBM Business Process Manager Advanced. With each new version of the IBM Business Process Manager software, these two disparate products become more tightly integrated. Portions of the software stack
that served Lombardi’s need to support a wide variety of Java Platform, Enterprise Edition application servers are being replaced with more security hardened IBM WebSphere Application Server counterparts. Similarly, WebSphere Process Server’s user interface has benefited from the merger of the two products.

From a security standpoint, consider how the two different descriptions of IBM WebSphere Application Server and IBM Business Process Manager environments map onto each other.

In almost all corporate environments, there are distinct functional (and often physical) differences between servers that are used for software development, testing (both by the developers and by the users), and their production servers. IBM Business Process Manager supports this common pattern by using the mechanism of deployment environments. Business process applications are developed within the Process Center, which is commonly referred to as the IBM Business Process Manager development environment.

After the process application authors are satisfied with their current iteration of the process application, they can take a snapshot of that process application and deploy it to the testing environment. One benefit of this is that you divorce the execution of the process application from the dependencies that are present in your company’s development environment. This helps ensure that the process application is bundled with all the underlying software and toolkits that it needs to run.

When all parties are convinced that the process application is free of these dependencies and it is ready for wider distribution, it is then typically promoted to another environment. This process is called staging or User Acceptance Testing (UAT). The UAT environment is where a wider universe of users is given access to the process application. It is the job of these users to ensure that the process application satisfies all business requirements and is without bugs.

When the testing is complete, this staged application is eligible for promotion to the production environment with confidence that the application is ready for use.

Each of these IBM Business Process Manager environments is its own WebSphere Application Server cell, which is not universally true. In special situations, you can require a cell to span IBM Business Process Manager environments, but that is a special topic that is dealt with later in this book. For now, you can consider that an IBM Business Process Manager deployment environment equals a WebSphere Application Server cell.
In Figure 3-4, you can see the dotted boxes as defining a cell’s boundary, and that each cell has a deployment manager and one or more nodes. The deployment manager is a WebSphere Application Server construct that does not map into the IBM Business Process Manager lexicon. The nodes themselves are where the real action occurs.

A node contains one or more servers, which are Java virtual machines that are dedicated to a specific set of IBM Business Process Manager tasks. Depending on the type of IBM Business Process Manager topology you choose, each node can have one to five servers. These servers map directly to the IBM Business Process Manager concepts of AppTarget (where the IBM Business Process Manager runtime engine runs), Support (which is where the IBM Business Process Manager Performance Data Warehouse runs), and others. These servers are then clustered together across node boundaries. These clusters and their functions are the main topic of this book and are covered in great detail in the following chapters.
In this diagram, the cells are named according to their role as deployment environments:

**bpmDevCell**
Contains the Process Center and central development repository, and is known as the development or PC environment.

**bpmTestCell**
A Process Server runtime deployment environment where process application authors can ensure that their process applications are free from any dependencies on development tools or artifacts. This is known as the testing environment.

**bpmStageCell**
An IBM Business Process Manager Process Server runtime deployment environment where process application stakeholders can ensure that the process applications are isolated completely from the development environment. This is known as the staging or UAT environment. Typically, the staging environments closely mimic the production deployment environment. This helps ensure that after the staging testing is completed, the process applications are able to be installed into production environments with no issues.

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

By having each deployment environment hosted within a unique WebSphere Application Server cell, the cell’s security configuration can be used and differentiated from that of other deployment environments or cells. For example, you almost certainly want the staging LDAP server and the production LDAP server completely isolated from those of the development and testing environments.
For example, Figure 3-5 shows that the dev and test environments share a common LDAP server (ldap-dev), but staging and production each have their own LDAP servers (ldap-stage and ldap-prod). Furthermore, both stage and production are 4-cluster topologies, where dev and test are only 3-cluster topologies.

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

Figure 3-5 Complex realities of an IBM Business Process Manager solution

3.2.2 Complex realities

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

All of these components talk to each other, and each line of communication introduces another touch point that must be scrutinized from a security point of view. Complexity breeds fragility, which in turn breeds opportunity for exploitation.

The antithesis is simplicity. But how does one achieve simplicity when faced with so many product components, each one speaking to another over different protocols?

Complexity is tamed by breaking down the universe of connection points and possible security holes into easily understood components with an overall framework for management.

**Architectural documentation:** Consider investing in architectural documentation that describes the nature of each communication point, together with a discussion of communication options and rationale for choosing one option over another.

Documentation of this nature provides an excellent repository of knowledge and expertise. It can enable all interested parties to understand the security choices that are employed at each connection point.

### 3.2.3 SSL Everywhere and other hardening steps

Beyond a doubt, the biggest security hole is an overly optimistic belief in the security of a corporate, perimeter-wide firewall. This posture is a dangerous and precarious one to take.

Can you trust with complete certainty that your firewall vendors will never release a software update that has a security hole in it? How often is your notebook’s operating system updated with security fixes?

Many studies, from Gartner, Ponemon, the FBI, and others, have shown the following are true:

- Most attacks originate from within.
- The attacker’s identity is rarely known or discovered.
Security breaches are equally likely to be caused by employees as by external agents.

An overwhelming majority of attacks are the result of an exploitation of a misconfiguration or failure to follow leading practices.

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 occurred, and you must deal with the consequences. However, it is still prudent to consider the following question: is it safe to believe that none of your employees can ever steal data?

The problem faced with hactivist groups like Anonymous is that they are, in fact, anonymous. Estimates on the number of arrests (and therefore name disclosures) as a percentage of security attacks are hard to come by, but it is reasonable to assume that more attacks occur than arrests. Most security breaches are instigated by individuals who remain unknown.

Even if you choose to trust that there is not one employee within your ranks who sympathizes with hactivists, can you ensure that one hundred percent of your employees always follow corporate security guidelines? Email and browser exploits can serve as an entry point to your corporate network. And free software can include non-trusted code. What about CDs, DVDs, and USB drives that your employees insert into their notebooks. Can you ensure that all of these devices have been thoroughly scrutinized?

The bottom line on firewall security is that it is helpful, but it is not a stand-alone solution to enterprise security. *Firewalls are necessary, but not sufficient.*

The goal is to secure every touch point, reducing the potential number of attackers by simultaneously increasing the skills that are required to exploit a security hole.
Here is an example of an overly optimistic faith in firewalls. During the installation of a Process Server, you (or your IBM consultant) turned to the WebSphere Integrated Solutions Console and ran a wizard to create the deployment environment. The wizard includes a step where the Process Server specifies the host name of the Process Center it will use as its repository as illustrated in Figure 3-6.

![Create new deployment environment](image)

**Figure 3-6  Creating the deployment environment**

Note that the Protocol defaults to http://. During the Process Server startup, 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, effectively changing the way that you do business. An attacker can also deploy a malware application that monitors the network, carries out denial of service attacks, and spreads malware...
to other systems in the same network (not only systems your process applications connect to, but basically any systems that can be reached).

If you specify the https:// protocol in Figure 3-6 on page 66, you send your IBM Business Process Manager admin account name and password in clear text.

Therefore, take the time to ensure that all IBM Business Process Manager product components communicate with each other, and with any external systems, over SSL.

3.2.4 Web server or reverse proxy in DMZ

IBM Business Process Manager V8.0 requires either a web server or a reverse proxy server be placed (logically) in front of the WebSphere clusters because different elements of the IBM Business Process Manager user interface are served by more than one cluster. Without the web server or reverse proxy, the client browser rejects the IBM Business Process Manager user interface because it violates the client browser's same server policy.

In a hardened IBM Business Process Manager installation, physically install the web server or reverse proxy in front of the WebSphere Application Server clusters. Specifically, install the web server or reverse proxy server on a physical server that sits between two firewalls. This location is commonly called a DMZ. The outer firewall allows only SSL port traffic (typically 443, but this can be customized). The web server or reverse proxy then communicates with the BPM servers over a different SSL port through the inner firewall.

This configuration accomplishes the following goals:

► It adds another layer of obfuscation between the potential hacker on the outside of the firewall, and the ports that are exposed to receive the actual IBM Business Process Manager traffic.

► It eliminates the need for a node agent on the web server or reverse proxy server, further simplifying what these servers must do. The simpler the server, the easier to keep it free from security vulnerabilities. Note, therefore, that the installation team must use unmanaged web servers. Ensure that the plugin.xml file is kept up to date on the web server as a manual process.

► It eliminates the need for a Java virtual machine on the web server or reverse proxy server. This is an important consideration for many customers. This helps keep the web server or reverse proxy server simpler, and therefore less likely to expose a security vulnerability.
3.2.5 Securing your database

This section covers considerations for securing your database.

Securing your database communications
Everyone recognizes that database user accounts should be password protected. What most fail to recognize is how incredibly easy it is to observe database traffic while it is in transit. If a hacker can view unencrypted text on its way to the database, they also have the opportunity to store these data in their own systems and to gain knowledge of how your SQL statements are formed, possibly leading to SQL injection attacks.

The solution to this is simple: SSL. The specific steps to ensure SSL between your IBM Business Process Manager and database servers is unique to the database vendor you have selected and to your company's certificate management strategy. Nevertheless, the concept is simple enough, and is generally familiar to your database analysts and administration team.

Securing your data at rest
IBM Business Process Manager is highly database-driven, and much of the user-facing code runs within a web browser as JavaScript. Without disparaging JavaScript as a language, any meaningful encryption algorithm is almost certainly going to overpower the runtime JavaScript engines found in any browser. Although it might be possible to overcome some of this by doing the encryption and decryption on the server and then sending the data to the browser in clear text, this is a moot point. Because of performance concerns, compatibility constraints, or simple design decisions, IBM Business Process Manager does not offer this strategy for encrypting data at rest for any data elements that are intrinsic to the inner workings of the product. Encryption in the client is rare. Typically you want the server to work with the data so the server needs the data in clear text.

You can design your business process applications to encrypt and decrypt data by using the extension points provided by Business Process Manager. However, this is most likely just a theoretical consideration. The computational processor load of doing so within the confines of a runtime JavaScript engine is formidable. More importantly, you cannot know with absolute certainty what percentage of your data is cached somewhere within the IBM Business Process Manager database tables, effectively nullifying your encryption.

Therefore, consider these strategies for encrypting your data while at rest:

- Operating system and file system encryption
- Database encryption
SSL certificate host name verification

More recent versions of the IBM Business Process Manager applications (including IBM Business Process Manager V8.0) include hardening steps that were not present in previous versions. Previously, it was possible to create the BPM profiles using local host as the name for the IBM Business Process Manager server. There are many scenarios where IBM Business Process Manager talks to itself such as heartbeats, deployment of process applications from Process Center to Process Servers, the WebInspector REST Facade, and the federated REST APIs. The product now requires that the host names of each part of these communications match the names in the SSL certificates.

Ensure that the certificate's common name (CN) matches the actual fully qualified name of the IBM Business Process Manager servers.

3.3 Authentication

Authentication is the process of proving the identity of the user who (or even another computer system that) is requesting access to software.

The most common type of authentication is the user ID and password. But there are other methods of authenticating to a server:

- What you know, including passwords or session IDs
- What you have, including digital certificates, or hardware passcode generators
- What you are, including biometrics such as fingerprints and retinal scans

For each of these types of authentication, consider the following questions:

- Where is the system of record that holds user accounts?
- How will the authentication information communicate with this system?
- How will you detect a compromise?
- How will you revoke access?

In light of recent research that shows the high incidence of security attacks that originate from employees or contractors, evaluate carefully how users authenticate to your corporate systems. Often, the choice of how users authenticate to corporate systems is decades old, and it might well be worth reviewing the policies at your organization.
Regardless of which authentication mechanism (or combination of methods) your organization uses, the following steps are the same. The user (or other computer system) presents some authentication information, WebSphere Application Server validates that this information is correct and current, and then WebSphere Application Server creates a security context (a subject and principal) on behalf of the user. This security context accompanies all future requests during the session.

This section is your second step in securing your Business Process Manager environments. It investigates who has access to your Business Process Manager applications.

### 3.3.1 WebSphere Application Server user registry

IBM Business Process Manager relies entirely on the WebSphere Application Server mechanism for user authentication. Before an individual can authenticate to WebSphere Application Server, that user must exist within a list that has been configured for this purpose with WebSphere Application Server. This list is sometimes called the WebSphere Application Server user registry, and at other times, the WebSphere Application Server user realm.

When a user logs in, that user’s credentials are presented to WebSphere Application Server, which in turn compares them against the user’s information that is stored within the user registry. The types of lists that the WebSphere Application Server user registry allows can be categorized into the following types:

- A flat-file repository
- A stand-alone LDAP repository
- A custom software repository
- Any federated combination of these

The terms repositories and registries are often confused. A repository is a concrete set of items (in this case, the list of user accounts). A registry is a reference to something (in this case, the repositories within the user registry). Visualize this as an analogy: A library’s card catalog is a registry, whereas the library’s books are its repository.

Using the Federated Repositories user registry is advised. In Federated Repositories, you can connect any mixture of heterogeneous repositories, including flat file and LDAP servers, or multiple LDAP servers.
3.3.2 Flat-file repositories

IBM Business Process Manager ships and installs with a single federated registry, which is called Federated Repositories (Figure 3-7). At installation time for Network Deployment environments, it is composed of just one single flat-file repository, called the defaultWIMFileBasedRealm. This name is adequate, but quickly becomes misleading in most customer environments because most customers immediately federate more user repositories (typically an LDAP server). Therefore, change the name from defaultWIMFileBasedRealm to something more accurate, such as enterpriseLdapRealm, or whatever might make more sense to your environment.

![Figure 3-7 Federated repositories](image)

The flat-file repository was originally provided as a mechanism to facilitate the immediate securing of a WebSphere Application Server environment at installation time. It does so by providing user IDs and passwords for administrative accounts and associated functions. Without such a mechanism, there can be a gap in security before the WebSphere Application Server installation is integrated into an organization’s already existing security infrastructure.
The flat-file repository is not intended to scale beyond 200-300 users. However, it does provide usefulness, even in large-scale production environments, where you want to maintain the IBM Business Process Manager administrative accounts locally. This configurations allows the IBM Business Process Manager environment to be administered in the case of a failure to reach the main repository.

### 3.3.3 LDAP repositories

The most common type of user list in use by corporations today is the LDAP repository, which is also commonly a directory of user information. LDAPs are often described as a database, but be aware that they are a specialized type of database with characteristics that set them apart from general purpose relational databases.

#### Optimized for read-only access

One of the most important specialized characteristics is that an LDAP repository is read much more often than it is updated. Applications and other users frequently look up an employee’s user ID, name, or phone number, but these values rarely change for this employee. This fact produces the following generalizations:

- LDAPs are optimized for read-access.
- LDAPs store static information.
- LDAPs do not store application-specific data.

Unlike a general-purpose database, which might be used for any number of high-volume high-update applications (such as an airline reservation system), an LDAP server can be optimized for read (and search) access. In fact, it is fairly common for the administrators of the LDAP repository to have strict guidelines over which software applications are even allowed to write to the repository.

Often, corporate LDAP systems are considered the system of record for employee data. Because of this, LDAP administrators are typically careful about what type of data can be stored in the LDAP.

Consider IBM Business Process Manager. Every IBM Business Process Manager user has an inbox that receives business process tasks during a typical work day. But even in an organization whose BPM adoption is mature, where potentially every employee listed in the corporate LDAP might share this same requirement, it is not a good idea to store the inbox nor process application task lists in the LDAP. Even though they all share requirements, the tasks themselves vary from person to person. The tasks therefore most likely need updating several times per day, which violates the nature of the LDAP concept.
**LDAP groups and ACLs**

However, many organizations do have grouping information stored in the LDAP repository. These groups can be along geographic, organizational, or business functional lines. Perhaps the groups reflect other business meaningful parameters such as employees who joined as a result of an acquisition. In each of these cases, the presupposition is that the individual employees are not likely to change their group affiliations frequently. Therefore, this information is appropriate for an employee system of record such as the LDAP repository.

Furthermore, some LDAP repositories support the notion of an access control list (ACL). An ACL relates to the LDAP groups, and can be used to effectively limit software program access along business lines.

**Custom software repository**

Although most customers use an LDAP repository, situations can exist where a corporation’s user and group data are in other repositories or custom user registries, such as a database. Moving this information to either a local operating system registry or a dedicated LDAP registry implementation might not be feasible. For these situations, WebSphere Application Server security does provide a service provider interface (SPI) that you can implement to interact with your current registry. This custom registry feature can be developed to support virtually any user registry that is not implemented by WebSphere Application Server.

However, developing a custom software registry is decidedly non-trivial, and developing one that is truly secure is even far more complex. There are a number of reasons, but chief among them is that the WebSphere Application Server security mechanisms are initialized and enabled well before other WebSphere Application Server services, such as data sources and enterprise beans. You must therefore write a great deal of software yourself.

In addition, you must meet the following considerations:

- The SPI must be completely implemented, including error scenarios.
- You must consider and implement your own mechanisms for availability and failover.
- Portions of IBM Business Process Manager require more security extensions that are beyond the WebSphere Application Server custom user registry SPI.
- Any custom registry must undergo extensive and rigorous third-party penetration and security vulnerability testing.
Federated repositories

IBM Business Process Manager’s preferred user registry is called Federated Repositories. This name indicates that it is a collection of independent repositories. The Federated Repositories are built on a sophisticated software layer called the Virtual Member Manager (VMM). The VMM allows for tremendous flexibility. Multiple repositories, of various types, can be joined in the federation, and they act as one as shown in Figure 3-8.

![Virtual Member Manager Diagram](image)

Figure 3-8 shows a simple case with one federated registry that consists of one flat-file repository and one LDAP repository. As mentioned before, WebSphere Application Server is compatible with various LDAP vendors’ products. Each LDAP vendor can define a different reserved word to access a particular function. WebSphere Application Server’s VMM can be configured to abstract these differences and therefore work with any LDAP server that is LDAP V3 compliant. WebSphere Application Server also ships with several LDAP templates to facilitate installation.
Customers commonly have more than one LDAP server, which is often the case because of acquisitions or geographical dispersion. The acquired companies can have a host of software systems that rely on their existing LDAP structures. There is always a period of integration when old systems are updated or replaced. WebSphere Application Server allows for this by federating LDAP repositories together. Figure 3-9 shows an example where the VMM federated registry is composed of a single flat-file repository, one generic LDAP V3 server, and a series of Microsoft Active Domain repositories arranged in a tree structure. Even more complicated arrangements are possible, but a complete treatment of this topic is beyond the scope of this book.

Figure 3-9  Multiple LDAP repositories with VMM
The need to secure LDAP

Most people think of LDAP as a server, but LDAP is fundamentally a protocol, which means that it is a conversation between two servers.

Figure 3-10 shows the actual network communications as captured by the freeware network protocol analyzer, WireShark, during the normal boot-up process of the IBM Business Process Manager Process Center.

If you have never used a network packet analyzer before, all you need to know is that each line is a summary of the TCP/IP traffic, which you can watch in real time. The lower portion of the panel shows the contents of the selected TCP/IP packet.

This highlighted summary shows that this packet is an LDAP bindRequest on the account uid=admin, ou=system. That is, it is a request to bind the IBM Business Process Manager servers to the LDAP database to make a query. If you know

Resource: For more information, see *Understanding LDAP - Design and Implementation*, SG24-4986.
the account name and password that are used to bind, you can browse the LDAP for any information it contains. You can see, in the packet's content area, that the password for this account is secret.

The bind account name and password are exchanged at each step of the IBM Business Process Manager to LDAP conversation. The WebSphere Deployment Manager and Node Agents, the IBM Business Process Manager application servers (including /ProcessAdmin, /ProcessCenter, and /portal), plus the Process Designer, all communicate with the LDAP server and issue this same bindRequest.

Unless you secure your LDAP server by using encryption (SSL), your corporate LDAP server is open to browsing every time an IBM Business Process Manager user logs in to their /portal Inbox.

Use the following steps to secure LDAP:

- Enforce encryption by using SSL over the communications channel between the IBM Business Process Manager servers and your LDAP servers
- Be sure to disable non-SSL traffic
- Create a specific SSL trust store and alias for the LDAP

### 3.4 Authorization

Authorization is the process of ensuring that a user (or other computer system) has permission to perform an act.

In general, authorization can be enforced in a number of ways:

- Access control lists (ACLs)
- LDAP groups
- Role-based access control (RBAC) such as LDAP groups in J2E authorization
- Attribute-based access control (ABAC)

Authorization can be defined for any application along a continuum of granularity. For example, the following list of theoretical authorizations goes from coarse-grained to fine-grained:

- Everyone is authorized to view this web page.
- A user must be logged in to view this web page.
- A logged in user must also exist within an ACL to update this web page.
- A logged in user must be a member of a specific LDAP group to view certain sections of this web page.

- A logged in user must be known to the underlying application that generates this web page. Before any data is displayed on the web page, the application programmatically checks isUserInRole() to determine whether this user has been granted the role that is associated with this data.

- A logged in IBM Business Process Manager user can run this task only if they have these characteristics:
  - Are a member of a specific security group
  - Were not the last user to touch this task
  - Belong to a level of management that has authority to run this task
  - The task has not sat unattended for more than four hours

As you can see, IBM Business Process Manager defines a fine-grained authorization model, and in product-specific terms. For example, you are not authorized to run this task if you were also the last user to do so.

Authorization is mentioned in this book because it is commonly overlooked. Many customers believe that because they have groups defined within their corporate LDAP, then that is all that really must be considered. A discussion of IBM business process management, together with agile business process improvement, is outside of the scope of this book. For more information about these topics, see IBM Business Process Manager Security: Concepts and Guidance, SG24-8027.
IBM Business Process Manager presentation layer

This chapter describes the different options in IBM Business Process Manager processes in which the user can participate in the process execution.

This chapter includes the following sections:

- 4.1, “Introduction” on page 80
- 4.2, “Process Portal” on page 82
- 4.3, “IBM Business Space powered by WebSphere widgets” on page 86
- 4.4, “REST API” on page 88
- 4.5, “IBM Business Process Manager Tools and Add-Ons” on page 90
4.1 Introduction

The presentation layer is a major component in a human centric business process. It provides process functions to the participants. Usually, your business process management (BPM) application architecture resembles Figure 4-1. However, your needs can be much more simple. This diagram illustrates the high level architecture you might need.

![Figure 4-1 Typical BPM solution](image-url)
IBM Business Process Manager supports this approach from end-to-end with the bundle of tools shown in Figure 4-2.

Figure 4-2   BPM solution with IBM Business Process Manager
You can also replace some of these tools with your own implementations. Figure 4-3 shows what can be replaced by another tool such as a business intelligence (BI) solution to implement measurement and reporting.

![Figure 4-3 BPM solution with IBM Business Process Manager and other tools](image)

The focus in this chapter is the presentation layer. It describes the IBM Business Process Manager Process Portal (called Process Portal throughout this document) and other options you have to implement a presentation layer for your participants.

### 4.2 Process Portal

The IBM Process Portal is available in all configurations of IBM Business Process Manager. It is different in appearance and functionality from the IBM Process Portal in previous versions of IBM Business Process Manager.

From IBM Business Process Manager V7.5 to IBM Business Process Manager V8.0, the IBM Process Portal got a new Web 2.0 design. The new IBM Process Portal delivers a highly collaborative work experience with increased social
capabilities and visibility for knowledge workers. It is based on IBM Business Space powered by WebSphere.

In IBM Business Process Manager V8, you can complete your work more effectively. You can now collaborate in real time with experts and other users on tasks, comment on and discuss the work on process instances, and subscribe to the events and discussion streams for process instances. In addition, the new task list provides you with better access to the related business information.

IBM Process Portal includes the following new features:

- The ability to request help from experts, and collaborate with experts and other users in real time to complete work on a task.
- The ability to add comments and attach documents to a specific process or task.
- One-click subscription to process instances that a user is interested in, providing process-related on-screen notifications and activity updates in the subscribing user's activity stream.
- Activity streams that display activity updates, such as task creation and completion, user comments and actions, and notifications. Those that are displayed are related to tasks that are owned by a user or related to particular process instances that a user is following.
- Ability to bookmark a page to replace the default IBM Process Portal start page.
- Support for IBM Connections integration, which enables the default IBM Process Portal business card to be replaced with the IBM Connections Business Card.
- Enhanced user profile information, including avatars and configuration of notifications.
Figure 4-4 shows the main areas of the IBM Process Portal interface.

![Main areas of the Process Portal interface](image)

Table 4-1 describes each of the numbered areas in Figure 4-4.

**Table 4-1  Description of the main areas of the IBM Process Portal interface**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The <strong>Start Page</strong> is shown whenever you log in to IBM Process Portal. You can bookmark a different view or page, including a search results page, to be your start page.</td>
</tr>
</tbody>
</table>
| 2   | The Work page. The **My Tasks → Open Tasks** view contains both the tasks that you have claimed to work on and the tasks that are available for you to claim. The **My Tasks → Completed Tasks** view contains all of your finished work.  
   
   The **My Tasks → Saved Searches** tab contains customized task views that have been made available by the IBM Process Portal administrator. |
| 3   | The **Dashboards** page. Use dashboards to monitor the performance of processes, individuals, and teams. |
4.2.1 User interfaces

Participants interact with an IBM Business Process Manager implemented process through human services. *Coaches* are the user interfaces for human services.

Coaches are part of the human service flow. At run time, when the flow enters a Coach, you see 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.

The Coaches in IBM Business Process Manager V8.0 are different in construction than the Coaches in previous versions of IBM Business Process Manager.

The primary difference between Coaches and the Heritage Coaches of previous versions is that Coaches consist of one or more Coach Views. Coach Views are reusable collections of user interfaces that are frequently bound to a data type. This means that you can share common pieces of user interfaces between Coaches. You can now implement your own custom controls as Coach Views.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4   | The tabs that are shown depend on whether you working with your list of tasks in the My Tasks tab, or working on an individual task to complete the work. When the My Tasks tab is displayed, this area contains the following tabs:  
  - **Launch**  
    Use this tab to start processes and human services.  
  - **Following**  
    Use this tab to follow the work that is done on a specific process and add your comments to it.  
  - **@Mentions**  
    Use this tab to see a list of your collaboration invitations, and posts that mention your name. |
| 5   | Your **Preferences** page, where you can work with your user preferences. For example, you can update your business card information, or change your notification preferences. |
| 6   | The **Other Spaces** page is available only if the system is configured to use IBM Business Space powered by WebSphere. |

For more details about IBM Process Portal, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.wl e.widget.doc/topics/cport_gettingstarted.html
and then reuse these custom controls in other Coach Views and Coaches as shown in Figure 4-5.

Another key difference is the introduction of a client-side model to Coaches to apply the Web 2.0 appearance and behavior. The Coach has data on the client, which is available to all of the Coach Views at this Coach. This means if you have a control used in different Coach Views at this Coach that is bound to the same data object, all fields where this data object is bound to are updated as soon as one of these fields are updated. This happens without requiring a full-page refresh. The Coach framework and the stock control Coach Views use Dojo 1.7.1.

For more information about Coaches, see the following website:

4.3 IBM Business Space powered by WebSphere widgets

IBM Business Space powered by WebSphere is a browser-based, Web 2.0 user interface component. It is based on widgets that are grouped into pages within business spaces. These widgets adhere to the open iWidget 2.1 specification.
Figure 4-6 shows the IBM Business Space powered by WebSphere framework and products in the IBM Business Process Manager portfolio.

For more information about IBM Business Space powered by WebSphere, see these resources:

- Building IBM Business Process Management Solutions Using WebSphere V7 and Business Space, SG24-7861

Human Task Management widgets in IBM Business Process Manager are designed to run in an IBM Business Space powered by WebSphere environment. IBM Business Space powered by WebSphere provides an integrated Web 2.0 user experience for business users across the IBM Business Process Manager portfolio. These widgets can also be configured to work in the IBM WebSphere Portal environment.

You can build a unified environment of portlets and widgets within a single web portal page. It includes Human Task Management widgets, which business users and managers can use to interact with business processes and human tasks in Business Space. The following widgets related to IBM Business Process Manager are available:

- Viewer widgets
  - Documents, Google Gadgets, Presentations, Spreadsheets, Web Feeds, and Web Sites
Wiring widgets
Page Navigator and Script Adapter

User management widgets
Team List

Monitoring widgets
Alert Manager, Alerts, Diagrams, Export Values, Instances, KPI Manager, KPIs, KPI History and Prediction, Report Designer, Report Viewer, and Alphablox-based

Business Rules widget
Using Business Rules and Configuring Business Rules

For more information about the available widgets and their functions, see the following website:

4.4 REST API

IBM Business Process Manager provides a set of application programming interfaces (APIs) that are implemented by using Representational State Transfer (REST) services.

A set of IBM Business Process Manager-related REST resources are provided for accessing business processes, human tasks, and business object data. You can use these REST APIs to build a user interface or customize an existing portal application. The APIs are simple enough to be called from mobile devices or from rich Internet applications (RIAs).

Several REST methods are available to use on each IBM Business Process Manager resource. The following is the list of IBM Business Process Manager components in which various product functions are exposed in REST APIs:

- Business process definitions
- Process instances
- Tasks
- External activities and services
- Users and groups
- Saved searches and custom searches
For all REST resources provided by the IBM Business Process Manager REST APIs, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.bpc.doc/topics/rdev_restapis_resourcecategories.html

IBM Business Process Manager REST API calls were designed to work on behalf of a user. For example, claiming a task is done for a user, and getting a list of tasks is specific to a user. As a result, all IBM Business Process Manager REST API calls must be authenticated for a specific user.

The IBM Business Process Manager REST API uses these HTTP methods to access and modify server resources:

- GET (list, retrieve)
- POST (create)
- PUT (update)
- DELETE

An IBM Business Process Manager REST call can return its result as either a JavaScript Object Notation (JSON) or XML structure.

The IBM Business Process Manager software provides a convenient testing mechanism for these API calls as shown in Figure 4-7. This testing interface is at:

http://<host>:<port>/bpmrest-ui

Figure 4-7  IBM Business Process Manager REST API tester
4.5 IBM Business Process Manager Tools and Add-Ons

IBM Business Process Manager Tools and add-ons make it easier to get everyone involved in the business process management lifecycle. Workers can create, run, and manage processes that are built with IBM Business Process Manager using their iPhone and iPad, or the Microsoft SharePoint or Outlook environments.

4.5.1 IBM Business Process Manager for iPhone and iPad

You can start, collaborate on, and complete work items on the go with IBM Business Process Manager for iPhone and iPad. This app gives you the peace of mind that comes from knowing that important and time sensitive tasks are accessible wherever workers might be.

The IBM Business Process Manager app provides a single view that consolidates tasks from multiple IBM process sources. Built with ease of use and collaboration in mind, it allows you to interact with others to ensure that the correct people are working on the correct thing at the correct time. You can perform these tasks:

- View and complete tasks from your mobile device
- Start new processes remotely
- Review file attachments for extra context or approval
- Attach photos to an existing task

For more details about the IBM Business Process Manager for iPhone and iPad, see the following website:

https://www.blueworkslive.com/bpmmobile/

4.5.2 IBM Business Process Manager for Microsoft SharePoint

The IBM Business Process Manager for Microsoft SharePoint Add-On is an integrated add-on for Microsoft SharePoint. It provides access to the IBM Process Portal inbox and task execution, and reporting capabilities through SharePoint web parts.
Using IBM Business Process Manager, you can add IBM Business Process Manager process-related information to corporate or personal SharePoint sites. You can also effectively maintain, manage, and analyze IBM Business Process Manager tasks and process instances from any Microsoft SharePoint portal.

- Drag special IBM Business Process Manager Web parts onto your Microsoft SharePoint web pages to start processes, perform assigned tasks, and monitor performance.
- Manage in-flight IBM Business Process Manager processes, including starting and stopping process instances, viewing process diagrams, and reassigning tasks to balance workload.
- View real-time reports that show performance ScoreBoards for individuals, teams, and business processes.
- A common security and authentication model provides seamless interaction between IBM Business Process Manager and Microsoft SharePoint.
- Install without having to change or reconfigure your Microsoft SharePoint Server setups.
- Provides an integrated process toolbar for all user actions.

For more information about the IBM Business Process Manager for Microsoft SharePoint Add-On, see the following website:


4.5.3 IBM Business Process Manager for Microsoft Office Add-On

IBM Business Process Manager for Microsoft Office Add-On is an integrated add-on for Microsoft Outlook in Microsoft Office. It provides the following advantages:

- Start your tasks or view process performance reports directly from inside Microsoft Outlook
- IBM Business Process Manager task folders are integrated into Microsoft Outlook folders
- A common security and authentication model provides seamless interaction between IBM Business Process Manager and Microsoft Outlook
- Install without having to change or reconfigure your Microsoft Exchange Server setups
For more information about the IBM Business Process Manager for Microsoft Office Add-On, see the following website:

Chapter 5. Clustered topology choices

In Chapter 2, “Business Process Manager, Business Monitor, and WebSphere Application Server” on page 13, two levels of topology are described:

- The topology of the end-to-end IBM Business Process Manager environment
- The topology of each cell

This chapter focuses on the topology choices of each cell. There is a cell for the Process Center environment and a cell for each Process Server environment. It describes cell topologies and the factors that are involved in selecting an appropriate topology for each cell.

This chapter includes the following sections:

- 5.1, “Topology choice factors” on page 94
- 5.2, “Single Cluster topology” on page 95
- 5.3, “Remote Messaging topology” on page 98
- 5.4, “Remote Messaging Remote Support topology” on page 101
- 5.5, “Remote Messaging, Remote Support, and Web topology” on page 104
- 5.6, “Comparison of clustered topologies” on page 109
- 5.7, “Considerations for selection of clustered topology” on page 110
5.1 Topology choice factors

The key aspects of the cell topology design are introduced in 2.8, “Network deployment environment concepts” on page 41. The goal of building and configuring any cell in the IBM Business Process Manager environment is to meet your business needs for functionality, capacity, availability, and scalability. These include, but are not limited to, the following factors:

- The components to be used and how heavily each is to be used:
  - Types of business processes to be implemented
  - Business Space
  - Common Event Infrastructure
- Application invocation patterns
- Load on the system, including numbers of users or applications
- The number of application server clusters and cluster members that are needed to provide your production environment with the processing capabilities required by your business
- Individual scalability requirements

In addition to these factors, the selection of an appropriate topology for each of your cells can be influenced by factors unique to your situation. In this case, trade-offs might be necessary. The following, among others, are additional factors:

- Available hardware resources
- Hardware and software costs
- Administrative effort that is involved

When you select a cell topology, examine the suggested topology (sometimes referred to as a golden topology) to understand how that topology meets your requirements. The Remote Messaging, Remote Support, and Web topology is the suggested topology for IBM Business Process Manager Standard or Advanced.

A number of topologies, including the suggested topologies, are commonly used. The Deployment Environments wizard, found in the WebSphere Integrated Solutions Console, helps you create and configure these well-known topologies. The following deployment environment patterns are available in IBM Business Process Manager Standard and Advanced:

- Single Cluster
- Remote Messaging
- Remote Messaging and Remote Support
- Remote Messaging, Remote Support, and Web
The following deployment environment patterns are available for creating IBM Business Process Manager plus IBM Business Monitor topologies:

- Single Cluster
- Remote Messaging, Remote Support, and Web

Your choice of topology ultimately depends on your individual business requirements. Your business requirements, along with a detailed understanding of the products, can lead to a topology that is slightly different from those created by using the Deployment Environments wizard. In this case, you can piece together an optimized cluster configuration.

This chapter describes the various factors that can be considered for selection of cluster topology in 5.7, “Considerations for selection of clustered topology” on page 110.

5.2 Single Cluster topology

A Single Cluster topology is available for the following environments:

- IBM Business Process Manager Standard
- IBM Business Process Manager Advanced
- IBM Business Process Manager Standard or Advanced plus IBM Business Monitor environment

Single Cluster topologies can be easily created by using the Deployment Environment wizard.

Figure 5-1 on page 96 shows a sample configuration of the Single Cluster topology for IBM Business Process Manager Advanced. In this topology, the lone cluster hosts these components:

- Six messaging engines
- Process Center server (including the Process Center Console, Process Admin Console, and Process Portal) or Process Server server (including the Process Admin Console and Process Portal)
- Performance Data Warehouse
- Business Process Choreographer (for Business Process Execution Language (BPEL))
- Business Process Choreographer Explorer (for BPEL)
- Business Space
- Business Rules Manager
Deploy the process applications that you create by using IBM Process Designer and IBM Integration Designer to this cluster. The WebSphere Integrated Solution Console runs in the Deployment Manager. This cell also uses many sets of database tables:

- The Common database tables
- Process Server tables
- Performance Data Warehouse (PDW) tables
- Six sets of messaging engine tables
- BPEDB tables
- Tables for the Business Process Choreographer Reporting function
- Tables for Business Space

The following information applies to the Single Cluster topology for IBM Business Process Manager Standard:

- The lone cluster hosts:
  - Two messaging engines (one for Process Server, one for PDW)
  - Process Center server or Process Server server
  - Performance Data Warehouse
You can deploy the process applications that you create to this cluster by using IBM Process Designer.

The WebSphere Integrated Solution Console runs in the Deployment Manager.

This cell also uses many sets of database tables:
- The Process Server tables
- PDW tables
- Two sets of messaging engine tables

The following applies to the Single Cluster topology when IBM Business Monitor is included:
- The lone cluster also hosts:
  - A messaging engine for IBM Business Monitor
  - A messaging engine for Common Event Infrastructure
    If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, a single messaging engine for CEI is shared.
  - The IBM Cognos application
  - Business Space
    If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, a single Business Space is shared.
  - IBM Business Monitor widgets
- You also deploy your IBM Business Monitor Models to this cluster.
- This cell uses extra tables for IBM Business Monitor, IBM Cognos, each messaging engine, and Business Space.
  If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, single Business Space and Business Space tables are shared.

The Single Cluster topology is most suitable for environments with limited workload isolation requirements and limited hardware. This topology is most frequently used for early test environments. Because all of the components are installed in the same cluster, there are fewer total application server processes in the cell. Because each application server process requires runtime memory, and there are fewer application server processes, it might be possible to use smaller hardware.

However, each server instance must run the supporting applications and your integration applications. Therefore, the memory requirements for the individual Java virtual machines (JVMs) are much greater, which becomes a limitation in a
32-bit JVM. In addition, one or more members of the cluster must also run the messaging engines that are required for asynchronous interactions.

Combining all aspects of the IBM Business Process Manager environment into a single cluster has other implications other than the increased memory requirements for each server process. All types of workload, including business processes, CEI, and Business Space, are run in every cluster member. In addition, any cluster member that hosts an active messaging engine has messaging workload. Because all of these components are running in the same server process, a failure in a server process impacts all work in that server process.

From an administrative perspective, there is only one cluster to be started and stopped, and only one cluster's worth of cluster members' logs, such as SystemOut.log, to be monitored. However, because the cluster is hosting every type of component, the cluster members' log files, such as SystemOut.log, contain the output from all types of workloads.

From a scalability perspective, the ability to do more work can be increased by increasing the memory available to the existing cluster members, or by adding another member to the cluster. The most common pattern for adding a cluster member is to create another node and add another cluster member on that node.

All components are scaled at the same rate, except for the messaging engines, because each messaging engine is a singleton. In Figure 5-1 on page 96, the active messaging engines are indicated by the lighter icons, and the standby messaging engines are indicated by the shaded icons. Dispersing the messaging workload across the cluster by creating a Core Group policy for each active messaging engine is possible.

## 5.3 Remote Messaging topology

The Remote Messaging topology is the two-cluster topology. It can be created in IBM Business Process Manager Standard or Advanced by using the Deployment Environment wizard.

The most visible difference between the Remote Messaging topology and the Single Cluster topology is the location of the messaging engines. In the Remote Messaging topology, the messaging engines are in a cluster separate from the rest of the functions. Not only does this relieve the other cluster of the messaging workload, but it is also valuable because it limits the impact of specific failure scenarios.
Figure 5-2 shows a sample configuration of the Remote Messaging topology for IBM Business Process Manager Advanced.

The following information applies to the Remote Messaging topology for IBM Business Process Manager Standard:

- The messaging cluster hosts: Two messaging engines (one for Process Server, one for PDW).

- The application cluster hosts:
  - Process Center server or Process Server server
  - Performance Data Warehouse

- You also deploy the process applications that you create by using IBM Process Designer to the application cluster.

- The WebSphere Integrated Solution Console runs in the Deployment Manager.
This cell also uses many sets of database tables:

- The Process Server tables
- PDW tables
- Two sets of messaging engine tables

From a scalability perspective, the ability to do more work can be increased by these methods:

- Increasing the memory available to the existing cluster members
- Adding another member to the application cluster
- Adding another member to the messaging cluster and creating a core group policy for each active messaging engine so that the active messaging engines are dispersed across the cluster members

The most common pattern for adding a cluster member is to create another node and add another cluster member on that node.

When you add another member to a cluster, all components that are configured on that cluster are scaled at the same rate. In this topology, this applies to the application cluster. If you require a more fine-grained scalability of the specific components that are used in the application cluster, the Remote Messaging topology is not the correct choice.

The messaging cluster’s purpose is to host the messaging engines. Because each messaging engine is a singleton, adding another member to the Messaging cluster has no effect. In Figure 5-2 on page 99, the active messaging engines are indicated by the lighter icons, and the standby messaging engines are indicated by the shaded icons.

You can disperse the messaging workload across the cluster by creating a Core Group policy for each active messaging engine. Spreading the messaging engines across server members by using policies splits the messaging burden across the cluster’s members. However, even when you are using core group policies, adding more cluster members to the messaging cluster than you have active messaging engines has no scaling effect on the processing capability of the messaging infrastructure.

From an administrative perspective, there are two clusters’ worth of cluster members’ logs, such as `SystemOut.log`, to be monitored, and two clusters to be started and stopped. The application cluster depends on the messaging cluster for the messaging engines. To avoid errors or warnings during startup of the application cluster, start the messaging cluster first and ensure that all of the messaging engines start cleanly. Likewise, to avoid errors or warnings when you are stopping the clusters, stop the application cluster first, then stop the messaging cluster.
For more information, see the following website:
http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0mx/topic/com.ibm.wbpm.ad
min.doc/topics/start_stop_resources.html

5.4 Remote Messaging Remote Support topology

The Remote Messaging Remote Support topology is a three-cluster topology. It can be created in IBM Business Process Manager Standard of Advanced by using the Deployment Environment wizard.

The most visible difference between the Remote Messaging Remote Support topology and the Remote Messaging topology is the location of the components that support the execution of your process applications. They are not required to be in the same server process as your process applications. Support components include the Performance Data Warehouse and the Common Event Infrastructure.

In this topology, the support cluster also includes Business Space, the Business Process Choreographer Explorer, Business Rules Manager, and the REST API Services. This configuration relieves the application cluster from the workload of the supporting components, and is also valuable because it limits the impact of specific failure scenarios. If using IBM Business Monitor, this support cluster includes Cognos application and the CEI component are shared between both products (Process Center/Process Server and Monitor).
Figure 5-3 shows a sample configuration of the Remote Messaging Remote Support topology for IBM Business Process Manager Advanced.

The following applies to the Remote Messaging topology for IBM Business Process Manager Standard:

- The messaging cluster hosts: Two messaging engines (one for Process Server, one for PDW).
- The application cluster hosts: Process Center server or Process Server server
- The support cluster hosts Performance Data Warehouse.
- You also deploy the process applications that you create by using IBM Process Designer to the application cluster.
- The WebSphere Integrated Solution Console runs in the Deployment Manager.
This cell also uses many sets of database tables:

- The Process Server tables
- PDW tables
- Two sets of messaging engine tables

The hardware requirements for distributed systems are more intensive, but having more clusters that run specific functions allows greater flexibility when adjusting and tuning memory and processor usage for the JVMs.

This three-cluster topology has more administrative burden than the smaller Single Cluster or Remote Messaging topologies. There are three clusters' worth of cluster members' logs, such as SystemOut.log, to be monitored and three clusters to be started and stopped.

Your performance-tuning plan must address all three clusters. However, because of the greater division of workload among the three clusters, you can pinpoint performance bottlenecks and adjust the configuration fairly easily.

From a scalability standpoint, the Remote Messaging and Remote Support topology provides more flexibility than Remote Messaging topology. The ability to do more work can be increased by these procedures:

- Increasing the memory available to the existing cluster members
- Adding another member to the application cluster
- Adding another member to the support cluster
- Adding another member to the messaging cluster and creating a core group policy for each active messaging engine so that the active messaging engines are dispersed across the cluster members

The most common pattern for adding a cluster member is to create another node and add another cluster member on that node.

When you add another member to a cluster, all components that are configured on that cluster are scaled at the same rate. In this topology, this applies to the application cluster and to the support cluster. However, because the application cluster and the support cluster are configured to host different components, they can be scaled independently. For example, if you need more CEI processing, you can add a cluster member to the support cluster and not do anything to the application cluster. Similarly, if you need more processing capability for your business processes or human tasks, you can add cluster members to the application target cluster.

The messaging cluster's purpose is to host the messaging engines. Because each messaging engine is a singleton, merely adding another member to the messaging cluster has no effect. In Figure 5-3 on page 102, the active
messaging engines are indicated by the lighter icons, and the standby messaging engines are indicated by the shaded icons. You can disperse the messaging workload across the cluster by creating a core group policy for each active messaging engine. Spreading the messaging engines across server members by using policies splits the messaging burden across the cluster's members. However, even when using core group policies, adding more cluster members to the messaging cluster than you have active messaging engines has no scaling effect on the processing capability of the messaging infrastructure.

The Remote Messaging and Remote Support topology is better than a Single Cluster or Remote Messaging topology when requirements include extensive use of the Performance Data Warehouse or the Common Event Infrastructure.

Because the support cluster is still responsible for running your web applications and your business integration applications, it might be overloaded when there are heavy web UI interactions such as heavy use of Business Space functions. In this scenario, use the Remote Messaging, Remote Support, and Web topology, which is addressed in the following section.

**Requirements:** In a three or four cluster topology, Process Portal requires a routing server because it uses web components that are distributed across two clusters. If you do not configure a suitable server to redirect requests to the appropriate clusters, the same origin policy for the web browser prevents Process Portal from working correctly.

In a three cluster configuration, Process Portal relies on applications on both the application deployment target cluster and the support cluster. In a four cluster configuration, Process Portal relies on applications on both the application deployment target cluster and the web cluster.

## 5.5 Remote Messaging, Remote Support, and Web topology

The Remote Messaging, Remote Support, and Web topology is a four cluster topology. You can create it in IBM Business Process Manager by using the Deployment Environment wizard. This topology is the suggested topology for IBM Business Process Manager Advanced and IBM Business Process Manager Standard, or either of them with IBM Business Monitor.

The most visible difference between the Remote Messaging, Remote Support, and Web topology and the Remote Messaging Remote Support topology is the location of the Business Space, Business Process Choreographer Explorer, and
the Business Rules Manager. The most visible difference between the Remote Messaging, Remote Support, and Web topology and the Remote Messaging Remote Support topology is the location of the Business Process Choreographer Explorer, Business Rules manager, Business Space, Process Portal, and REST API Services. In the Remote Messaging, Remote Support, and Web topology, these are hosted in the web cluster. This configuration relieves the support cluster from the workload of the supporting components, and is also valuable because it limits the impact of specific failure scenarios.

Figure 5-4 shows a sample configuration of the Remote Messaging, Remote Support, and Web topology for IBM Business Process Manager Advanced.

Restriction: For IBM Business Process Manager Standard, the Remote Messaging, Remote Support, and Web topology does not provide any greater functionality than the Remote Messaging Remote Support pattern. This is because the web cluster is not used to host any IBM Business Process Manager Standard functions.
The following information applies to the Remote Messaging Support and Web topology when IBM Business Monitor is included:

- The messaging cluster also hosts:
  - A messaging engine for IBM Business Monitor
  - A messaging engine for Common Event Infrastructure
    
    If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, a single messaging engine for CEI is shared.

- The support cluster also hosts the IBM Cognos application.

- The web cluster also hosts:
  - Business Space
    
    If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, a single Business Space is shared.
  - IBM Business Monitor widgets

- You also deploy your IBM Business Monitor Models to the application cluster.

- This cell uses extra tables for IBM Business Monitor, IBM Cognos, each messaging engine, and Business Space.

  If IBM Business Process Manager Advanced and IBM Business Monitor are configured together, single Business Space and Business Space tables are shared.
Figure 5-5 shows an example of the Remote Messaging, Remote Support, and Web topology with IBM Business Process Manager Advanced plus IBM Business Monitor.

This four cluster topology has more administrative burden than the smaller Single Cluster or Remote Messaging topologies. There are four clusters’ worth of cluster members' logs, such as SystemOut.log, to be monitored, and four clusters to be started and stopped.

Your performance tuning plan must address all four clusters. However, because of the greater division of workload among the four clusters, you can pinpoint performance bottlenecks and adjust the configuration fairly easily. On distributed systems, having more clusters that run specific functions allows greater flexibility when you adjust and tune memory and processor usage for the JVMs.

From a scalability standpoint, the Remote Messaging, Remote Support, and Web topology provides more flexibility than the Remote Messaging Remote...
Support topology. The ability to do more work can be increased by these procedures:

- Increasing the memory available to the existing cluster members
- Adding another member to the application cluster
- Adding another member to the support cluster
- Adding another member to the web cluster
- Adding another member to the messaging cluster and creating a core group policy for each active messaging engine so that the active messaging engines are dispersed across the cluster members

The most common pattern for adding a cluster member is to create another node and add another cluster member on that node.

When you add another member to a cluster, all components that are configured on that cluster are scaled at the same rate. In this topology, this applies to the application cluster, the support cluster, and the web cluster. However, because the application cluster, support cluster, and web cluster are configured to host different components, they can be scaled independently. For example, if you need more CEI processing, you can add a cluster member to the support cluster without affected the application cluster and web cluster.

The messaging cluster’s purpose is to host the messaging engines. Because each messaging engine is a singleton, merely adding another member to the messaging cluster has no effect. In Figure 5-5 on page 107, the active messaging engines are indicated by the lighter icons, and the standby messaging engines are indicated by the shaded icons.

You can disperse the messaging workload across the cluster by creating a core group policy for each active messaging engine. Spreading the messaging engines across server members by using policies splits the messaging burden across the cluster’s members. However, even when using core group policies, adding more cluster members to the messaging cluster than you have active messaging engines has no scaling effect on the processing capability of the messaging infrastructure.

The Remote Messaging, Remote Support, and Web topology is more preferred than a Remote Messaging Remote Support topology when requirements include extensive use of the Business Space or Business Process Choreographer Explorer.
5.6 Comparison of clustered topologies

Table 5-1 shows the matrix of the topologies that are described in this chapter.

Table 5-1  Matrix of topologies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Cluster</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ Offered through Deployment Environments wizard</td>
</tr>
<tr>
<td>Remote Messaging</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ No DE wizard support</td>
<td>▶ No DE wizard support</td>
</tr>
<tr>
<td>Remote Messaging and Remote Support</td>
<td>▶ Preferred ▶ Offered through Deployment Environments wizard</td>
<td>▶ Offered through Deployment Environments wizard</td>
<td>▶ No DE wizard support</td>
<td>▶ No DE wizard support</td>
</tr>
<tr>
<td>Remote Messaging, Support and Web</td>
<td>▶ No better than Remote Messaging Remote Support ▶ Offered through Deployment Environments wizard</td>
<td>▶ Preferred ▶ Offered through Deployment Environments wizard</td>
<td>▶ Preferred ▶ Offered through Deployment Environments wizard</td>
<td>▶ Preferred ▶ Offered through Deployment Environments wizard</td>
</tr>
</tbody>
</table>

Table 5-2 is a brief summary of the pros and cons for each topology.

Table 5-2  Comparison of topologies

<table>
<thead>
<tr>
<th>Topology</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Cluster</td>
<td>▶ Excellent for test environments ▶ Suitable for limited hardware ▶ Minimum number of clusters to administer</td>
<td>▶ Least granular scalability ▶ Lack of isolation ▶ Each server process does all kinds of work, which might consume all memory</td>
</tr>
</tbody>
</table>
### 5.7 Considerations for selection of clustered topology

Table 5-3 lists the factors that can be considered while selecting the topology.

**Table 5-3  Cluster topology selection criteria**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of clusters to maintain</td>
<td>One cluster for all components.</td>
<td>Two clusters: One cluster for applications and for the support infrastructure. One cluster for messaging.</td>
<td>Three clusters: One cluster for applications. One cluster for the support infrastructure. One cluster for messaging.</td>
<td>Four clusters: One cluster for applications. One cluster for web interfaces. One cluster for support infrastructure. One cluster for messaging.</td>
</tr>
<tr>
<td>Hardware requirements</td>
<td>Can be implemented on limited hardware.</td>
<td>More hardware is required for distributed environments.</td>
<td>More hardware is required for distributed environments.</td>
<td>Most hardware intensive.</td>
</tr>
<tr>
<td>Asynchronous interactions</td>
<td>Use can be minimal.</td>
<td>Use must be balanced against resource availability.</td>
<td>Ideal environment for asynchronous interactions.</td>
<td>Ideal environment for asynchronous interactions.</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Long-running processes, state machines, and human tasks</td>
<td>Use can be minimal.</td>
<td>Use must be balanced against resource availability.</td>
<td>Ideal environment for interruptible processes, state machines, and human tasks.</td>
<td>Ideal environment for interruptible processes, state machines, and human tasks.</td>
</tr>
<tr>
<td>Heavy CEI activity</td>
<td>Not recommended (Light CEI use can be balanced against resource usage.)</td>
<td>Not recommended (Light CEI use can be balanced against resource usage.)</td>
<td>Ideal environment for heavy CEI use.</td>
<td>Ideal environment for heavy CEI use.</td>
</tr>
<tr>
<td>Operational effort</td>
<td>Relatively small.</td>
<td>Medium.</td>
<td>Relatively large.</td>
<td>The most effort.</td>
</tr>
<tr>
<td>Scalability</td>
<td>All components are scaled at the same rate.</td>
<td>Messaging cluster scalability limited (no benefit beyond three servers). All other components are scaled at the same rate.</td>
<td>Easy to scale. All functions are separated. Messaging cluster scalability still limited.</td>
<td>Easiest to scale. All functions separated Messaging cluster scalability still limited (benefit comes when other BPM products are introduced).</td>
</tr>
<tr>
<td>Routing server</td>
<td>Optional for load balancing and high availability.</td>
<td>Optional for load balancing and high availability.</td>
<td>Required for Process Portal, and can also be used for load balancing and high availability.</td>
<td>Required for Process Portal, and can also be used for load balancing and high availability.</td>
</tr>
</tbody>
</table>
Advanced topology choices

This chapter describes how existing topologies can be extended. It also describes a few advanced cluster topology options available with these extensions.

- Cross Cell topology with IBM Business Monitor: This topology can be used to set up IBM Business Monitor in its own cell based on the Remote Messaging, Remote Support, and Web topology pattern.
- Five cluster topology: This an extension of the four cluster pattern by adding a cluster for IBM Business Monitor. This topology is most useful in cases that require heavy use and isolation of IBM Business Monitor models.

This chapter includes the following sections:

- 6.1, “Extending a topology” on page 114
- 6.2, “Adding cluster members” on page 116
- 6.3, “Five cluster topology” on page 119
- 6.4, “Adding cells” on page 120
6.1 Extending a topology

Extending a topology refers to modifying an existing topology to expand the topology in some way. You might consider expanding an existing topology for one or more of the following reasons:

- Isolation
- Multi-tenancy
- Growth
- Resource constraints
- Simplicity
- Performance

6.1.1 Isolation

One reason to expand your topology is to satisfy isolation requirements. These requirements might be for business reasons, or they might be for technical or operational reasons. For example, the new application set might be on a unique schedule for maintenance and updates, and that schedule might not be acceptable to the original application running on the original environment. Another reason for isolation is that the new application set might be identified as not being well behaved. It is important to eliminate any risk of errors that are caused by the new application set from having an impact on the execution of the existing application sets.

In addition to logical cluster-only isolation, the new clusters can be created on separate hardware, allowing for dedication of physical machine capacity. Therefore, hardware isolation can be achieved as well.

Another reason for isolation stems from functional necessity. The applications might have different functional requirements. There might be different requirements for qualities of service, or the two application sets might have different characteristics/requirements for performance.

For example, suppose that an application set is deployed and that it does not use human tasks. Operations might not configure the Human Task Manager (HTM) because it is not required. Later, a second application set is to be deployed, but this second application set uses human tasks. Before the second application set can be deployed, the original deployment target must be configured to host HTM or a new deployment target must be created and configured.

Another example is the same situation above, where the first set of applications consists only of microflows, and the second set of applications uses human tasks, and therefore consists of some macroflows. The existing topology might
be configured with just microflows in mind for performance reasons. In this case, deploying the second application set is detrimental to the performance of the second application set, and its runtime characteristics might degrade performance of the first set.

6.1.2 Multi-tenancy

Multi-tenancy refers to the capability of one set of applications to serve multiple clients organizations (tenants). Multi-tenancy is contrasted with a multi-instance configuration where separate instances of the set of applications are set up for different client organizations. With a multi-tenant configuration, a set of applications virtually partitions its data and configuration. Each client organization works with a customized virtual instance of the set of applications. Isolation is a must for a multi-tenant configuration.

6.1.3 Growth

Another reason for expanding a topology is growth. There are limits to the capacity of a single cluster, whether it is an application target cluster, a messaging engine cluster, or even a support or web cluster. If many applications are deployed and they are running high volumes with many different large objects in memory, the application target cluster can become resource constrained.

There might be some growth that is based on versioning of applications. If the old versions of the application remain while the new versions of the application are deployed, the number of applications and destinations increases. This eventually leads to an overburdened situation. Overburdened situations are another growth-related reason for using more clusters to avoid a performance bottleneck.

6.1.4 Resource constraints

Resource constraints are a reason you might want to expand a topology. Types of resources used by a system include runtime memory, native memory, processor, databases, disks, and backend systems. Overburdened situations involving these resources create a performance bottleneck. Runtime memory can become constrained if there are many applications that are deployed, running high volumes, with many large objects in memory, or a combination of these. For example, a constraint might be caused by having too much static XSD type information. Or the underlying JVMs might spend too much time doing garbage collection because the heap is constrained or even fragmented because of large objects.
Another resource constraint to avoid is overuse of a single set of database tables. For example, if there are many deployed Business Process Execution Language (BPEL) applications, and many process instances are started and tasks claimed, there is heavy use of the BPEDB tables. This heavy use can lead to a resource constraint on those database tables, and access times to the tables increase. Having many applications that are deployed might introduce contention on shared thread pools, database connection pools, or any other shared resource.

### 6.1.5 Simplicity

Another reason for expanding a topology is simplicity. Growing a topology by creating more application deployment target and messaging target pairs is a repeatable and proven process with these steps:

1. Create the clusters.
2. Configure each cluster.
3. Include settings for service integration bus connectivity.

As you implement more application sets, each one receives a new application deployment target and messaging target pair. It is much easier to plan for messaging engine capacity and service integration bus connectivity than it is to retrofit an existing topology.

There are multiple ways to expand your topology:

- Adding cluster members to a cell
- Adding a cluster
- Adding cells

### 6.2 Adding cluster members

The easiest way to expand your infrastructure is to add more cluster members to your existing clusters. You can add cluster members to each cluster independently or in combination, depending on where you need growth. You can add an application cluster member, a messaging cluster member, or both. By expanding your clusters this way, you can improve your application throughput, your message throughput, or both.
Consider this approach when one of the following situations occurs:

- You plan to deploy new applications to your existing environment.
- You anticipate increased volume requirements for your existing applications.
- You need more capacity for operational purposes, such as failover.

However, there are some cases where expanding existing clusters is not appropriate.

Consider another solution in the following cases:

- You have applications or sets of applications that serve different business purposes, and you want to keep them distinct. If you deploy these distinct applications to the same deployment environment, you might introduce dependencies between otherwise unrelated business domains. Dependencies can affect such things as maintenance schedules and application availability when, for example, unrelated applications are less reliable.

- After you analyze your performance characteristics, you realize that planned deployments might push your system beyond the limits of the current deployment target. They might introduce too many modules from new applications or new versions of applications to run in the existing memory space, or use your database tables too heavily.

Extending cluster members can be done in these ways:

- Horizontal clustering
- Vertical clustering

### 6.2.1 Horizontal clustering

The first is the horizontal type that you are probably more familiar with. In this arrangement, a clone of the application target server is created on another node. The resulting set of equivalent servers (one on each node) is a traditional cluster. Horizontal capacity provide the benefit of increased fault tolerance. Because the cluster members are running on separate nodes, they are running on separate systems (at least logical systems and possibly physical machines). For a logical machine, this might still increase processor capacity. For a physical machine, it definitely does. Figure 6-1 on page 118 shows how cluster members are added by using horizontal clustering.

There is extra processor usage with any calls that must pass between the JVMs on two separate machines. Remember that a single Messaging Engine server is active, so one of the servers incurs this extra processor usage.
Often the benefit of increased hardware capacity and fault tolerance of horizontal clustering outweighs the costs.

![Figure 6-1 Adding a cluster member horizontally](image)

### 6.2.2 Vertical clustering

Similarly, you can create cluster members vertically, which means that multiple application target servers are created on the same node. Each cluster member can serve the same content as in the horizontal cluster member case.

The goal of vertical clustering is to distribute the processing of the original cluster across two clusters, increasing performance or removing a resource constraint. This assumes that the node has the resource capacity to handle the additional servers. In addition, vertical clustering carries a cost. Vertical clustering is a good idea when the benefits outweigh the costs, and you have excess capacity at the node level.
Vertical clustering means that there are more JVMs sharing resources, causing more contention for processor resources. There is extra processor usage with any calls that must pass between the JVMs. However, that is incurred with either clustering method.

6.3 Five cluster topology

The five-cluster topology can be used in environments that have IBM Business Process Manager Advanced with IBM Business Monitor. This topology is not one of the patterns that are offered by using the Deployment Environment wizard. It can be created by first creating a Remote Messaging, Remote Support, and Web topology by using the Deployment Environments wizard, then manually creating the fifth cluster and completing the configuration for IBM Business Monitor.

This topology is most useful in cases that require heavy use and isolation of IBM Business Monitor models. In addition, this topology might be familiar to you if you have previously used WebSphere Process Server and WebSphere Business Monitor.

The most visible difference between the five-cluster topology and the Remote Messaging, Remote Support, and Web topology is the location of the IBM Business Monitor models. In the five-cluster topology, these are hosted in the IBM Business Monitor cluster. This configuration relieves the application cluster from the workload of the supporting monitor model execution, and also limits the impact of specific failure scenarios.

**Requirement:** To use this topology, your IBM Business Monitor models must be packaged separately from your process applications. The IBM Business Monitor models are deployed to a separate deployment target (the IBM Business Monitor cluster) from the process applications (the application cluster).

You cannot use the five-cluster topology if your IBM Business Monitor model is associated with a process application. All parts of a process application (such as BPMN processes and their IBM Business Monitor models) are packaged together and must be installed to the same deployment target. There is no support for deploying part of a process application to the application cluster while the other part is deployed to the IBM Business Monitor cluster. If the IBM Business Monitor models are created by using IBM Process Designer and published to the Process Center repository, the IBM Business Monitor model must be part of the process application. Therefore, the five-cluster topology cannot be used as a target run time. If you use IBM Integration Designer to
create the IBM Business Monitor models, they can be exported from IBM Integration Designer in their own EAR file. This EAR file can be deployed to the IBM Business Monitor cluster.

Figure 6-2 shows a sample configuration of the five-cluster topology for IBM Business Process Manager Advanced plus IBM Business Monitor.

Figure 6-2  Adding new cluster

6.4 Adding cells

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 completes isolation for your applications.
However, adding another cell involves more administration. You must duplicate common cell-level configurations, such as global security settings. You must use multiple consoles to manage all of your applications, such as separate administrative consoles and failed event managers. In fact, you might want some of this separation based on your isolation requirements.

A scenario where this option can be useful is when you must extend the existing topology by adding IBM Business Monitor in its own cell.

### 6.4.1 Cross-cell topology with IBM Business Monitor

A cross-cell environment is one in which IBM Business Monitor receives events from an event server that is in a different cell from the IBM Business Monitor server. A cross-cell environment can involve either network deployment (ND) or single-server topology. In either case, you must perform several steps to enable communication between the Common Event Infrastructure (CEI) server and the IBM Business Monitor server. For more information about how to enable cross-cell communication, see Chapter 14, “Cross-cell topology with IBM Business Monitor” on page 293.

**Topology overview**

When you install IBM Business Monitor in a separate cell from Process Server, you have multiple choices of which topology to use in the IBM Business Monitor cell, just as you had multiple choices of topologies in the Process Server cell. The primary choices are the Single Cluster or the Remote Messaging, Remote Support, and Web (the Four-Cluster) topology. These topologies each have a deployment environment pattern. You can use the deployment environment wizard to configure the clusters, servers, and components.
This chapter addresses the Four-Cluster topology, which uses the Remote Messaging, Remote Support, and Web deployment environment pattern. This pattern groups the IBM Business Monitor applications into four clusters in a single cell. The components of IBM Business Monitor are distributed among the four clusters as shown in Figure 6-3.

![Figure 6-3 Four-Cluster topology component layout](image)

**Event delivery in cross-cell topology**

In a cross-cell topology, IBM Business Monitor is installed and configured as its own WebSphere Application Server plus IBM Business Monitor cell. Common Business Events (CBEs) issued in the IBM Business Process Manager cell by a Process Server instance must be delivered to the monitor model applications in the IBM Business Monitor cell. There are two options for this cross-cell delivery:

- Table-based event delivery
- Queue-based event delivery

**Table-based event delivery**

You can configure your CEI event service to send the events to the event database table for the monitor model. With table-based event delivery, the work can be distributed among multiple cluster members. Additionally, the event flow skips the JMS queue of the monitoring model and directs all events into the event database table of the model. For most environments, this method improves performance by avoiding a persistence step that is required by the JMS queue. A benefit of the table-based methods is that you no longer must configure the service integration bus and link when you receive events from a remote cell. You can rebuild earlier models to use this method.
In table-based event delivery, the CBEs are delivered to IBM Business Monitor by using the monitor database (Figure 6-4).

![Queue based event delivery diagram]

**Queue-based event delivery**
An alternative option is to use a cross-cell bus link between the monitor bus in the Process Server cell and the monitor bus in IBM Business Monitor.

Queue-based event delivery uses JMS to deliver events from CEI to the monitor model. Table-based event delivery (formerly known as queue bypass) uses a database table to deliver events from CEI to the monitor model.
To receive events using the JMS queues, you do not need to perform any additional steps unless you want to enable communication between the IBM Business Monitor server and a remote CEI server. You must use the queue-based method for event management if you are using a monitor model that was created using IBM Business Monitor 6.1 in an IBM Business Monitor 8.0 environment without upgrading your monitor model. See Figure 6-5.

**Figure 6-5  Queue-based event delivery**
IBM HTTP Server and WebSphere proxy server

This chapter provides an introduction to the web server products, including IBM HTTP Server and WebSphere proxy server. After the IBM Business Process Manager deployment environment is ready, you must further configure your environment so that it can function properly as a cluster with a web server.

This chapter includes the following sections:

- 7.1, “IBM HTTP Server and plug-in” on page 126
- 7.2, “WebSphere proxy server” on page 128
- 7.3, “IBM HTTP Server versus WebSphere proxy server” on page 130
- 7.4, “Configuring IBM Business Process Manager to use a web server” on page 131
7.1 IBM HTTP Server and plug-in

The IBM HTTP Server is a full-featured web server that is based on Apache HTTP Server with IBM enhancements. The IBM HTTP Server plug-in provides (among other functions) a load-balancing capability that can be closely integrated with the IBM Business Process Manager cell topology. IBM HTTP Server and plug-in is an independent product and shipped as a supplement with all WebSphere Application Server packages.

An IBM HTTP Server is usually on an unmanaged node and installed outside the firewall or in the DMZ. The DMZ is a safe zone between firewalls that is typically located between a client and a back-end server. The IBM HTTP Server on the unmanaged node can be administered from the WebSphere Integrated Solutions Console. With this configuration, the administrator can automatically push the plug-in configuration file to IBM HTTP Server with the deployment manager by using HTTP commands, as shown in Figure 7-1.

The IBM HTTP Server plug-in is used to route requests to one of multiple cluster members, as shown in Figure 7-2 on page 127. The plug-in uses the plug-in configuration file to determine whether a request is handled by IBM HTTP Server or forwarded to a WebSphere Application Server. The request can be transmitted by the plug-in by using either HTTP or Hypertext Transfer Protocol Secure (HTTPS).

The plug-in configuration file, plugin-cfg.xml, is an XML file that contains application, server, and cluster configuration information that is used for server selection. This file is generated in the IBM Business Process Manager cell, which...
is propagated to IBM HTTP Server, and stored in the plug-in directory of IBM HTTP Server. When any new application is deployed, or any server or cluster configuration changes are made, the plugin-cfg.xml file must be regenerated and redistributed to IBM HTTP Server.

![Figure 7-2 IBM HTTP Server plug-in and plug-in configuration file](image)

The IBM HTTP Server's responsibility is to distribute load among cluster members. It is designed to handle HTTP load from thousands of users, and is a key component for high-volume scenarios.

The IBM Business Process Manager cell topologies that are described use this load-balancing function to route requests from Business Space widgets to the REST gateway services, and from the Business Process Choreographer Explorer UI to the BPEContainer and HTMContainer REST services. Essentially, this decouples the web user interfaces (UIs) from the backend data requests by acting as an HTTP sprayer.
7.2 WebSphere proxy server

WebSphere proxy server is a reverse caching proxy that is included in WebSphere Application Server Network Deployment. The proxy server is a different type of application server that manages the request workload received from clients. It then forwards them on to the application server that is running applications. Because the proxy server is based on WebSphere Application Server, it inherits these advantages:

- The proxy server can be dynamically informed of cluster configuration, runtime changes, and application information updates by using the built-in high availability infrastructure, unified clustering framework, and on-demand configuration.

- The proxy server can also use the transport channel framework, which builds specific I/O management code per platform. Using this framework enables the proxy to handle thousands of connections and run I/O operations quickly.

WebSphere proxy server can be used to classify, prioritize, and route HTTP and SIP requests to servers in the enterprise and cache server content. The proxy server is created in the same cell of IBM Business Process Manager and shares the IBM Business Process Manager network deployment configuration. It usually is the initial point of entry, after the protocol firewall, for requests that enter the environment. It cannot be considered a secure proxy for DMZ deployments.
WebSphere proxy server must stay in the intranet or secure zone, as shown in Figure 7-3.

WebSphere proxy server provides many functions that IBM HTTP Server and the plug-in have. However, it is not a full replacement for the IBM HTTP Server plug-in because it does not have web serving capabilities. Static content can be served from the proxy cache. If the web server is used only for load balancing and routing with session affinity, WebSphere proxy server can take the place of IBM HTTP Server.

In this book, WebSphere proxy server is used in the IBM Business Process Manager cell topologies in a similar way to IBM HTTP Server and the plug-in.
7.3 IBM HTTP Server versus WebSphere proxy server

Both the server configured with the IBM HTTP Server plug-in and the WebSphere proxy server can be used to load balance requests being serviced by application servers and clusters. Both can also be used to improve performance and throughput by providing services such as workload management and caching web content to offload back-end server work.

However, there are some important differences between the two:

- IBM HTTP Server as an independent product that must be installed separately with IBM Business Process Manager. For WebSphere proxy server, no additional installation is required. It is easily created because it is built into the WebSphere Application Server Network Deployment product that the IBM Business Process Manager products are based on.

- IBM HTTP Server is usually on an unmanaged node and installed outside the firewall or in the DMZ. WebSphere proxy server is usually on a managed node in the same cell of IBM Business Process Manager, and cannot be considered a secure proxy for DMZ deployments. WebSphere proxy server must stay in the intranet or secure zone.

- IBM HTTP Server uses a static configuration file that contains application, server, and cluster configuration information that is used for data routing and server selection. When any new application is deployed or any server or cluster configuration changes are made, this configuration file must be regenerated in IBM Business Process Manager and redistributed to IBM HTTP Server. In contrast, WebSphere proxy server can be dynamically informed of cluster configuration, runtime changes, and application information updates because it is created in the same cell of IBM Business Process Manager and shares the IBM Business Process Manager network deployment configuration. For the proxy server, there are no static configuration files to generate and propagate like with IBM HTTP Server.

Select the correct web server for your IBM Business Process Manager cell topology. They are used in a similar way to route HTTP requests to each member of the appropriate clusters. It helps you determine whether you can set up an IBM HTTP Server plug-in or a proxy server to provide session affinity, failover support, and workload balancing for your IBM Business Process Manager topology.
7.4 Configuring IBM Business Process Manager to use a web server

The IBM HTTP Server or WebSphere proxy server can be used to spread the http requests among the IBM Business Process Manager cluster members. After the IBM Business Process Manager deployment environment is ready, you can further configure it to use IBM HTTP Server or WebSphere proxy server.

**Important:** In a three-cluster or four-cluster topology, a web server (either IBM HTTP Server or WebSphere proxy server) must be configured to make the Process Portal work correctly. You need a web server for three and four-cluster configurations because Process Portal uses web components that are distributed across two clusters. If you do not configure a suitable server to redirect requests to the appropriate clusters, the same origin policy for the web browser prevents Process Portal from working correctly.

In a three-cluster configuration, Process Portal relies on applications on both the application deployment target cluster and the support cluster. In a four-cluster configuration, Process Portal relies on applications on both the application deployment target cluster and the web cluster.

For more information about configuring a routing server for Process Portal in a three or four-cluster topology, see this website:


7.4.1 Configuring IBM Business Process Manager to use IBM HTTP Server

Complete the following steps to configure IBM Business Process Manager to use IBM HTTP Server:

1. Install an IBM HTTP Server and configure the plug-in.
   The IBM HTTP Server and plug-in must be installed and configured properly. For the installation instructions, see “Installing IBM HTTP Server and Web Server plug-in” on page 154. For the plug-in configuration instructions, see 16.1.1, “Configuring IBM HTTP Server plug-in” on page 345.

2. Add IBM HTTP Server to the IBM Business Process Manager cell.
   The IBM HTTP Server must be added to the IBM Business Process Manager cell as a web server. For more information, see 16.1.2, “Adding the HTTP server to the Business Process Manager cell” on page 346.
3. Check the web modules’ mapping to the web server.

After you add IBM HTTP Server to the cell, all the existing web modules must be mapped to IBM HTTP Server. If you have already created the IBM HTTP Server configuration as in step two before the generation of the deployment environment, you must manually map these modules.

For more information, see to 16.1.3, “Checking the web modules mapping to the web server” on page 355

4. Configure the host aliases.

Ensure that each host alias in the virtual host `default_host` contains the host and port information for each cluster member and web server to be serviced. For more information, see 16.1.4, “Configuring host aliases” on page 358

5. Configure the IBM HTTP Server plug-in properties.

You must configure IBM HTTP Server plug-in properties to make it work properly with Business Space and Process Portal component of IBM Business Process Manager. For more information, see 16.1.5, “Configuring IBM HTTP Server plug-in properties” on page 361.

6. Customize the Process Center or Process Server cluster to use IBM HTTP Server.

You can customize the Process Center or Process Server environment to enable it to function properly as a cluster with IBM HTTP Server. For more information, see 16.1.6, “Customizing Process Center cluster to use IBM HTTP Server” on page 362.

7.4.2 Configuring IBM Business Process Manager to use the WebSphere proxy server

Because WebSphere proxy server is built into the WebSphere Application Server Network Deployment product that the IBM Business Process Manager are based on, if you decide not to use a stand-alone product such as IBM HTTP Server, the easiest solution is to configure the built-in WebSphere proxy server by using the administrative console. This solution does not require you to install any other products or purchase extra licenses.

WebSphere proxy server is simpler to set up than IBM HTTP Server for these reasons:

- WebSphere proxy server is built into WebSphere Application Server Network Deployment product that the IBM Business Process Manager products are based on. Therefore, no additional installation is required.
- Because WebSphere proxy server is created in the same cell of IBM Business Process Manager and shares the IBM Business Process Manager
network deployment configuration, there are no static configuration files to generate and propagate as with IBM HTTP Server.

Complete the following steps to configure IBM Business Process Manager to use WebSphere proxy server:

1. Create the WebSphere proxy server in the IBM Business Process Manager cell.

   Create the WebSphere proxy server in the IBM Business Process Manager cell as a web server. For more information, see 16.2.1, “Creating WebSphere proxy server in the IBM Business Process Manager cell” on page 368.

2. Check that web modules are enabled for the proxy server.

   For each WebSphere enterprise application that you want the proxy server to serve, verify that its web modules are enabled for the proxy server. For more information, see 16.2.2, “Checking the web modules that are enabled for proxy server” on page 370.

3. Configure the host aliases.

   Ensure that each host alias in the virtual host `default_host` contains the host and port information for each cluster member and web server to be serviced. For more information, see 16.2.3, “Configuring host aliases” on page 373.

4. Configure the proxy server settings.

   You must configure proxy server settings to make it use the HTTP protocol. For more information, see 16.2.4, “Configuring proxy server settings” on page 377.

5. Customize the Process Center or Process Server cluster to use WebSphere proxy server.

   You can customize the Process Center or Process Server environment so it can function properly as a cluster with the proxy server. For more information, see 16.2.5, “Customizing Process Center cluster to use proxy server” on page 379.
Building production topologies

This part includes the following chapters:

- Downloading and installing binary files
- Database tables and schema creation
- Creating IBM Business Process Manager profiles
- Single Cluster topology
- Remote Messaging, Remote Support, and Web topology
- Remote Messaging, Remote Support, and Web topology with IBM Business Monitor
- Cross-cell topology with IBM Business Monitor
- Post-creation configuration and verification
Downloading and installing binary files

This chapter describes creating the infrastructure, and provides information about the software that used, installing the software, and the installation of other software components necessary to prepare the topologies.

This chapter includes the following sections:

- 8.1, “Installation overview” on page 138
- 8.2, “Prerequisite steps” on page 139
- 8.3, “Installing the software” on page 142
8.1 Installation overview

The installation steps that this chapter describes are based on multiple installations on many clients and represent the preferred practices. Follow the steps to install IBM Business Process Manager successfully on a production environment.

Figure 8-1 shows the steps to run during the installation process. It is divided into prerequisite and installation steps. Certain prerequisite steps can be done in parallel. Run all the prerequisite steps before you install the software.
When the prerequisites steps are thoroughly run, the installation process will likely be fast and smooth. Ensure that you go through each of the steps and check that all the components are configured and available.

Before you start the software installation in a production environment, ensure that you have all the infrastructure ready.

8.2 Prerequisite steps

This section lists the prerequisite steps to take before you install and configure your system.

8.2.1 Selecting the topology

The first and most important step is to select the topology that you are going to use on your production environment. For more information, see Chapter 5, “Clustered topology choices” on page 93 and Chapter 6, “Advanced topology choices” on page 113.

8.2.2 Selecting a database

A database is a key component in an IBM Business Process Manager and IBM Business Monitor installation. These products can only be configured and run if there is a database installed and available for them.

This example uses IBM DB2® as its database. You can choose IBM DB2 or any other database provider that is supported by IBM Business Process Manager products in your environment. For a complete list of supported databases, access the Information Center.

The database administration (DBA) team involvement in the early phases of the installation process is essential for a timely installation and acceptable performance of your IBM Business Process Manager project.

8.2.3 Allocating servers

The host systems where you plan to run IBM Business Process Manager V8.0 must be installed and running. They must have enough capacity, RAM memory, and disk space to run the topology that you created.
The operating system must also comply with the software prerequisites and be configured accordingly. Verify the operating system's prerequisites and set up the system before you install IBM Business Process Manager V8.0.

To verify the hardware and software prerequisites for IBM Business Process Manager Advanced V8.0, see the following website:


Servers to run database, LDAP (or any user registry), Simple Mail Transfer Protocol (SMTP), and any other component must be available too. The IBM Business Process Manager relies on these components to be configured and run.

### 8.2.4 Defining the network

A production topology installation can include various components that are spread across many host servers. These components use the network to communicate changing runtime request information and IBM WebSphere Application Server internal administration data. If your network is misconfigured, problems might arise during the installation or when you are running the production environment. Verify that the network components are working and are set up properly, including firewalls, host names, IPs, DNS, latency time, and other components.

### 8.2.5 Installing and tuning the operating system

After you decide which topology to use, allocate the servers (or at least a subset of them), and configure your network, install the operational system. Some configuration might apply depending on the operating system on which you are planning to install IBM Business Process Manager V8.0. Be sure that you complete all configuration indicated in the IBM Business Management Process Advanced V8.0 and IBM Business Monitor V8.0 installation manuals.

For more information about operating system prerequisites, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/prep_bpm_os.html
8.2.6 Defining the user registry

The user registry is the repository of all user names, passwords, groups, and other information needed to run the system securely through an authentication process. Most environments use LDAP as the user registry. In IBM Business Process Manager V8.0, you can use all registries that are available for WebSphere Application Server. This is because IBM Business Process Manager V8.0 relies on the WebSphere security mechanism to authenticate users and authorize access.

Regardless of the repository that you use on your environment (LDAP, custom, operating system, or federated repositories), the repository must be available with at least the necessary administrative users and groups defined. Table 10-1 on page 178 in chapter lists a basic example of users and groups that can be used.

Before you install the product, check with your security team that all users who need to install and run IBM Business Process Manager V8.0 were created and are available.

8.2.7 Defining SMTP

It is a good practice to define an SMTP service before installing or configuring IBM Business Process Manager. IBM Business Process Manager processes can use the SMTP service to send automatic emails for escalations or alerts. You might need an SMTP service available for the Business Process Manager installation while you create the deployment environment. For information about how to configure the SMTP service, see 17.1, “Configuring the Simple Mail Transfer Protocol (SMTP) server” on page 386.

8.2.8 Creating SSL certificates

SSL certificates are created automatically during profile creation. The default certificates that are generated during profile creation are not self-signed. WebSphere Application Server creates a self-signed root signer certificate, which is used to sign chained certificates for all the nodes in the cell. The root certificate is in CellDefaultTruststore. Every node's certificate that is signed with that is trusted by everyone else.

The communications that happen among IBM WebSphere Application Server components are secured by using SSL. IBM Business Process Manager runs on top of IBM WebSphere Application Server and inherits this security mechanism.
For external communication (for example, to expose your services to the internet), create your own signed certificate. In certain environments, the security team must define or create the SSL certificates for you even for internal intra-process communication.

8.3 Installing the software

The software in this example runs on Red Hat Enterprise Linux Server 64-bit. To take advantage of security and the database of a production environment, LDAP is configured as the user registry and DB2 is the database.

The default options are unchanged for most of the software installation options. In a production installation, you can change them as needed for your configuration.

The following software versions are used in this example:

- Red Hat Enterprise Linux Server V6.3 64-bit
- IBM Business Process Manager Advanced Version 8.0.1.0 for Linux 64-bit
- IBM DB2 Enterprise Server Edition 10.1.0 for Linux 64-bit
- IBM HTTP Server v8.0.0.0, web server plug-ins, and WebSphere Customization Toolbox for Linux 64-bit
- IBM Tivoli Directory Server v6.3.0.0 for Linux 64-bit
- IBM Business Monitor V8.0.1.0 for Linux 64-bit
- IBM Cognos Business Intelligence Server Version 10.1.1.2 for Linux 64-bit, included in the IBM Business Monitor V8.0.1 package
- IBM Integration Designer V8.0.1
- IBM Process Designer V8.0.1

**Installation note:** Instructions for preparing the Linux operating system as described are on the following website:

The products in Table 8-1 are also installed

Table 8-1  Installed products

<table>
<thead>
<tr>
<th>Product</th>
<th>Part numbers</th>
<th>Fixes applied</th>
<th>Installed directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Business Process Manager Advanced V8.0.1</td>
<td>CICLOML</td>
<td>JR44669</td>
<td>/opt/IBM/BPM</td>
</tr>
<tr>
<td></td>
<td>CICL1ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICL2ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICL3ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICK5ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>JR44669</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM Installation Manager 1.6.0</td>
<td>Comes with IBM Business Process Manager Advanced 8.0.1 package</td>
<td></td>
<td>/opt/IBM/InstallationManager</td>
</tr>
<tr>
<td>IBM Business Monitor V8.0.1</td>
<td>CICA7ML</td>
<td>(none)</td>
<td>/opt/IBM/Monitor</td>
</tr>
<tr>
<td></td>
<td>CICA8ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICA9ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICB0ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM Integration Designer V8.0.1</td>
<td>CICV2ML</td>
<td>(none)</td>
<td>/opt/IBM/IntegrationDesigner</td>
</tr>
<tr>
<td></td>
<td>CICV3ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICV4ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CICV5ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM Process Designer V8.0.1</td>
<td>none</td>
<td>(none)</td>
<td>/opt/IBM/ProcessDesigner</td>
</tr>
<tr>
<td>IBM HTTP Server V8.0</td>
<td>CZM91ML</td>
<td>(none)</td>
<td>/opt/IBM/HTTPServer</td>
</tr>
<tr>
<td>Web server plug-ins</td>
<td>CZM94ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WebSphere Customization Toolbox</td>
<td>CZM95ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CZXR9ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM Cognos Business Intelligence Server V10.1.1.2</td>
<td>Comes with IBM Business Monitor V8.0.1 package</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBM DB2 Advanced Enterprise Server Edition V10.1</td>
<td>CI6W6ML</td>
<td>(none)</td>
<td>/opt/ibm/db2</td>
</tr>
<tr>
<td>IBM Tivoli Directory Server 6.3</td>
<td>CI6Z2ML</td>
<td>(none)</td>
<td>Installed on another server</td>
</tr>
</tbody>
</table>
Installation note: There is no separate installation package for IBM Process Designer. You need to download it from the Process Center console after you finished the cell topology and install it. Only Microsoft Windows operating systems are supported for IBM Process Designer. For more information about installing IBM Integration Designer, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.doc/topics/tins_bpm_pcntr_wle.html

Throughout the chapter, some directory abbreviations are used to simplify the examples. Table 8-2 summarizes the abbreviations and the directories that are used in this example.

Table 8-2   Directory abbreviations that are used in examples

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;download_dir&gt;</td>
<td>Location to which all files are downloaded</td>
<td>/var/opt/software</td>
</tr>
<tr>
<td>&lt;base_dir&gt;</td>
<td>Product installer directory</td>
<td>/var/opt/repository/BPM_Adv_V8.0.1</td>
</tr>
<tr>
<td></td>
<td>Fix or fix pack directory</td>
<td>/var/opt/repository/Monitor_V8.0.1</td>
</tr>
<tr>
<td>&lt;BPM_install_dir&gt;</td>
<td>Installation directory of the IBM Business Process Manager</td>
<td>/opt/IBM/BPM</td>
</tr>
<tr>
<td>&lt;IM_install_dir&gt;</td>
<td>Installation directory of the IBM Installation Directory</td>
<td>/opt/IBM/InstallationManager</td>
</tr>
<tr>
<td>&lt;fixpack_dir&gt;</td>
<td>Location to which fixes and fix packs are unpacked</td>
<td>/var/opt/repository/BPMFixes, /var/opt/repository/WASFixes</td>
</tr>
</tbody>
</table>

Important: This book contains examples using a non-root user bpmuser created with the useradd command to perform the installation. Therefore, you need to assign bpmuser as the owner of the directories /var/opt/software, var/opt/repository, and /opt/IBM (create it if it does not exist) that are listed in Table 8-1 on page 143 and Table 8-2. You can do so by using the chown command in Linux.
8.3.1 Installation order

After you complete the prerequisite steps, you can install your IBM Business Process Manager environment.

For this example, the software stack is installed in the following order:

1. Installed IBM DB2.
2. Created DB2 instances by using the `db2icrt` command.
4. Installed IBM HTTP Server, web server plug-ins, and WebSphere Customization Toolbox.
5. Configured the web server plug-in by using the Web Server Plug-ins Configuration Tool or `pct` command-line tool with a response file.
6. Installed the IBM Business Process Manager and IBM Business Monitor software.
7. Applied the fixes or fix packs.
8. Installed the IBM Integration Designer.

For more information about these topics, see the following resources:

- Installation and configuration guide of IBM Tivoli Directory Server:

- Installation and configuration guide of DB2:

The detailed installation steps for IBM DB2 and IBM Tivoli Directory Server can be found in the information center. This chapter describes the installation for following products:

- IBM Business Process Manager and related fixes
- IBM Business Monitor products and related fixes
- IBM HTTP Server, web server plug-ins, and WebSphere Customization Toolbox
8.3.2 Creating a software repository

The repository is a directory that contains all the binary installation products and fixes to organize the installation job. It helps the installation process, making it easier to configure IBM Installation Manager during installations and updates.

This example uses the /var/opt/repository directory as the software repository, and includes all installation software and fix files for this book.

8.3.3 Installing the products

This section describes the steps to install the products (Table 8-2 on page 144).

Installing IBM Installation Manager

The IBM Business Process Manager V8.0, IBM Business Monitor V8.0, and IBM HTTP Server V8.0 installation process uses only the IBM Installation Manager. When you start the installation process, IBM Installation Manager starts and guides you through the installation process using an installation wizard.

IBM Installation Manager manages the installation and uninstallation of IBM Business Process Manager and IBM Business Monitor, IBM HTTP Server software, and fixes. It offers GUI wizards that lead you through the entire installation process. Alternatively, you can use a silent mode installation by using response files.

Installation Manager can download fixes and fix packs from the Internet when you have internet connectivity. This book does not describe that feature because most production environments do not have access to the internet. You must
download all necessary files first and copy those files to the software repository directory.

**Note:** Appendix C, “Different approach for installing IBM products” on page 427 describes an automated installation approach based on creating a centralized installation repository.

On systems where IBM Installation Manager is not already installed, the installation process installs IBM Installation Manager automatically with the IBM Business Process Manager V8.0, IBM Business Monitor V8.0, or IBM HTTP Server V8.0.

The only way to install IBM Business Process Manager V8.0, IBM Business Monitor V8.0, and IBM HTTP Server V8.0 is using IBM Installation Manager. Thus, when you install any IBM Business Process Manager V8.0 or IBM Business Monitor V8.0, and IBM HTTP Server V8.0 product, IBM Installation Manager is installed as well. In this example, IBM Installation Manager is installed automatically with IBM Business Process Manager.

You can, if you want, install the IBM Installation Manager first and then install the other products. For more information about IBM Installation Manager v1.6, see:


If you prefer installing IBM Installation Manager before the other products, see:


For information about how to install silently, see:

Using the installation manager command line

The installation manager command line (imcl) is a tool that comes with the IBM Installation Manager version. It allows installation, uninstallation, and modification of software packages, and update and rollback of fixes by using the command line, without a response file.

To install IBM Installation Manager with imcl, complete the following steps:

1. Use the 32 bit IBM Installation Manager to install all production file, so copy them to the <base_dir>/IM/tools directory.

Note: Location of 64bit IBM Installation Manager is <base_dir>/IM64/tools.
2. Run the following command:

   
   
   ./imcl install com.ibm.cic.agent -repositories <base_dir>/IM
   -installationDirectory <IM_install_dir>/eclipse -accessRights
   nonAdmin -acceptLicense

   
   
   For more information about installing IBM Information Manager by using imcl, see:

   
   
   com.ibm.cic.commandline.doc/topics/t_imcl_install_im.html

   
   
   **Installing IBM Business Process Manager Advanced**

   
   Whether you want to create a Process Center cell or a Process Server cell, you must install the IBM Business Process Manager V8.0. It contains all the binary code to configure as a Process Center and a Process Server. You configure a Process Center or a Process Server during the profile creation.

   
   This example involves the IBM Business Process Manager V8.0 Advanced configuration. It contains all the components that are needed and is the most appropriated for the topology that is described in this book.

   
   For more information about how to install IBM Business Process Manager Advanced V8.0, see:

   
   
   rary/documentation/

   
   **Installing from the command line**

   This section provides the steps for installation by using the command line with the response file. Response files simplify the silent installation and reduce error because you set up your installation options once in a saved, sharable file that can be used on one or more systems.

   
   To install IBM Business Process Manager V8.0, complete these steps:
1. In `<base_dir>/responsefiles/BPM`, copy and rename the template response file `bpmAdv_linux_response_nonroot_64bit.xml` to `~BPM_Install.xml`.

2. Edit the copied `BPM_Install.xml` file.

There are a few changes that you must make to this file. Basically, you define the location of the repository file and the location where IBM Business Process Manager V8.0 will be installed. You also define that this is a 64-bit installation:

a. Define the IBM Installation Manager repository directory in:

   `<repository location='"/var/opt/repository/BPM_Adv_V8.0.1/IM' temporary='true'/>`

b. Define where the IBM Installation Manager will be installed by changing the following information:

   `<profile kind='self' installLocation='"/opt/IBM/InstallationManager/eclipse' id='IBM Installation Manager'>
   <data key='eclipseLocation' value='"/opt/IBM/InstallationManager/eclipse'/>`

   `/profile>

c. Uncomment the following line, and modify the value to change the default location of the eclipseCache, which is the shared resources directory:

   `<preference value="/opt/IBM/BPMShared" name="com.ibm.cic.common.core.preferences.eclipseCache" />

   `/preference>

d. As you are installing on a 64-bit server, define the 64-bit repository directory:

   `<repository location="/var/opt/repository/BPM_Adv_V8.0.1/repository/repos_64bit" />

   `/repository>

e. Define where the IBM Business Process Manager V8.0 Advanced will be installed by changing the following information. In a 64-bit installation, define `true` for `user.select.64bit.image,com.ibm.websphere.ND.v80` in following statement, and change the profile id to be appropriate value like `IBM Business Process Manager V8.0.1`. Its default value is 'IBM WebSphere Application Server Network Deployment V8.0':

   `<profile installLocation="/opt/IBM/BPM" id='IBM Business Process Manager V8.0.1'>
   <data key='eclipseLocation' value="/opt/IBM/BPM" />
   <data key="cic.selector.nl" value="en" />
   <data key='user.import.profile' value='false'/>

   `/profile>`
f. Set the following properties to false to not try internet access:
   
   offering.service.repositories.areUsed
   com.ibm.cic.common.core.preferences.searchForUpdates

3. Run the following command:

   `<base_dir>/IM/userinstc -acceptLicense input ~/BPM_Install.xml -log ~/BPMSilentInstall.log`

The installation takes a little time. After the installation is complete, you can verify the installation by using the following command:

   `<BPM_install_dir>/bin/versionInfo.sh`

Change `<BPM_install_dir>` to suit your product installation.

For the IBM Installation Manager, you can verify the installation with the following command:

   `cd <IM_install_dir>/eclipse/tools
   ./imcl version`

**Installing IBM Business Monitor**

At the time of writing, no fixes or fix packs were available for IBM Business Monitor V8.0, so this book describes installing the base product.

IBM Business Monitor V8.0 and IBM Cognos Business Intelligence v10.1.1.2 that was contained in IBM Business Monitor V8.0 installation package are installed. IBM DB2 is also installed.

You might want to install all the components at once. In this case, the IBM WebSphere Application Server is installed together with IBM Business Process Manager or IBM Business Monitor in a single step. If you want to install everything in one step, see 8.3.5, “Installing and applying fixes all-in-one” on page 157.

This section provides the steps for installation of IBM Business Monitor V8.0 using command line with the response file.

To install IBM Business Monitor V8.0, complete these steps:
1. In `<base_dir>/responsefiles/BusMon`, copy and rename the template response file `mon_linux_response_nonroot_64bit.xml` to `~/Monitor_Install.xml`.

2. Edit the copied `Monitor_Install.xml` file.

   You must make a few changes to this file. Define the location of the repository file and the location where IBM Business Process Manager V8.0 will be installed. You also define that this is a 64-bit installation:
   a. Define the IBM Installation Manager repository directory in:
      ```xml
      <repository location='"/var/opt/repository/Monitor_V8.0.1/IM' temporary='true'/>
      ```
   b. Define where the IBM Installation Manager will be installed by changing the following information:
      ```xml
      <profile kind='self' installLocation="/opt/IBM/InstallationManager/eclipse' id='IBM Installation Manager'>
        <data key='eclipseLocation' value="/opt/IBM/InstallationManager/eclipse'/" />
      </profile>
      ```
   c. Uncomment following line, and modify the value to change the default location of the eclipseCache, which is the shared resources directory:
      ```xml
      <preference value="/opt/IBM/BPMShared" name="com.ibm.cic.common.core.preferences.eclipseCache" />
      ```
   d. Define the repository directory:
      ```xml
      <repository location="/var/opt/repository/Monitor_V8.0.1/repository/" />
      ```
   e. Define where the IBM Business Monitor V8.0 will be installed by changing the following information. In a 64-bit installation, define true for `user.select.64bit.image,com.ibm.websphere.ND.v80` in following statement, and change the profile id to be appropriate value. Its default value is 'IBM WebSphere Application Server Network Deployment V8.0':
      ```xml
      <profile installLocation="/opt/IBM/Monitor' id='IBM Business Monitor V8.0.1' value="/opt/IBM/Monitor' />
      ```
      ```xml
      <data key='cic.selector.nl' value='en' />
      ```
      ```xml
      <data key='user.import.profile' value='false'/>
      ```
      ```xml
      <data key='user.select.64bit.image,com.ibm.websphere.ND.v80' value='true'/>
      ```
      ```xml
      </profile>
      ```
Chapter 8. Downloading and installing binary files

**Attention:** If you want to install IBM Business Monitor V8.0 with an existing IBM Business Process Manager V8.0, you need to pay attention to the following items:

1. Change the `installLocation` and `eclipseLocation` to be where IBM Business Process Manager V8.0 was installed, such as:

   ```
   <profile installLocation='/opt/IBM/BPM' id='IBM WebSphere Application Server Network Deployment V8.0'>
     <data key='eclipseLocation' value='/opt/IBM/BPM' />
     <data key='cic.selector.nl' value='en' />
     <data key='user.import.profile' value='false' />
     <data key='user.select.64bit.image,com.ibm.websphere.ND.v80' value='true' />
   </profile>
   ```

2. Uncomment the following line to ignore installation of WebSphere Application Server, because it has been already installed with IBM Business Process Manager V8.0:

   ```
   <offering profile="IBM Business Monitor V8.0.1" id="com.ibm.websphere.ND.v80"
   features='core.feature,ejbdeploy,thinclient,embeddablecontainer,samples,com.ibm.sdk.6_64bit'/>
   ```

3. Keep the value of profile id the same as the value you specified in the response file for silent installation of IBM Business Process Manager V8.0 Advanced:

   ```
   <profile installLocation='/opt/IBM/BPM' id='IBM Business Process Manager Advanced V8.0.1'>
     ...
   </profile>
   ```

f. By default, the template response file `mon_linux_response_nonroot_64bit.xml` does not cover the installation of IBM Cognos Business Intelligence Server. You must add the following line into the response file `~/Monitor_Install.xml` to install IBM Cognos 64-bit.

   ```
   <install>
   ...
   ```
g. Set the following properties to false to not try internet access:

offering.service.repositories.areUsed
com.ibm.cic.common.core.preferences.searchForUpdates

4. Run the following command:

<base_dir>/IM/userinstc -acceptLicense input ~/Monitor_Install.xml
-log ~/monitorSilentInstall.log

The installation takes a little time. After the installation is complete, you can verify
the installation by using the following command:

<Monitor_install_dir>/bin/versionInfo.sh

Change <Monitor_install_dir> to suit your product installation.

For the IBM Installation Manager, you can verify the installation with the following
command:

cd <IM_install_dir>/eclipse/tools
./imcl version

Installing IBM HTTP Server and Web Server plug-in

This section provides the steps for installation of IBM HTTP Server V8.0 and
Web Server plug-in by using command line with the response file. For more
information about configuration of IBM HTTP Server, see 16.1, “Configuring
Business Process Manager to use IBM HTTP Server” on page 344.

To install IBM HTTP Server and web server plug-in, complete these steps:

1. Copy the template response file (IHS_Install.xml) found in Appendix A, to
your home directory.

2. Edit the response file to point to your repositories. Example 8-1 shows the
change in the response file.

Example 8-1   IBM HTTP Server installation response file

...<server>
  <repository location='/var/opt/repository/IHS_V8.0'/>
</server>
...
<offering id='com.ibm.websphere.IHS.v80'
profile='IBM HTTP Server V8.0'
features='core.feature,arch.64bit' installFixes='none'/>
...
<profile id='IBM HTTP Server V8.0'
installLocation='/opt/IBM/HTTPServer'>
  <data key='eclipseLocation' value='~/opt/IBM/HTTPServer'/>
  <data key='user.ihs.allowNonRootSilentInstall' value='true'/>
...
</profile>
...
<profile id='Web Server Plug-ins for IBM WebSphere Application Server V8.0' installLocation='/opt/IBM/WebSphere/Plugins'>
  <data key='eclipseLocation' value='~/opt/IBM/WebSphere/Plugins'/>
...
</profile>
...
<profile id='WebSphere Customization Toolbox V8.0' installLocation='/opt/IBM/WebSphere/Toolbox'>
  <data key='eclipseLocation' value='~/opt/IBM/WebSphere/Toolbox'/>
...
</profile>
...


4. Because you are installing IBM HTTP Server using non-root user bpmuser, you must add the following option to the silent installation response file to enable a non-root installation:
   <data key='user.ihs.allowNonRootSilentInstall' value='true'/>

5. Run the following command:
   ./imcl -acceptLicense input ~/IHS_Install.xml -log
   ~/IHSInstallSilent.log

8.3.4 Applying the fixes

The process of applying fixes and fix packs is similar. First, you download the latest fixes or fix packs that you want to install. Then, you copy these files to the repository directory and run the Installation Manager.

Note: Apply fixes when installing the product. If you install the fixes after profiles creation, follow the post-installation steps defined in the fix instructions.
Install a fix or fix pack in IBM Business Process Manager V8.0 by using the imcl command without a response file or using a response file.

This chapter describes both methods in the sections that follow. Both examples show how to apply the fixes that were available at time of writing.

**Installing from the command line**

To install using the command line, complete the following steps:

1. Download the fix or fix pack that you want to install. The following was the only fix that was available at the time of writing:

   - 8.0.1.0-WS-BPM-IFJR44669

2. Go to the eclipse/tools directory in the IBM Installation Manager installation CD <IM_install_dir>/eclipse/tools directory.

3. Run the following command:

   ```
   ./imcl install <version_id> -repositories <base_dir>
   -installationDirectory <BPM_install_dir>
   ```

Example 8-2 shows how to apply fix 8.0.1.0-WS-BPM-IFJR44669.

**Example 8-2 Installing a fix with imcl, no response file**

```
./imcl install 8.0.1.0-WS-BPM-IFJR44669 -repositories 
/opt/repository/BPMFixes/8.0.1.0-WS-BPM-IFJR44669/ 
-installationDirectory /opt/IBM/BPM/
```

**Installing with the response file**

To install a fix or fix pack by using a response file, complete these steps:

1. Copy the template response file (BPM_Patch.xml), found in Appendix A, to your home directory.

2. Edit the response file to point to your repositories. Example 8-3 shows the change to the response file.

**Example 8-3 Changes on the response files**

```
...  
<server>
<repository 
location="/var/opt/repository/BPMFixes/8.0.1.0-WS-BPM-IFJR44669" />
...  
<install modify='false'>
  <offering id='8.0.1.0-WS-BPM-IFJR44669' profile='IBM Business Process Manager Advanced V8.0.1' features='-'/>
```
3. Ensure that the preference values for the following variables are set to false:
   - com.ibm.cic.common.core.preferences.searchForUpdates
   - offering.service.repositories.areUsed

4. Save your changes and run the Installation Manager. Go to the
   <base_dir>/IM/eclipse/tools directory in the IBM Installation Manager
   installation directory and run the imcl command:
   
   ./imcl -acceptLicense input ~/BPM_Patch.xml

5. At the end of the installation verify that the fixes or fix packs are installed
   successfully by using the following command:
   
   <install_dir>/bin/versionInfo.sh -maintenancePackages

8.3.5 Installing and applying fixes all-in-one

You can install and patch a product in a single step. This example assumes that
no products have been installed, including the IBM Installation Manager.

To install all-in-one, you must define all the repositories that you are going to use.
This sample illustrates installing the IBM Installation Manager, IBM Business
Process Manager V8.0, IBM Business Monitor V8.0, and the available fixes.

To do so, complete these steps:

1. Ensure that you have created the <base_dir> and <fixpack_dir> repositories.

2. From Appendix A, copy the template response file
   (BPM_Mon_InstallAndPatch.xml) to the home directory of user bpmuser.

3. Edit this response file to point to your repositories. Example 8-4 shows
   specific folders.

   Example 8-4   Specific folders

   ...
   <server>
     <repository location="/var/opt/repository/BPM_Adv_V8.0.1/IM"
                 temporary='true'/>
     <repository
       location="/var/opt/repository/BPM_Adv_V8.0.1/repository/repos_64bit/" />
     <repository
       location="/var/opt/repository/Monitor_V8.0.1/repository" />
   </server>
<repository
location="/var/opt/repository/BPMFixes/8.0.1.0-WS-BPM-IFJR44669"/>
</server>

...<install>
  <offering profile="IBM Business Process Manager Advanced V8.0.1"
id="com.ibm.websphere.ND.v80"
features='core.feature,ejbdeploy,thincient,embeddlecontainer,samples,com.ibm.sdk.6_64bit' installFixes='all'/>
  <offering profile="IBM Business Process Manager Advanced V8.0.1"
id="com.ibm.bpm.ADV.V80"
features='wps.client.feature,wps.server.feature,bpmAdv.prod'
installFixes='all'/>
  <offering profile="IBM Business Monitor V8.0.1"
id="com.ibm.websphere.MON.V80"
features='wbm.core.feature,wbm.server.feature' installFixes='all'/>
  <offering profile="IBM Business Monitor V8.0.1"
id="com.ibm.ws.cognos.v1011.linuxia64" installFixes='all'/>
</install>

...

4. Save your changes and run the Installation Manager.

5. Go to the <base_dir>/IM/eclipse/tools directory in the IBM Installation Manager installation directory and run the imcl command:

   ./imcl -acceptLicense input ~/BPM_Mon_InstallAndPatch.xml
Database tables and schema creation

This chapter describes how to create databases, tables, and schema for IBM Business Process Manager V8.0 topologies.

This chapter includes the following sections:

- 9.1, “Generating database scripts” on page 160
- 9.2, “Creating database tables and schema for IBM DB2” on page 163
- 9.3, “Creating database tables and schema for Oracle Database” on page 167
9.1 Generating database scripts

There are a number of databases for IBM Business Process Manager and IBM Business Monitor, and each database can have different schemas (collections of tables). Table 9-1 on page 161 and Table 9-2 on page 162 illustrate that the Message Engine database (MEDB) has seven schemas.

The creation of databases, schemas, tables, and other objects in the following sections is based on database script files. These database script files contain most of the commands that are executed to create these objects and statements to populate some of the tables. In the example, the database script files were created in the dbscripts subdirectory of the user's home directory.

These files were generated by the Database Design Tool (DDT). This tool is explained in detail in Appendix A, “Database design tool” on page 393.

**Note:** Only one database instance was used to create either Process Center and Process Server databases in the lab. To differentiate these databases, the letter C as a suffix was inserted for the database names or user name for Oracle. So, for instance, CMNDB is the common database for the Process Server cell, and CMNDBC is the database for the Process Center cell.

9.1.1 Generating database scripts for IBM DB2

In this example, all these databases are created in one IBM DB2 database instance, managed by instance owner db2inst1.

For IBM Business Process Manager and IBM Business Monitor, a general user named db2user who is not the root user nor the IBM DB2 database instance owner is used to access all the databases. Make sure that this user has already been created in the operating system.
9.1.2 Generating database scripts for Oracle Database

In this example, a single instance of Oracle Database with different user IDs is used for configuring IBM Business Process Manager. Make sure that the user name and schema name are the same.

### Table 9-1 Database used and schema names for DB2

<table>
<thead>
<tr>
<th>Database name</th>
<th>Schema name</th>
<th>Function supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMNDB</td>
<td></td>
<td>The common database</td>
</tr>
<tr>
<td>BPEDB</td>
<td>BPC</td>
<td>The Business Process Choreographer database</td>
</tr>
<tr>
<td>BPMDB</td>
<td></td>
<td>Process Server database</td>
</tr>
<tr>
<td>PDWDB</td>
<td></td>
<td>Performance Data Warehouse database</td>
</tr>
<tr>
<td>BSPACE</td>
<td>BSPACE</td>
<td>The database for Business Space</td>
</tr>
<tr>
<td>MONDB</td>
<td>MONITOR</td>
<td>The database that is used by IBM Business Monitor</td>
</tr>
<tr>
<td>COGNOS</td>
<td></td>
<td>Database that is used by IBM Cognos content store</td>
</tr>
<tr>
<td>MEDB</td>
<td>BPMME</td>
<td>Process Server messaging engine data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>PDWME</td>
<td>Performance Data Warehouse messaging data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>BPCME</td>
<td>The Business Process Choreographer messaging data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>CEIME</td>
<td>The Common Event Infrastructure (CEI) messaging data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>MONME</td>
<td>The IBM Business Monitor messaging data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>SCAAPP</td>
<td>The SCA application messaging data store</td>
</tr>
<tr>
<td>MEDB</td>
<td>SCASYS</td>
<td>The SCA system messaging data store</td>
</tr>
</tbody>
</table>

Note: Refer to the database name and schema name in Table 9-1 when you run DDT to generate database scripts. When no explicit schema is listed, the default is to use the `db2user` as the schema name.

Use `db2user` whenever you are asked to input data source user name because IBM Business Process Manager and IBM Business Monitor use this user to access all databases.
Create the following Oracle Database objects before you create any tables:

1. Create a table space:
   
   ```sql
   CREATE TABLESPACE [tablespace_name] DATAFILE '[datafile_name]' SIZE 200M AUTOEXTEND ON NEXT 10M MAXSIZE UNLIMITED LOGGING
   ```

2. Create the users:
   
   ```sql
   CREATE USER [username] IDENTIFIED BY [password] DEFAULT TABLESPACE [tablespace_name]
   ```

3. Grant privileges to the users:
   
   ```sql
   GRANT ALL PRIVILEGES TO [username]
   ```

4. Grant execute privileges on DBMS_LOCK:
   
   ```sql
   GRANT EXECUTE ON DBMS_LOCK TO [username]
   ```

See Table 9-2 for the databases and schema names to use with Oracle Database.

**Table 9-2  Databases used and schema names for Oracle Database**

<table>
<thead>
<tr>
<th>User name</th>
<th>Schema name</th>
<th>Function supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPM8_COMMON</td>
<td>BPM8_COMMON</td>
<td>The common database</td>
</tr>
<tr>
<td>BPM8_BPE</td>
<td>BPM8_BPE</td>
<td>The Business Process Choreographer database</td>
</tr>
<tr>
<td>BPM8_BPM</td>
<td>BPM8_BPM</td>
<td>Process Server database</td>
</tr>
<tr>
<td>BPM8_PDW</td>
<td>BPM8_PDW</td>
<td>Performance Data Warehouse database</td>
</tr>
<tr>
<td>BPM8_BSPACE</td>
<td>BPM8_BSPACE</td>
<td>The database for Business Space</td>
</tr>
<tr>
<td>BPM8_MONITOR</td>
<td>BPM8_MONITOR</td>
<td>The database that is used by IBM Business Monitor</td>
</tr>
<tr>
<td>BPM8_COGNOS</td>
<td>BPM8_COGNOS</td>
<td>Database that is used by IBM Cognos content store</td>
</tr>
<tr>
<td>BPM8_ME_BPM</td>
<td>BPM8_ME_BPM</td>
<td>Process Server messaging engine data store</td>
</tr>
<tr>
<td>BPM8_ME_PDW</td>
<td>BPM8_ME_PDW</td>
<td>Performance Data Warehouse messaging data store</td>
</tr>
</tbody>
</table>
9.2 Creating database tables and schema for IBM DB2

This section describes how to create database tables and schema by running the generated database scripts for IBM DB2 database.

9.2.1 The common database and tables

Create the common database using the appropriate instance owner on the IBM DB2 server and verify it:

```
cd ~/dbscripts/DB2-distributed-WBI_CommonDB
db2 "connect reset"
./configCommonDB.sh createDB
```

Enter your instance owner password when prompted:

```
db2 "connect to CMNDB"
db2 "list tables for schema db2user"
```

```
db2 "connect reset"
```

The output of the `list tables` commands is approximately 44 tables in the `db2user` schema.
9.2.2 The Process Server database and tables

Create the Process Server database using the appropriate instance owner on the IBM DB2 server. Create the tables and verify them:

```bash
cd ~/dbscripts/DB2-distributed-BPM_ProcessServer
db2 "connect reset"
./configProcessServerDB.sh createDB
```

Enter your instance owner password when prompted:

```bash
db2 "connect to BPMDB"
db2 "list tables for schema db2user"
db2 "connect reset"
```

The output of the `list tables` command is approximately 223 tables.

9.2.3 The Performance Data Warehouse tables

Create the Performance Data Warehouse database using the appropriate instance owner on the IBM DB2 server. Create the tables and verify them:

```bash
cd ~/dbscripts/DB2-distributed-BPM_PerformanceDW
db2 "connect reset"
./configPerformanceDWDB.sh createDB
```

Enter your instance owner password when prompted:

```bash
db2 "connect to PDWDB"
db2 "list tables for schema db2user"
db2 "connect reset"
```

The output of the `list tables` command is approximately 22 tables.

9.2.4 The Business Process Choreographer tables

Create the Business Process Choreographer database using the appropriate instance owner on the IBM DB2 server. Create the tables and verify them:

```bash
cd ~/dbscripts/DB2-distributed-BPC
db2 "connect reset"
CREATE DATABASE BPEDB USING CODESET UTF-8 TERRITORY en-us PAGESIZE 8 K;
```

```bash
db2 "connect to BPEDB"
grant dbadm on database to user db2user;
UPDATE DATABASE CONFIGURATION FOR BPEDB USING LOGFILSZ 4096;
UPDATE DATABASE CONFIGURATION FOR BPEDB USING LOGSECOND 64;
```
The output of the `list tables` command is approximately 187 tables.

### 9.2.5 The messaging engine tables

There are many messaging engines sets of tables. They are grouped by schema. For a full production environment that includes IBM Business Process Manager V8.0 Advanced and IBM Business Monitor V8.0, you must have at least seven messaging engine schemas.

Create the messaging engine database using the appropriate instance owner on the DB2 server:

```sql
db2 "connect reset"
DB2 -tf DB2-distributed-SibME.sql
db2 "list tables for schema <ME_schema>"
```

The output of the `list tables` command is nine tables per schema.

**Note:** Table 9-1 on page 161 provides a list of the messaging engine schema names that were used in the lab.
9.2.6 The Business Space tables

Create the Business Space database using the appropriate instance owner on the IBM DB2 server. Create the tables and verify:

```
cd ~/dbscripts/DB2-distributed-BSpace
./configBusinessSpaceDB.sh
```

Enter your instance owner password when prompted.

```
db2 "connect to BSPACE"
db2 "list tables for schema BSPACE"
db2 "connect reset"
```

The output of the `list tables` command is 38 tables.

9.2.7 The IBM Business Monitor V8.0 tables

Perform the following actions on the IBM DB2 server:

```
cd ~/dbscripts/DB2-distributed-Monitor
db2 "connect reset"
db2 -tf createDatabase.sql
```

```
db2 "connect to MONDB"
db2 -tf createTables.sql
```

```
db2 "list tables for schema MONITOR"
db2 "connect reset"
```

The output of the `list tables` command is 87 tables.

IBM Business Monitor messaging engine

The IBM Business Monitor messaging engine database might not yet exist. You must create it before you run IBM Business Monitor. The process of creating the messaging engine database is the same for any messaging engine.

If your messaging engine database is not created, create it using the instructions in 9.2.5, “The messaging engine tables” on page 165.

CEI messaging engine

If IBM Business Monitor V8.0 is installed in its own cell, then we also need a CEI messaging schema in the messaging engine database.

If your messaging engine database is not created, create it using the instructions in 9.2.5, “The messaging engine tables” on page 165.
Business space
If you are going to use business space, you can reuse a business space that exists in the cell. Otherwise, the business space database must be created.

If your business space database is not created, create it using the instructions in 9.2.6, “The Business Space tables” on page 166.

9.2.8 The IBM Cognos content store

Perform the following actions on the IBM DB2 server:

cd ~/dbscripts/DB2-distributed-Cognos
db2 "connect reset"
db2 -tf createDatabase.sql

Only the IBM Cognos database and some objects are created. No tables are created.

9.3 Creating database tables and schema for Oracle Database

This section describes how to create database tables and schema by running the generated database scripts for Oracle Database.

9.3.1 The common database tables

Create the common database tables by using the Oracle database user, BPM8_COMMON, and verify the list of tables created:

cd ~/dbscripts/Oracle-WBI_CommonDB
./configCommonDB.sh

Enter the password of the Oracle database user, BPM8_COMMON, when prompted:

sqlplus BPM8_COMMON
SQL> select table_name from user_tables;
SQL> quit

The select table_name command returns 44 tables for the BPM8_COMMON schema.
9.3.2 The Process Server tables

Create the Process Server tables by using the Oracle database user, BPM8_BPM, and verify the list of tables created:

```bash
cd ~/dbscripts/Oracle-BPM_ProcessServer
./configProcessServerDB.sh
```

Enter the password of the Oracle database user, BPM8_BPM, when prompted:

```bash
sqlplus BPM8_BPM
SQL> select table_name from user_tables;
SQL> quit
```

The `select table_name` command returns 223 tables for the BPM8_BPM schema.

9.3.3 The Performance Data Warehouse tables

Create the Performance Data Warehouse tables by using the Oracle database user, BPM8_PDW, and verify the list of tables created:

```bash
cd ~/dbscripts/Oracle-BPM_PerformanceDW
./configPerformanceDWDB.sh
```

Enter the password of the Oracle database user, BPM8_PDW, when prompted:

```bash
sqlplus BPM8_PDW
SQL> select table_name from user_tables;
SQL> quit
```

The `select table_name` command returns 22 tables for the BPM8_PDW schema.

9.3.4 The Business Process Choreographer tables

Create the Business Process Choreographer tables by using the Oracle database user, BPM8_BPC, and verify the list of tables created:

```bash
cd ~/dbscripts/Oracle-BPC
./createBPCDB.sh
```

```bash
sqlplus BPM8_BPM
SQL> select table_name from user_tables;
SQL> quit
```
The select table_name command returns 152 tables for the BPM8_BPC schema.

9.3.5 The Business Space tables

Create the Business Space tables by using the Oracle database user, BPM8_BSPACE, and verify the list of tables created:

```
cd ~/dbscripts/DB2-BSpace
./configBusinessSpaceDB.sh
```

Enter the password of the Oracle database user, BPM8_BSPACE, when prompted:

```
sqlplus BPM8_BSPACE
SQL> select table_name from user_tables;
SQL> quit
```

The select table_name command returns 38 tables.

9.3.6 The messaging engine tables

Create the messaging engine tables for all components by using the specific Oracle database users for each component:

```
cd ~/dbscripts/Oracle-SibME/BPM_ProcessServer_ME
sqlplus BPM8_ME_BPM @createSIBSchema_ProcessServerME.sql
```

```
sqlplus BPM8_ME_BPM
SQL> select table_name from user_tables;
SQL> quit
```

```
cd ~/dbscripts/Oracle-SibME/BPM_PerformanceDW_ME
sqlplus BPM8_ME_PDW @createSIBSchema_PerformanceDWME.sql
```

```
sqlplus BPM8_ME_PDW
SQL> select table_name from user_tables;
SQL> quit
```

```
cd ~/dbscripts/Oracle-SibME/WBI_BPC_ME
sqlplus BPM8_ME_BPC @createSIBSchema_BPCME.sql
```

```
sqlplus BPM8_ME_BPC
SQL> select table_name from user_tables;
SQL> quit
```
cd ~/dbscripts/Oracle-SibME/WBI_SCA_APP_ME
sqlplus BPM8_ME_SCAAPP @createSIBSchema_SCAAPPME.sql

sqlplus BPM8_ME_SCAAPP
SQL> select table_name from user_tables;
SQL> quit

cd ~/dbscripts/Oracle-SibME/WBI_SCA_SYS_ME
sqlplus BPM8_ME_SCASYS @createSIBSchema_SCASYSME.sql

sqlplus BPM8_ME_SCASYS
SQL> select table_name from user_tables;
SQL> quit

cd ~/dbscripts/Oracle-SibME/WBI_CEI_ME
sqlplus BPM8_ME_CEI @createSIBSchema_CEIME.sql

sqlplus BPM8_ME_CEI
SQL> select table_name from user_tables;
SQL> quit

cd ~/dbscripts/Oracle-SibME/WBI_Monitor_ME
sqlplus BPM8_ME_MON @createSIBSchema_MonitorME.sql

sqlplus BPM8_ME_MON
SQL> select table_name from user_tables;
SQL> quit

The select table_name commands return nine tables per schema.

9.3.7 The IBM Business Monitor V8.0 tables

Create the IBM Business Monitor tables by using the Oracle database user, BPM8_MONITOR, and verify the list of tables created:

cd ~/dbscripts/Oracle-Monitor
sqlplus system as SYSDBA @createDatabase.sql
sqlplus BPM8_MONITOR @createTables.sql
sqlplus BPM8_MONITOR @dim_time_entries_oracle.sql

sqlplus BPM8_MONITOR
SQL> select table_name from user_tables;
SQL> quit
The `select table_name` command returns 80 tables.

### 9.3.8 The IBM Cognos content store user

Create the IBM Cognos content store tables by using the Oracle database user, BPM8_COGNOS, and verify the list of tables created.

```bash
cd ~/dbscripts/Oracle-Cognos
sqlplus system as SYSDBA @createDatabase.sql

sqlplus system
SQL> select * from v$tablespace;
SQL> select * from all_users;
SQL> quit
```

Only the Oracle database user, BPM8_COGNOS, for the IBM Cognos content store component is create. No tables are created.
Creating IBM Business Process Manager profiles

This chapter describes how to create IBM Business Process Manager profiles for an IBM Business Process Manager cell topology. It also addresses how to augment IBM Business Process Manager profiles if IBM Business Monitor is included in the cell.

There is an example that teaches how to create a cell topology of Process Center, including a deployment manager with security, one or more nodes created (and federated), and a federated Lightweight Directory Access Protocol (LDAP) user registry.

This chapter includes the following sections:

- 10.1, “Creating and augmenting IBM Business Process Manager profile” on page 174
- 10.2, “Federating a custom profile into a cell” on page 188
10.1 Creating and augmenting IBM Business Process Manager profile

An IBM Business Process Manager profile can be created in these ways:

1. Using the `manageprofiles` command
2. Using the `manageprofiles` command with a response file
3. Using the Profile Management Tool GUI

X-windows is usually not available on a production environment, so this chapter covers only silent profile creation using the `manageprofiles` command-line utility with response file.

For information about how to create an IBM Business Process Manager profile using the Profile Management Tool GUI, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.im uc.ebpm.doc/topics/pmt_dm_pc_lin_db2.html

For information about how to create an IBM Business Process Manager profile using the `manageprofiles` command without a response file, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.im uc.ebpm.doc/topics/mp_dm_lin_db2.html

10.1.1 Creating a Process Center or Process Server deployment manager profile

The following steps describe the procedure to create a deployment manager profile of Process Center, or Process Server using the `manageprofiles` command with a response file.

**Response file:** A response file here is a saved, reusable file that is used to record the parameters that are parsed to `manageprofiles` command. For more information about the parameters of the `manageprofiles` command, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm .ref.doc/topics/rins_manageprofiles_parms.html
To create a Process Server deployment manager profile, complete the following steps:

1. Create the response file with a name like PS_Adv_Dmgr.response and content similar to that shown in Example 10-1.

   **Example 10-1  Response file to create a Process Server deployment manager profile**

   ```
   create
   profilePath=/opt/IBM/BPM/profiles/ProcServerDmgr
   templatePath=/opt/IBM/BPM/profileTemplates/BPM/dmgr.procsvr.adv
   
   procServerDmgr
   ProcServer
   ProcServerDmgrNode
   true
   bpmadmin
   itso4you
   
   /home/bpmuser/bpm.advanced.nd.topology.dbDesign
   false
   true
   
   Production
   
   For more information about the parameters that are specified in the response file, see:
   
   http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/mp_sa_pcaddmdb2_samp.html
   
2. For the value of parameter bpmdbDesign, you can use the database design file for IBM Business Process Manager V8.0 Advanced network deployment that was generated in Chapter 9, “Database tables and schema creation” on page 159.

   You can get detailed information about all the parameters shown in Example 10-1 from the sample response file PS_Adv_Managed_DB2.response in the directory <BPM_install_dir>/BPM/sample/manageprofiles.

   **Important:** Ensure that you do not leave blank spaces after the values in the response file. For example, `profileName=ProcServerDmgr` or `enableAdminSecurity=true`. Spaces cause the profile creation to fail.

When you create an IBM Business Process Manager deployment manager for a Process Center cell, be sure to specify the correct template:

```
3. During profile creation, the `manageprofiles` command-line utility uses an automatically generated set of ports by default. If you want to specify a special port range, for example as a security consideration, you can do it by adding following line into response file to set `startingPoint` parameter:

```
startingPoint=30000
```

By setting the `startingPoint` parameter in the response file, the port for deployment manager is allocated from the value you specified. In this example, the port is allocated from 30000, and 30000 is the admin host port that is used to access the WebSphere Integrated Solutions Console.

Usually, you must know the value of some important ports like `SOAP_CONNECTOR_ADDRESS` for federating custom profiles that are introduced later and `WS_adminhost` for accessing the WebSphere Integrated Solutions Console. You can get the whole port list for deployment manager in the following ways:

a. Go to `<BPM_install_dir>/profiles/<dmgr_profile_name>/properties` and open file `portdef.props` as shown in Figure 10-1. All of the deployment manager ports are listed.

![Figure 10-1 Port list in Portdef.props](image)

b. Log on to the WebSphere Integrated Solutions Console using an address similar to this:

```
http://<deployment_manager_hostname>:30000/ibm/console
```
Then, click **System administration → Deployment manager** and you can see the port list in the right pane as shown in Figure 10-2.

![Port list on admin console](image)

**Figure 10-2  Port list on admin console**

4. Go to the `<BPM_install_dir>/bin` directory and run the following command:

   ```
   ./mangeprofile.sh -response ~/PS_Adv_Dmgr.response
   ```

   At the end of the profile creation process, the following message displays:

   ```INSTCONFSUCCESS: Success: Profile ProcServerDmgr now exists. Please consult
   /opt/IBM/BPM/profiles/ProcServerDmgr/logs/AboutThisProfile.txt for more information about this profile.```

5. If the cell includes IBM Business Monitor, the deployment manager profile must be updated. Create another response file with a name like `PS_Adv_Dmgr_augment_Monitor.response` and content similar to the information shown in Example 10-2.

---

**Example 10-2  Response file to augment a deployment manager profile for IBM Business Monitor**

```bash
augment
profileName=ProcServerDmgr
nodeName=ProcServerDmgrNode
cellName=ProcServer
profilePath=/opt/IBM/BPM/profiles/ProcServerDmgr
templatePath=/opt/IBM/BPM/profileTemplates/wbmonitor/dmgr
enableAdminSecurity=true
adminUserName=bpmadmin
```
adminPassword=itso4you

dbDesignEnabled=true
wmbDbDesign=/home/bpmuser/monitor.nd.topology.dbDesign
wmbDBDelayConfig=true

Remember: The deployment manager profile template for IBM Business Monitor is the same for both a Process Server cell and a Process Center cell.

For the value of parameter bpmDbDesign, you can use the database design file for IBM Business Monitor that was generated in Chapter 9, “Database tables and schema creation” on page 159.

6. Go to the <BPM_install_dir>/bin directory and run the following command:
   ./mangeprofile.sh -response ~/PS_Adv_Dmgr_augment_Monitor.response

7. At the end of the profile creation process, a success message is displayed.

10.1.2 Federating the LDAP repository into user registry

Now that the deployment manager profile is ready, you can configure the user registry for the cell on demand. By default, the file-based user registry is being used, but the most common type of user list in use by corporations today is the LDAP repository. Therefore, this section describes the procedure for federating an LDAP repository into the user registry. Table 10-1 lists the users and groups that are expected within LDAP. These users are used for security configuration while you are setting up the IBM Business Process Manager deployment environment. See Figure 12-18 on page 242 and Figure 12-20 on page 246.

Table 10-1  LDAP users by product

<table>
<thead>
<tr>
<th>Bind distinguished name for federating LDAP repository</th>
<th>IBM Business Monitor</th>
<th>IBM Business Process Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid=bmbind, ou=ITSO, o=IBM</td>
<td>uid=bmbind, ou=ITSO, o=IBM</td>
<td></td>
</tr>
<tr>
<td>Group used for IBM Business Process Manager or IBM Business Monitor Administrative</td>
<td>cn=monadmins, ou=ITSO, o=IBM</td>
<td>cn=bpmadmins, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Authentication for the business flow and human task monitor role</td>
<td>uid=bpcmon, ou=ITSO, o=IBM</td>
<td></td>
</tr>
<tr>
<td>Authentication for IBM Business Process Choreographer administrative</td>
<td>IBM Business Monitor</td>
<td>IBM Business Process Manager</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>uid=bpcadmin, ou=ITSO, o=IBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authentication for human task escalation</td>
<td></td>
<td>uid=escalation, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Authentication for the business flow manager and human task manager administrative jobs. This user must be in the Administrator role.</td>
<td></td>
<td>uid=bpcjobadmin, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Authentication for IBM Cognos Administrative access</td>
<td></td>
<td>uid=cognosadmin, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Java Message Service API Authentication</td>
<td></td>
<td>uid=jmsapi, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Used for connection to the IBM Business Process Manager Messaging Bus</td>
<td></td>
<td>uid=bpmjms, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>Used for the connection to the PerformanceDW Messaging Bus</td>
<td></td>
<td>uid=pdwjms, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>User for connection to the IBM Common Event Infrastructure Messaging Bus</td>
<td></td>
<td>uid=ceijms, ou=ITSO, o=IBM</td>
</tr>
<tr>
<td>User for connection to the Service Component Architecture Messaging Buses</td>
<td></td>
<td>uid=sca, ou=ITSO, o=IBM</td>
</tr>
</tbody>
</table>
To federate the LDAP repository, complete these steps:

1. Start the deployment manager if it is not already started:
   
   `<BPM_install_dir>/profiles/<dmgr_profile_name>/bin/startManager.sh`  

2. Log in to the WebSphere Integrated Solutions Console.


4. Select the Enable administrative security check box if it is not selected.

   In the User account repository panel (Figure 10-3), ensure that Federated repositories is selected in the Available realm definitions list, and click Configure.

---

**User account repository**

<table>
<thead>
<tr>
<th>Realm name</th>
<th>Federation definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>defaultWIMFileBasedRealm</td>
<td></td>
</tr>
</tbody>
</table>

**Current realm definition**

<table>
<thead>
<tr>
<th>Federated repositories</th>
</tr>
</thead>
</table>

**Available realm definitions**

- Federated repositories

---

*Figure 10-3  User account repository*
5. From the Federated repositories window, under Related Items, click **Manage repositories** (Figure 10-4).

![Repositories in the realm](image)

**Figure 10-4  Repositories in the realm**

6. On the **Manage repositories** pane, click **Add → LDAP repository** (Figure 10-5).

![Manage repositories panel](image)

**Figure 10-5  Manage repositories panel**
7. On the New Repository pane (Figure 10-6), set the following attributes:
   a. Set Repository identifier to itdsLDAP.
   b. For Directory type, select IBM Tivoli Directory Server.
   c. Set the primary host name to sa-w310-2.itso.ral.ibm.com.
   d. Ensure that port is set to 389.
   e. Set the bind distinguished name to uid=bpmbind,ou=ITSO,o=IBM.
   f. Set the bind password to itso4you.
   g. Set the login properties to uid.
   h. Click Apply.
   i. Click Save.

Figure 10-6 Configuring a new LDAP repository
There are now two repositories (Figure 10-7).

8. Click the **Federated repositories** link at the top of the page.

9. From the Federated Repositories pane, click **Add Base entry to Realm** in the Repositories in the realm section (Figure 10-4 on page 181).
10. From the Repository reference pane (Figure 10-8), in this example enter the following attributes:

a. For the Distinguished name of a base entry that uniquely identifies this set of entries in the realm field enter ou=ITSO,o=IBM.

b. For the Distinguished name of a base entry in this repository field enter ou=ITSO,o=IBM.

c. Click OK.

d. Click Save.

![Global security](image)

**Figure 10-8** ITSO LDAP repository

The Federated Repositories panel displays two repositories (Figure 10-9).

![Repositories in the realm](image)

**Figure 10-9** Repositories in the realm
11. From the Federated Repositories pane, complete these steps:
   a. Click **OK**.
   b. Click **Save**.

12. Log out from the WebSphere Integrated Solutions Console.

13. Restart the deployment manager.

**Adding administrative groups**

After you federate the LDAP repository into the user registry, you might want to assign the administrative privileges to the users and groups in LDAP. To do so, complete the following steps:

1. Log on to the WebSphere Integrated Solutions Console.

2. Click **Users and Groups → Administrative group roles**.

3. Click **Add**.

4. On the Roles select pane, select the appropriate roles for your topology.

5. Click **Search**.
6. The available groups are displayed from the LDAP repository. Select the group for this role (for example, group bpmadmins in LDAP for IBM Business Process Manager) and click the arrow to add it to the Mapped to role as shown in Figure 10-10.

![Administrative group roles](image)

**Figure 10-10  Adding administrative groups**

7. Click **OK**.

8. Save your configuration.

You can now log in to the WebSphere Integrated Solutions Console by using any of the users that are defined in the bpmadmins group.
10.1.3 Creating a Process Center or Process Server custom profile

The creation of a custom profile is much easier than the dmgr profile. The following steps describe the procedure to create a custom profile by using the `manageprofile` command with response file:

1. To create an IBM Business Process Manager custom profile, create the response file `PS_Adv_Custom.response` in the user's root directory. The content should be similar to Example 10-3.

```
Example 10-3  Response file to create an IBM Business Process Manager custom profile

create
templatePath=/opt/IBM/BPM/profileTemplates/BPM/managed.procsvr.adv
profilePath=/opt/IBM/BPM/profiles/Node01ProcServer
profileName=Node01ProcServer
bpmdbDesign=/home/bpmuser/bpm.advanced.nd.topology.dbDesign
federateLaterBPM=true
environmentType=Production
```

2. Set the `federateLaterBPM` parameter to `true`.

3. Go to the `<BPM_install_dir>/bin` directory and run the following command:

```
./mangeprofile.sh -response ~/PS_Adv_Custom.response
```

At the end of installation, the following message is displayed:

```
INSTCONFSUCCESS: Success: Profile Node01ProcServer now exists.
Please consult /opt/IBM/BPM/profiles/Node01ProcServer/logs/AboutThisProfile.txt for more information about this profile.
```

4. If the cell contains IBM Business Monitor, update the custom profile. Create the response file `PS_Adv_Custom_augment_Monitor.response` in the user's root directory with the content similar to Example 10-4.

```
Example 10-4  Response file to augment a custom profile for IBM Business Monitor

augment
templatePath=/opt/IBM/BPM/profileTemplates/BPM/managed.procsvr.adv
```

Important: When you are creating an IBM Business Process Manager custom profile for a Process Center cell, be sure to specify the correct template:

```
templatePath=/opt/IBM/BPM/profileTemplates/BPM/managed.procctr.ad
```

4. If the cell contains IBM Business Monitor, update the custom profile. Create the response file `PS_Adv_Custom_augment_Monitor.response` in the user's root directory with the content similar to Example 10-4.

```
Example 10-4  Response file to augment a custom profile for IBM Business Monitor

augment
templatePath=/opt/IBM/BPM/profileTemplates/BPM/managed.procsvr.adv
```
5. Go to the `<BPM_install_dir>/bin` directory and run the following command:
   
   ```
   ./mangeprofile.sh -response ~/PS_Adv_Custom_augment_Monitor.response
   ```
6. At the end of the profile creation process, a success message is displayed.

### 10.2 Federating a custom profile into a cell

The federation is the process that makes a custom profile become a node of a cell. The `addNode` command is used to federate a Process Server custom profile to a Process Server deployment manager, or to federate a Process Center custom profile to a Process Center deployment manager.

Before you federate the custom node, make sure that the deployment manager is running. If it is not, go to the `<BPM_install_dir>/profiles/<dmgr_profile_name>/bin` directory and run the following command:

```
./startManager.sh
```

To federate, go to `<BPM_install_dir>/profiles/<custom_profile_name>/bin` and run the following command:

```
./addNode.sh sa-w310-3.itso.ral.ibm.com 8879 -user bpmadmin -password itso4you
```

The parameters that you pass are the host name where deployment manager is located, the SOAP_CONNECTOR_ADDRESS port of deployment manager, the admin user name, and the password. Change them according to your environment.

For more information about how to get the value of the SOAP_CONNECTOR_ADDRESS port, see step 3 on page 176.

**Consideration:** Each custom profile becomes a node in the cell. Repeat the steps to create, augment, and federate a custom profile for each node.
Single Cluster topology

This chapter provides detailed instructions for creating the Single Cluster topology for IBM Business Process Manager V8.0. In this topology, all of the functional components run in the same cluster. This includes user applications, messaging infrastructure, Common Event Infrastructure (CEI), and support applications.

This chapter includes the following sections:

- 11.1, “Topology summary” on page 190
- 11.2, “Prerequisites for creating this topology” on page 192
- 11.3, “Configuring the deployment environment topology” on page 196
- 11.4, “Post-creation configuration” on page 215
11.1 Topology summary

The Single Cluster topology is the simplest clustered deployment environment pattern. It is targeted at environments with limited hardware, and is easy to set up with the Deployment Environment wizard tool.

**Note:** For more information about the topologies, see the following website:


This topology applies to IBM Business Process Manager environments with and without Monitor profile augmentation. For more information, see Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259. The topology also applies to clustered Process Center and clustered Process Server environments.
Figure 11-1 shows a diagram of the topology that you will create. It is a single clustered environment with two nodes that uses IBM Business Process Manager Advanced. In this topology, all of the functional components run in the same cluster. Thus, there is only one cluster member on each node, and the messaging engines running on one cluster member at a time.

This topology has four machines, each hosting partial components of the system:
1. One machine hosts the database installation.
2. One machine hosts the deployment manager, IBM HTTP Server, and a node with a cluster member.
3. One machine hosts a node with a cluster member.
Table 11-1 lists the details for this topology.

**Table 11-1  Summary for the servers**

<table>
<thead>
<tr>
<th>Host names</th>
<th>Abbreviations</th>
<th>Software component names</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>itsodbd2</td>
<td>&lt;Database_host_name&gt;</td>
<td>Database</td>
<td>Database server</td>
</tr>
<tr>
<td>sa-w310-4</td>
<td>&lt;DMGR_Process_Server_host_name&gt;</td>
<td>Deployment Manager</td>
<td>bpmdmg mgr node</td>
</tr>
<tr>
<td>sa-w310-4</td>
<td>&lt;IHS_host_name&gt;</td>
<td>IBM HTTP Server</td>
<td>Load balance web server</td>
</tr>
<tr>
<td>sa-w310-4</td>
<td>&lt;Node1_host_name&gt;</td>
<td>Cluster Node 1</td>
<td>Node bpmnode1</td>
</tr>
<tr>
<td>sa-w310-5</td>
<td>&lt;Node2_host_name&gt;</td>
<td>Cluster Node 2</td>
<td>Node bpmnode2</td>
</tr>
</tbody>
</table>

**11.2 Prerequisites for creating this topology**

Before you create this topology, you must complete the following prerequisite steps as described in Chapter 8, “Downloading and installing binary files” on page 137:

1. Install supported DB2 database (or an alternative database), as described in 8.3.1, “Installation order” on page 145.

2. Install IBM HTTP Server (or an alternative HTTP server) to the cell, as described in “Installing IBM HTTP Server and Web Server plug-in” on page 154. Alternatively, a proxy server can be installed and configured.

3. Install a supported IBM Tivoli Directory Server (or an alternative user registry), as described in 8.3.1, “Installation order” on page 145.

4. Define the appropriate users in your user registry, as described in 8.2.6, “Defining the user registry” on page 141. The examples use bpmadmin as the admin user account, and the related password is its04you.

5. Install IBM Business Process Manager V8.0 Advanced, as described in “Installing IBM Business Process Manager Advanced” on page 149.

6. Install IBM Business Monitor V8.0, as described in “Installing IBM Business Monitor” on page 151.

7. Create the required databases and schemas, as described in Chapter 9, “Database tables and schema creation” on page 159 for DB2 and Oracle database.
For DB2, the following databases are created for either a separate Process Center or a Process Server environment:

- Common Database (CMNDB)
- Process Server Database (BPMDB)
- Performance Data Warehouse Database (PDWDB)
- IBM Business Monitor database tables (MONDB)
- IBM Cognos database tables (COGNOS)
- Messaging engine Database (MEDB)
- Business Process Choreographer Database (BPEDB)
- Business Process reporting schema (OBSVRDB)
- Business Space schema (created in CMNDB)

**Consideration:** Only the Common database tables, IBM Business Monitor database tables, and IBM Cognos database tables are required to exist at the time that the deployment manager is started. The remaining databases and tables are not used until the deployment environment is created. However, the runtime administrator and the database administrator have already specified the database names, schema names, and user accounts. Also, the runtime administrator has already generated the scripts by using the Database Design Tool. Therefore, it is best to give all of the generated scripts to the database administrator immediately so that the database structure can be created in the database.

Do not reuse the generated SQL scripts for a Process Center database to create a Process Server database. For more information, see the Runtime server environments toggle in the Process Admin console for IBM Business Process Manager web page at:


8. Create a Process Server Deployment Manager profile, set up the federated user registry integration, add IBM HTTP Server to the cell, and modify certain configuration settings, as described in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174.

9. Create a deployment manager profile for IBM Business Process Manager as described in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174. Then, set up the federated LDAP user registry integration, as described in 10.1.2, “Federating the LDAP repository into user registry” on page 178.

Add IBM HTTP Server to the cell, and modify certain configuration settings, as described in 7.4.1, “Configuring IBM Business Process Manager to use IBM HTTP Server” on page 131.
10. Create and federate two Process Server custom nodes, as described in 10.1.3, “Creating a Process Center or Process Server custom profile” on page 187.

11. Create two custom nodes for IBM Business Process Manager, then augment them for IBM Business Monitor, as described in 10.1.3, “Creating a Process Center or Process Server custom profile” on page 187.

Finally, federate each custom profile to the deployment manager, as described in 10.2, “Federating a custom profile into a cell” on page 188.

12. Directory substitutions use the details that are defined in Table 8-2 on page 144.

Before running the WebSphere Integrated Solutions Console Deployment Environment wizard or command-line tools, ensure that the Deployment Manager (DMGR) and the node agents for the custom nodes are operational. Check that there are no errors or exceptions in the corresponding profile log directories. The following are example paths:

- Deployment manager
  <BPM_install_dir>/profiles/<dmgr_profile_name>/logs/dmgr/SystemOut.log

- bpmNode01 node agent
  <BPM_install_dir>/profiles/<custom_profile_name>/logs/nodeagent/SystemOut.log

- bpmNode02 node agent
  <BPM_install_dir>/profiles/<custom_profile_name>/logs/nodeagent/SystemOut.log

After you complete the prerequisite steps, it is assumed that the deployment manager, empty custom nodes, and database tables exist. This empty cell is ready for creating and configuring the clusters.

This chapter uses the values that are described in Table 11-2. Some of these values were created during the prerequisite steps.

**Table 11-2  Values that are used in this chapter**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>When created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell name</td>
<td>bpmCell01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Description</td>
<td>Value</td>
<td>When created</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Custom node 1 name</td>
<td>bpmNode01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Custom node 2 name</td>
<td>bpmNode02</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;DMGR_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/&lt;dmgr_profile_name&gt;</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;Custom_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/custom_profile_name</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Deployment Environment name</td>
<td>BPMRMSW</td>
<td>Chapter 11, “Single Cluster topology” on page 189</td>
</tr>
<tr>
<td>AppTarget cluster name</td>
<td>BPMRMSW.AppTarget</td>
<td>Chapter 11, “Single Cluster topology” on page 189</td>
</tr>
<tr>
<td>Messaging cluster name</td>
<td>BPMRMSWMessaging</td>
<td>Chapter 11, “Single Cluster topology” on page 189</td>
</tr>
<tr>
<td>Support cluster name</td>
<td>BPMRMSW.Support</td>
<td>Chapter 11, “Single Cluster topology” on page 189</td>
</tr>
<tr>
<td>Web cluster name</td>
<td>BPMRMSW.WebApp</td>
<td>Chapter 11, “Single Cluster topology” on page 189</td>
</tr>
<tr>
<td>Web server name</td>
<td>httpserver</td>
<td>Chapter 16, “Configuring IBM Business Process Manager for web server products” on page 343</td>
</tr>
</tbody>
</table>
11.3 Configuring the deployment environment topology

This section provides instructions for configuring and deploying the Single Cluster deployment environment pattern. Use the hardware and software that are listed in 11.2, “Prerequisites for creating this topology” on page 192. After you complete these instructions, complete the steps that are detailed in Chapter 15, “Post-creation configuration and verification” on page 303.

The topology includes a database server (IBM DB2), two nodes to provide the clustering required, and an IBM HTTP Server to serve as a web server and provide load balancing.

Before running the Deployment Environment wizard or command-line tools, ensure that the environment Deployment Manager component (DMGR) and the custom nodes with their corresponding node agents are up and running. Check that there are no errors or exceptions in the corresponding profile log directories, such as:

- `<BPM_install_dir>/profiles/bpmPSDmgr/logs`
- `<BPM_install_dir>/profiles/bpmPSNode01/logs`
- `<BPM_install_dir>/profiles/bpmPSNode02/logs`

The process is divided into two parts:
1. Define the deployment pattern topology. This is completed by using the WebSphere Integrated Solutions Console.
2. Apply the definition by generating the deployment environment. This can be done by using either the WebSphere Integrated Solutions Console or command-line tools.

It is possible to export the deployment pattern definitions from the WebSphere Integrated Solutions Console. For more information about how to use the topology definitions to generate the deployment environment using command-line tools, as an alternative silent option, see 8.3.5, “Installing and applying fixes all-in-one” on page 157.

11.3.1 Using the WebSphere Integrated Solutions Console

This section provides instructions for configuring and deploying the Single Cluster topology by using the WebSphere Integrated Solutions Console.

The following procedure creates the Single Cluster topology using the WebSphere Integrated Solutions Console. Before you begin, ensure that the deployment manager and nodes are running and that there are no errors shown in the logs.
For more information about creating a Process Center environment by using a deployment pattern, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_pc_db2.html

For more information about creating a Process Server environment by using a deployment pattern, see:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_ps_db2.html

Create the Single Cluster deployment environment topology with these steps:

1. Log in to the WebSphere Integrated Solutions Console as the primary administrative user that you defined when you created the profile. The example uses bpmadmin.

2. Click **Servers → Deployment Environments**, and click **New**.

3. The WebSphere Integrated Solutions Console displays the first page of the Deployment Environment wizard with the Create new deployment environment option selected. Enter the name of your deployment environment (this example uses BPMSingleCluster as shown in Figure 11-2). Then, click **Next**.

![Create new deployment environment window: Name selection](http://example.com/image.png)
4. Ensure that **BPMAPC** is selected as the deployment environment type on the Create new deployment environment wizard (Figure 11-3), then click **Next**.

![Create new deployment environment](image)

*Figure 11-3  Create new deployment environment window: Type selection*

**Note:** If you are creating a single cluster process center, the choice here can be BPMAPS, which is the Process Center.

WebSphere Enterprise Service Bus is a subset of functions that is included within the IBM Business Process Manager Advanced feature. You do not have to select it when you are creating a BPMAPS or BPMAPC deployment environment.
5. Select the **Single Cluster** deployment environment pattern (see Figure 11-4), which is the type of deployment environment that you are creating in this chapter, and then click **Next**.

![Figure 11-4  Deployment environment pattern type window](image.png)
6. You now run through a series of steps in the wizard, specifying how the deployment environment can be created. In the first step, specify which nodes are to be used to create the environment. Select both **bpmpsNode01** and **bpmpsNode02** because these are the nodes that you created earlier (Figure 11-5). The single cluster spans the nodes that you select.

*Figure 11-5  Select Nodes*
7. Select how many cluster members to create on each node for each cluster that is created. In this case, because you are creating a single-cluster topology, only one cluster (named Application Deployment Target) is listed. You can leave the values at the default to specify one cluster member per node (Figure 11-6).

![Cluster Members window](image)

*Figure 11-6  Cluster Members window*
8. Set up the cluster name and each cluster member name. You can leave the values as the defaults (Figure 11-7).
9. Enter the details for your REST endpoints. Because you are creating a production topology, you installed IBM HTTP Server to provide load balancing across the cluster. On this page, enter the HTTP server host name and port (Figure 11-8).

![System REST Service Endpoints]

**Step 1:** Select Nodes

**Step 2:** Clusters

**Step 3:** System REST Service Endpoints

**Step 4:** Import database configuration

**Step 5:** Database

**Step 6:** Security

**Step 7:** Process Server

**Step 8:** Business Process Choreographer

**Step 9:** Web Application Context Roots

**Step 10:** Summary

---

**System REST Service Endpoints**

Use this page to configure service endpoints for Representational State Transfer (REST) services. If you want widgets to be available in Business Space, you must configure REST services for your cluster. For each REST service endpoint, specify the host or virtual host name and port for your environment. If you leave the host and port fields empty, the value is 0.0.0.0 and 80, respectively. For a load-balanced environment, you must later configure the load balancer with the host name or virtual host name and port of your environment.

**REST services**

- **Protocol:**
  - http://

- **Host name or virtual host in a load-balanced environment:**
  - sa-w310-4.itso.ral.ibm.com

- **Port:**
  - 80

- **Context root:**
  - /rest

---

*Figure 11-8  System REST Service Endpoints*
10. For the next step, there are two choices. The first option is to browse to and import the design file output by the Database Design Tool in the installation. In this case, the inputs in step five will be pre-populated based on that design file. The second option is to not import a design file, in which case the inputs in step five must be entered manually. In this example, you leave the Import field blank and manually enter our database settings in the next step (Figure 11-9).

![Figure 11-9 Import database configuration](image-url)
11. Review the database settings that you selected (Figure 11-10). For each line, check that the database name and schema match what you planned in database creation. For each line, check that the Create Tables option is *not* selected, as you have already created the database tables. In the example that is shown in Figure 11-10, click to clear all these Create Tables options.

---

**Figure 11-10   Database window**

<table>
<thead>
<tr>
<th>Select</th>
<th>Name</th>
<th>Database Name</th>
<th>Schema</th>
<th>Create Tables</th>
<th>User Name</th>
<th>Password</th>
<th>Server</th>
<th>Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business Process Choreographer data source</td>
<td>BPEBPC</td>
<td>CMNBE00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Business Process Choreographer Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNBM00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Business Space data source</td>
<td>BSPACEPC</td>
<td>CMNBS00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>CEI Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNCM00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Performance Data Warehouse data source</td>
<td>PDWDEPC</td>
<td></td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Performance Data Warehouse Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNPE00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Process Server data source</td>
<td>BMPDBPC</td>
<td></td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>Process Server Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNPS00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>SCA System Bus Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNSS00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
<tr>
<td></td>
<td>SCA Application Bus Messaging Engine data source</td>
<td>MEDBPC</td>
<td>CMNSA00</td>
<td>No</td>
<td>db2inst1</td>
<td>********</td>
<td>sa-w310-5.i</td>
<td>DB2 DataServe</td>
</tr>
</tbody>
</table>
12. Leave the default user names and passwords for the CEI JMS authentication, SCA, and Business Process Choreographer JMS authentication aliases as shown in Figure 11-11.

**Note:** You can also use these create tables capabilities to simplify your Deployment Environment generation if the database engine on the same deployment manager machine. In this case, you do not need the Database Design Tool to generate the SQL scripts and run all the database scripts for all components. Only the databases must be created in advance. Make sure that the Create Tables option is checked here, which is the default, and create all the necessary tables. But in general, use these steps:

- Create database scripts by using the Database Design Tool
- Create the database and tables by using the generated scripts
- Click to clear the create tables option while you are generating the deployment environment

**Figure 11-11  Security window**
13. If you are creating a Process Server cluster, there is a Process Server configuration page before the Business Process Choreographer settings page. On the Process Server configuration page (Figure 11-12), enter the environment name, choose an environment type (this example uses Production), and enter the process center connection information (the HTTP server address for the clustered Process Center).

![Figure 11-12   Step 7: Process Server configuration](image)
14. Set the password for the JMS API, escalation user, and administration job user authentication according to the definitions in the user registry as shown in Figure 11-13. Here you have not defined an email service for the human task manager, so clear the **Enable e-mail service** option.

![Figure 11-13 Business Process Choreographer settings](image-url)
15. Modify the context roots for the IBM Business Process Manager components as needed. In the example environment, the default values were used as shown in Figure 11-14.

![Table of Web Application Context Roots]

<table>
<thead>
<tr>
<th>Context Root</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Process Choreographer Explorer context root:</td>
<td>/bpc</td>
</tr>
<tr>
<td>Business Process Rules Manager context root:</td>
<td>/br</td>
</tr>
<tr>
<td>Business Space context root:</td>
<td>/BusinessSpace</td>
</tr>
</tbody>
</table>

16. Review the summary of the entire topology before it is created (Figure 11-15 on page 210), and select Finish and Generate Environment.
This summary shows an overview of your new deployment environment. To save the deployment environment definition, click on "Finish". To save the definition and generate the deployment environment, click on "Finish and Generate Environment".

### Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment Environment Pattern</td>
<td>Single Cluster</td>
</tr>
<tr>
<td>Deployment environment name</td>
<td>BPSingleCluster</td>
</tr>
<tr>
<td>Features</td>
<td>BPMAPS</td>
</tr>
<tr>
<td>Deployment Environment Status</td>
<td>Not configured</td>
</tr>
</tbody>
</table>

### Deployment Targets

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bpmPSNode01</td>
</tr>
<tr>
<td></td>
<td>bpmPSNode02</td>
</tr>
</tbody>
</table>

### Data Sources

<table>
<thead>
<tr>
<th>Name</th>
<th>Database Name</th>
<th>Schema</th>
<th>Database Provider</th>
<th>Database Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Data Warehouse data source</td>
<td>PDB</td>
<td>CMNPE00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Performance Data Warehouse Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNPE00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Process Server data source</td>
<td>BPMDB</td>
<td>CMNPE00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Process Server Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNPS00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Business Process Choreographer data source</td>
<td>MEDB</td>
<td>CMNBE00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Business Process Choreographer Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNM00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>Business Space data source</td>
<td>BSPACE</td>
<td>CMNBS00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>CEF Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNNC00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>SCA Application Bus Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNBS00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
<tr>
<td>SCA System Bus Messaging Engine data source</td>
<td>MEDB</td>
<td>CMNSS00</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.30</td>
</tr>
</tbody>
</table>

### Security

<table>
<thead>
<tr>
<th>Name</th>
<th>Authentication</th>
<th>User Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Data Warehouse IMS authentication alias</td>
<td>BPSIMW_1</td>
<td>bpmadmin</td>
</tr>
<tr>
<td>Process Server</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment name</td>
<td>BPMPSCluster</td>
<td></td>
</tr>
<tr>
<td>Environment type</td>
<td>Production</td>
<td></td>
</tr>
<tr>
<td>Process center connection URL</td>
<td><a href="http://sa-w310-4.bpel.ral.bm.com:80/ProcessCenter">http://sa-w310-4.bpel.ral.bm.com:80/ProcessCenter</a></td>
<td></td>
</tr>
</tbody>
</table>

### Business Process Choreographer

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Process Choreographer Explorer context root</td>
<td>/bpc</td>
</tr>
<tr>
<td>Create a mail session to send e-mails</td>
<td>false</td>
</tr>
<tr>
<td>Mail session host</td>
<td></td>
</tr>
<tr>
<td>Business Process Choreographer URL</td>
<td></td>
</tr>
<tr>
<td>User for Administrator role</td>
<td>bpmadmin</td>
</tr>
<tr>
<td>Group for Administrator role</td>
<td></td>
</tr>
<tr>
<td>User for Monitor role</td>
<td>bpmadmin</td>
</tr>
<tr>
<td>Group for Monitor role</td>
<td></td>
</tr>
</tbody>
</table>

### Business Process Rules Manager

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Process Rules Manager context root</td>
<td>/br</td>
</tr>
</tbody>
</table>
17. Messages are displayed as the environment is generated. When finished, click **Save changes**. The successful output is be similar to that shown in Figure 11-16. If any errors appear, review and correct them before you continue.

![Configuration Status]

*Figure 11-16  Excerpt from the environment generation information*

**Note:** If you want, you can select **Finish** here instead to save the deployment environment definition without generating it. Doing so gives you a chance to review and edit it first. You can also use this method to export a topology definition file for use in command-line generation. For more information, see 11.3.2, “Using the command line” on page 212.
11.3.2 Using the command line

This section describes the required steps to create a single cluster deployment environment. Before you execute the following steps, you must increase the SOAP timeout (1800 should be enough).

Perform the following steps to increase the SOAP timeout:

1. Open the soap.client.props file
   (/opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/properties/)
2. Change the com.ibm.SOAP.requestTimeout property to 1800 (30 minutes).

To create the deployment environment topology, complete these steps:

1. Create deployment environment definitions for IBM DB2.
   Create a single cluster deployment environment using the database design file that you created in Chapter 9, “Database tables and schema creation” on page 159.
   Go to deployment manager profile bin folder and run the command shown in Example 11-1 to create the deployment environment definitions.

Example 11-1 Creating the deployment environment definitions

```
./wsadmin.sh -connType SOAP -host bmpDmgrHostName -port 8879 -user bpmadmin -password bpmadmin

wsadmin> $AdminTask createDeploymentEnvDef { -topologyName BPMPCSingleCluster -topologyPattern SingleCluster -topologyRuntime BPMAPC -dbDesign /home/bpmuser/dbDesigns\SingleCluster$dbDesign}

wsadmin> $AdminConfig save
```
Implementation notes:

- If you use the createTables parameter, the databases must already exist. Do not use createTables for a production environment where you want to customize the generated database scripts, or if you have a remote database server. In general, create the database and tables directly on database machine by DBA.

- If you are using Process Server, you must replace BPMAPC with BPMAPS.

- You can find more information about the createDeploymentEnvDef command at:
  

2. Add nodes to a deployment environment definition.

Add the augmented nodes to the deployment environment as members of the single cluster topology. Perform the step shown in Example 11-2 for each node that you need to add.

Example 11-2  Adding nodes to a deployment environment definition

```
./wsadmin.sh -connType SOAP -host bpmDmgrHostName -port 8879 -user bpmadmin -password bpmadmin

wsadmin> $AdminTask addNodeToDeploymentEnvDef {-topologyName BPMPCSingleCluster -topologyRole ADT -nodeName bpmPCNode01}

wsadmin> $AdminTask addNodeToDeploymentEnvDef {-topologyName BPMPCSingleCluster -topologyRole ADT -nodeName bpmPCNode02}

wsadmin> $AdminConfig save
```

You can find more information about the addNodeToDeploymentEnvDef command at:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm .ref.doc/topics/rref_addnodedepenvdef.html
3. Validate the deployment environment definition.

Validate the deployment environment definition before generating to avoid any exceptions during generation. Perform the step shown in Example 11-3 to validate the created definitions.

Example 11-3 Validating the deployment environment definition

```shell
./wsadmin.sh -connType SOAP -host bmpDmgrHostName -port 8879 -user bpmadmin -password bpmadmin

wsadmin> $AdminTask validateDeploymentEnvDef {-topologyName BPMPCSingleCluster}
```

You can find more information about `validateDeploymentEnvDef` command at:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.ref.doc/topics/rref_val_dep_envdef.html

4. Generating the deployment environment.

Generating the deployment environment based on the created definition. Perform the step shown in Example 11-4 to generate the single cluster deployment environment.

Example 11-4 Generating the deployment environment

```shell
./wsadmin.sh -connType SOAP -host bmpDmgrHostName -port 8879 -user bpmadmin -password bpmadmin

wsadmin> $AdminTask generateDeploymentEnv {-topologyName BPMPCSingleCluster}
```

Topology BPMPCSingleCluster has been successfully configured

wsadmin> $AdminConfig save

You can find more information about the `generateDeploymentEnv` command at:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.ref.doc/topics/rref_cfgtop.html

**Warning:** Do not restart your deployment manager yet. Ensure that the generation of the deployment environment is complete first. Perform the steps in 15.1.1, “Checking database connectivity” on page 304, to ensure that this is done successfully.
11.4 Post-creation configuration

A few steps must be done after the Deployment Environment generation is completed successfully. These steps apply to both Process Center and Process Server cells. For information about these steps, see Chapter 15, “Post-creation configuration and verification” on page 303.
Remote Messaging, Remote Support, and Web topology

This chapter provides instructions for creating the Remote Messaging, Remote Support, and Web (RMSW) deployment environment for IBM Business Process Manager. This four cluster topology pattern is the preferred topology for IBM Business Process Manager Standard and IBM Business Process Manager Advanced.

The RMSW topology pattern is a well-known deployment pattern that is provided by IBM. It distributes deployment environment functions across four separate clusters.

This topology can be used for creating either a Process Server or Process Center environment deployment environment.

This chapter includes the following sections:

- 12.1, “Topology summary” on page 218
- 12.2, “Prerequisites for creating the topology” on page 223
- 12.3, “Configuring the Deployment Environment topology” on page 226
- 12.5, “Post-creation configuration” on page 258
12.1 Topology summary

The RMSW deployment environment pattern for IBM Business Process Manager is suitable for production environments that require performance and flexibility. The RMSW applies to various use cases, including starting small and scaling as more resources are required to meet demand. This deployment environment pattern is the suggested topology for IBM Business Process Manager.

For more information about the topologies, see the following website:
http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.im uc.doc/topics/cpln_psvr_topologies.html

The name Remote Messaging, Remote Support, and Web reflects the relationship of the messaging engines, supporting functions, and web-based user interfaces to the application deployment target.

The deployment environment pattern has the benefit of concentrating applications of similar functional behavior on a specific target cluster, balancing usage with resource requirements. This setup is targeted at environments with isolation, performance, and resilience requirements across distributed hardware.

Although it is a complex deployment environment pattern, RMSW is relatively straightforward to set up using the Deployment Environment wizard. The deployment environment pattern can be applied to both the Process Center and Process Server environments of IBM Business Process Manager.

To use it with IBM Business Monitor 8.0, extra profile augmentation of the deployment environment is required. For more information, see Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259.

There are a number of physical servers that are used in the environment setup for this chapter. Each server hosts specific components of the system. One hosts the database installation, another IBM HTTP Server, another deployment manager, and finally two more each hosting an application server cluster node. Table 12-1 on page 221 shows the server details that are used in this chapter.
Each of the six messaging engines is only actively running on one cluster node at any one time. The passive messaging engines, all on the second node, are depicted as gray shaded components in Figure 12-1.

Consideration: Figure 12-1 depicts two IBM HTTP Server web servers, which each provide load balancing for HTTP requests to the cluster members. The illustration also depicts an IP sprayer for providing high availability of the web servers. Although Figure 12-1 depicts the preferred practice, this chapter describes the use of only a single web server. In production environments, the network administrator dictates and provides the routing and load balancing capabilities that meet the customer’s requirements.

The functions that are used in this deployment environment pattern are distributed across four clusters based on usage and functional purpose. One cluster is used for messaging functions, one cluster for support functions, one cluster for applications, and one cluster for web-based functions. This configuration provides the added advantage of precisely controlling the individual

Figure 12-1  RMSW deployment environment pattern for IBM Business Process Manager Advanced V8.0
components in your environment. The functionality is distributed across clusters as follows:

► Application Deployment Target cluster:
  – Process Server: The repository for the managing process model and integration process applications
  – Business Process Choreographer container: The run time for running process model and integration process applications
  – User applications for advanced integrations and IBM Business Monitor models

► Messaging Infrastructure cluster:
  – Business Process Choreographer bus members
  – Common Event Infrastructure (CEI) bus members
  – Performance Data Warehouse (PDW) bus members
  – Process Server bus members
  – Service Common Architecture (SCA) application bus members
  – SCA system bus members

► Supporting Applications cluster
  – Common Event Infrastructure (CEI) server application
  – Performance Data Warehouse
  – Process performance and monitoring applications

► Web Application Deployment cluster
  – Process Portal
  – Business Space application and widgets
  – Business Process Choreographer Explorer
  – REST API Services
  – Business Rules manager
Table 12-1 details the host names and usage of the servers in this deployment environment pattern.

<table>
<thead>
<tr>
<th>Host names</th>
<th>Abbreviation for host</th>
<th>Software component name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>itsodb2</td>
<td>&lt;Database_host_name &gt;</td>
<td>DB2 database server</td>
<td>Database server</td>
</tr>
<tr>
<td>itsoldap</td>
<td>&lt;LDAP_host_name&gt;</td>
<td>ITDS server</td>
<td>LDAP server</td>
</tr>
<tr>
<td>webserver</td>
<td>&lt;IHS_host_name&gt;</td>
<td>IHS</td>
<td>Front-end web server load-balancing network traffic between the cluster nodes</td>
</tr>
<tr>
<td>sa-w310-6</td>
<td>&lt;DMGR_Process_Center_host_name&gt;</td>
<td>bpmPCDmgr</td>
<td>Deployment Manager for Process Center</td>
</tr>
<tr>
<td>sa-w310-6</td>
<td>&lt;Node1_Process_Center_host_name&gt;</td>
<td>bpmPCNode01</td>
<td>Cluster node1 for Process Center</td>
</tr>
<tr>
<td>sa-w310-7</td>
<td>&lt;Node2_Process_Center_host_name&gt;</td>
<td>bpmPCNode02</td>
<td>Cluster node2 for Process Center</td>
</tr>
<tr>
<td>sa-w310-6</td>
<td>&lt;DMGR_Process_Server_host_name&gt;</td>
<td>bpmPSDmgr</td>
<td>Deployment Manager for Process Server</td>
</tr>
<tr>
<td>sa-w310-6</td>
<td>&lt;Node1_Process_Server_host_name&gt;</td>
<td>bpmPSNode01</td>
<td>Cluster node1 for Process Server</td>
</tr>
<tr>
<td>sa-w310-7</td>
<td>&lt;Node2_Process_Server_host_name&gt;</td>
<td>bpmPSNode02</td>
<td>Cluster node2 for Process Server</td>
</tr>
</tbody>
</table>
Figure 12-2 shows the details of a RMSW Process Center environment.

Figure 12-2  Remote Messaging, Remote Support, and Web Process Center environment

Figure 12-3 shows the details of a separate RMSW online runtime Process Server environment.

Figure 12-3  Remote Messaging, Remote Support, and Web Process Server environment
12.2 Prerequisites for creating the topology

Before you create this topology, you must complete the prerequisite steps as described in Chapter 8, “Downloading and installing binary files” on page 137:

1. Install supported DB2 database (or an alternative database), as described in 8.3.1, “Installation order” on page 145.

2. Install IBM HTTP Server (or an alternative HTTP server) to the cell, as described in “Installing IBM HTTP Server and Web Server plug-in” on page 154. Alternatively, a proxy server can be installed and configured.

3. Install a supported IBM Tivoli Directory Server (or an alternative user registry), as described in 8.3.1, “Installation order” on page 145.

4. Define the appropriate users in your user registry, as described in 8.2.6, “Defining the user registry” on page 141. The examples in this book, use bpmadmin as the admin user account, and the related password is itso4you.

5. Install IBM Business Process Manager V8.0 Advanced, as described in “Installing IBM Business Process Manager Advanced” on page 149.

6. Install IBM Business Monitor V8.0, as described in “Installing IBM Business Monitor” on page 151.

7. Create the required databases and schemas, as described in Chapter 9, “Database tables and schema creation” on page 159 for DB2 and Oracle database.

For DB2, the following databases are created for either a separate Process Center or a Process Server environment:

- Common Database (CMNDB)
- Process Server Database (BPMDB)
- Performance Data Warehouse Database (PDWDB)
- IBM Business Monitor database tables (MONDB)
- IBM Cognos database tables (COGNOS)
- Messaging engine Database (MEDB)
- Business Process Choreographer Database (BPEDB)
- Business Process reporting schema (OBSVRDB)
- Business Space schema (created in CMNDB)

Only the Common database tables, IBM Business Monitor database tables, and IBM Cognos database tables are required to exist at the time that the deployment manager is started. The remaining databases and tables are not used until the deployment environment is created. However, the runtime administrator and the database administrator has already specified the database names, schema names, and user accounts. Also, the runtime administrator has already generated the scripts by using the Database Design Tool. Therefore, it is likely most expedient to give all of the generated
scripts to the database administrator immediately so that the database structure can be created in the database.

Do not reuse the generated SQL scripts for a Process Center database to create an Process Server database. For more information, see the Runtime server environments toggle in the Process Admin console for IBM Business Process Manager web page at:


8. Create a Process Server Deployment Manager profile, set up the federated user registry integration, add IBM HTTP Server to the cell, and modify certain configuration settings, as described in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174.

9. Create a deployment manager profile for IBM Business Process Manager as described in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174, then set up the federated LDAP user registry integration, as described in 10.1.2, “Federating the LDAP repository into user registry” on page 178.

Then, add IBM HTTP Server to the cell, and modify certain configuration settings as described in 7.4.1, “Configuring IBM Business Process Manager to use IBM HTTP Server” on page 131.

10. Create and federate two Process Server custom nodes, as described in 10.1.3, “Creating a Process Center or Process Server custom profile” on page 187.

11. Create two custom nodes for IBM Business Process Manager, then augment them for IBM Business Monitor, as described in 10.1.3, “Creating a Process Center or Process Server custom profile” on page 187.

Finally, federate each custom profile to the deployment manager, as described in 10.2, “Federating a custom profile into a cell” on page 188.

12. Directory substitutions use the details that are defined in Table 8-2 on page 144.

Before running the WebSphere Integrated Solutions Console Deployment Environment wizard or command-line tools, ensure that the Deployment Manager (DMGR) and the node agents for the custom nodes are operational. Check that there are no errors or exceptions in the corresponding profile log directories, such as:

- Deployment manager

  <BPM_install_dir>/profiles/<dmgr_profile_name>/logs/dmgr/SystemOut.log
After you complete the prerequisite steps, it is assumed that the deployment manager, empty custom nodes, and database tables exist. This empty cell is ready for creating and configuring the clusters.

This chapter uses the values that are described in Table 12-2. Some of these values were created during the prerequisite steps.

Table 12-2  Values that are used in this chapter

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>When created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell name</td>
<td>bpmCell01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Custom node 1 name</td>
<td>bpmNode01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Custom node 2 name</td>
<td>bpmNode02</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;DMGR_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/&lt;dmgr_profile_name&gt;</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;Custom_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/custom_profile_name&gt;</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Deployment Environment name</td>
<td>BPMRMSW</td>
<td>Chapter 12, “Remote Messaging, Remote Support, and Web topology” on page 217</td>
</tr>
</tbody>
</table>
### 12.3 Configuring the Deployment Environment topology

This section provides instructions for configuring and deploying a RMSW cluster topology using a deployment environment pattern for IBM Business Process Manager. It uses the hardware and software that are listed in 12.2, “Prerequisites for creating the topology” on page 223. After you complete these instructions, complete the steps that are detailed in subsequent sections in the documented order. This topology includes a database server (DB2), two nodes to provide the horizontal clustering, and an IBM HTTP Server to serve as a web server and provide load balancing for the cluster nodes.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>When created</th>
</tr>
</thead>
<tbody>
<tr>
<td>AppTarget cluster name</td>
<td>BPMRMSW.AppTarget</td>
<td>Chapter 12, “Remote Messaging, Remote Support, and Web topology” on page 217</td>
</tr>
<tr>
<td>Messaging cluster name</td>
<td>BPMRMSW.Messaging</td>
<td>Chapter 12, “Remote Messaging, Remote Support, and Web topology” on page 217</td>
</tr>
<tr>
<td>Support cluster name</td>
<td>BPMRMSW.Support</td>
<td>Chapter 12, “Remote Messaging, Remote Support, and Web topology” on page 217</td>
</tr>
<tr>
<td>Web cluster name</td>
<td>BPMRMSW.WebApp</td>
<td>Chapter 12, “Remote Messaging, Remote Support, and Web topology” on page 217</td>
</tr>
<tr>
<td>Web server name</td>
<td>httpserver</td>
<td>Chapter 16, “Configuring IBM Business Process Manager for web server products” on page 343</td>
</tr>
</tbody>
</table>
The process is divided into these parts:

1. Define the deployment pattern topology. In this example, it is completed by using the WebSphere Integrated Solutions Console.

2. Apply this definition by generating the deployment environment. This can be completed either by using the WebSphere Integrated Solutions Console or command-line tools.

Exporting the deployment pattern definitions from the WebSphere Integrated Solutions Console is possible. For more information about using the topology definitions to generate the deployment environment using command-line tools as an alternative, silent option, see 12.4, “Using the command line” on page 254.

### 12.3.1 Using the WebSphere Integrated Solutions Console

This section provides instructions to create a Remote Messaging, Remote Support, and Web deployment environment pattern by using the Deployment Environment Configuration wizard from the WebSphere Integrated Solutions Console (ISC).

Ensure that the deployment manager and all nodes are running. In addition, you must import the database design file that was generated by the database design tool (DDT) with the Deployment Environment Configuration wizard:

1. Log in to the WebSphere Integrated Solutions Console as an administrative user.

2. Click **Servers → Deployment Environments**.

3. On the Deployment Environments panel, click **New**.
4. On the Create Deployment Environment window (Figure 12-4), accept the default to Create a deployment environment based on a pattern. To view all configuration steps in the wizard, select Detailed: Show all steps. The deployment environment name uniquely identifies the deployment environment. For this example, in the Deployment environment name, enter BPMRMSW. Click Next.
5. On the Feature for the Deployment Environment window, the displayed features are based on the configuration of the deployment manager profile. For IBM Business Process Manager Advanced, select **BPMAPS** for a Process Server deployment environment (Figure 12-5).

![Create new deployment environment](image)

*Figure 12-5  Selecting the Process Server feature*

Select **BPMAPC** for a Process Center deployment environment (Figure 12-6).

![Create new deployment environment](image)

*Figure 12-6  Selecting the Process Center feature*
6. On the Deployment Environment Patterns window (Figure 12-7), accept the default Remote Messaging, Remote Support, and Web pattern, and click **Next**.
7. On the Select Nodes window, select to the available Process Server (BPMAPS - Figure 12-8) or Process Center (BMAPC - Figure 12-9 on page 232) nodes. In this environment, the topology is created on two managed nodes. Click **Next**.

*Figure 12-8  Selecting the Process Server nodes*
Figure 12-9 shows selecting the Process Center.

8. On the Cluster Members window, each node is assigned as a member of all four clusters, application deployment target, messaging infrastructure, supporting infrastructure, and web applications.
In the Specify the port number for the first cluster group field, specify the initial port number to be used for assigning cluster ports. The initial port specified can be assigned to the first cluster member of the first cluster group. Subsequent cluster groups can be assigned ports after increasing the port value by 20. In this example, the port number for the first cluster group is 30040 (Figure 12-10). The port numbers for the application deployment target cluster members can be 30040, 30041, 30042, and so on. The port number of the second cluster group (the support infrastructure cluster) can be 30060 and the port numbers for the second cluster members can be 30060, 30061, 30062, and so on. The port number of the third cluster group (the messaging infrastructure cluster) can be 30080. The port number of the fourth cluster group (the web application cluster) can be 30100.

Figure 12-10 Specifying the number of cluster members
9. For the Application Deployment Target cluster type of the deployment environment (Figure 12-11), accept the default value for the cluster name based on the naming convention of <Deployment Environment Name>.<Cluster type name>. The default value for the cluster member names is based on the naming convention of <cluster name>.<node name>.<node number sequence>. Click Next.

Figure 12-11  Naming the Application Deployment Target cluster
10. For the Messaging Infrastructure cluster type of the deployment environment (Figure 12-12), accept the system generated default values for the cluster name and the cluster member names. Click **Next**.

*Figure 12-12  Naming the Messaging Infrastructure cluster*
11. For the Supporting Infrastructure cluster type of the deployment environment (Figure 12-13), accept the system generated default values for the cluster name and the cluster member names. Click **Next**.

*Figure 12-13  Naming the Supporting Infrastructure cluster*
12. For the Web Applications cluster type of the deployment environment (Figure 12-14), accept the system generated default values for the cluster name and the cluster member names. Click Next.
13. On the System REST Service Endpoints window (Figure 12-15), you can configure Representational State Transfer (REST) application programming interfaces (APIs). For the Business Space widgets to be available, you must configure the REST service endpoints:

a. From the Protocol list, select either http:// or https://.

b. In the Host name or virtual host in a load-balanced environment field, enter the name of a web server, a proxy server, or a proxy server cluster that has been configured.

c. In the Port field, enter the port number that a client uses to communicate with a web server or a proxy server. Click Next.
14. On the Import database configuration window (Figure 12-16), enter the fully qualified path name to the database design file that was created by the database design tool. Click **Next**.
Notes:

- For all distributed database types, this step is optional. If you did not provide the database design document, you must manually enter the database parameters.
- The database design document that you import must be available on the local file system from which the administrative console is being accessed.
- This database design file must have the .dbDesign extension.
- The database design document that you import for the deployment environment does not change the common database that is created at profile creation time.
15. On the Database window (Figure 12-17), all database components are populated with the data source configurations imported from the database design file.

![Database Window](image)

**Figure 12-17** Listing the database parameters

16. On the Security window (Figure 12-18 on page 242), enter the authentication alias user names and passwords. Although you can use the primary administrator user (bpmadmin) for all components, you can choose to provide specific users to be used to access these secure components. Click Next.
In this environment, the following user names are used:

- bpmjms: Process Server JMS user
- pdwjms: Performance Data Warehouse JMS user
- ceijms: Common Event Infrastructure JMS user
- sca: Service Component Architecture JMS user
- bpcjms: Business Process Choreographer JMS user

Figure 12-18 Configuring security
17. On the Process Server window (Figure 12-19 on page 244), set the following values for the Process Server configuration:

- Environment name: The name by which this cluster is known to a Process Center user.
- Environment type: Select Production to specify that this Process Server be used in a production capacity. The other available types are Stage and Test.
- User server offline: An offline server is a Process Server that is not connected to the Process Center.
- Protocol: Select either http:// or https:// as the connection protocol to the Process Center.
- Host name: Enter the host or virtual host that this Process Server must use to communicate with Process Center.
- Port: Enter the port number of the Process Center.
- User name: Enter a valid user name that exists on the Process Center.
- Password: Enter the password for that user.
Figure 12-19  Configuring Process Server properties

Note: The Process Server page is only available for a Process Server deployment environment. It is not available for a Process Center deployment environment.
18. On the Business Process Choreographer window (Figure 12-20 on page 246), enter the Business Process Choreographer user names and passwords. Although you can use the primary administrator user (bpmadmin) for all Business Process Choreographer components, you can provide specific users to authenticate to these components. In this environment, the following user names are used:

- bpcadmin: Business flow and human task administrator role
- bpcmon: Business flow and human task monitor role
- jmsadmin: Business flow manager message driven bean
- escalation: Human task manager message driven bean
- cleanup: Business flow and human task manager administrative jobs
### Security

<table>
<thead>
<tr>
<th>Role</th>
<th>Use Default</th>
<th>Users</th>
<th>Groups</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td></td>
<td>bpcadmin</td>
<td></td>
<td>User names, group names, or both, separated by the &quot;</td>
</tr>
<tr>
<td>Monitor</td>
<td></td>
<td>bpcmon</td>
<td></td>
<td>User names, group names, or both, separated by the &quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Authentication</th>
<th>Users</th>
<th>Password</th>
<th>Confirm Password</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JMS API Authentication</td>
<td>jmsapi</td>
<td>···········</td>
<td>···········</td>
<td>Authentication for business flow manager message-driven bean to process asynchronous API calls</td>
</tr>
<tr>
<td>Escalation User Authentication</td>
<td>escalation</td>
<td>···········</td>
<td>···········</td>
<td>Authentication for human task manager message-driven bean to process asynchronous API calls</td>
</tr>
<tr>
<td>Administration job user authentication</td>
<td>cleanup</td>
<td>···········</td>
<td>···········</td>
<td>Authentication for the business flow manager and human task manager administrative jobs. This user must be in the Administrator role.</td>
</tr>
</tbody>
</table>
19. On the Human Task Manager Mail Session window (Figure 12-21), click to clear the **Enable e-mail service** check box to disable email escalation notice for human tasks. Click **Next**.

![Figure 12-21 Configuring Human Task Manager Mail Session](image)
20. On the Web Application Context Roots window (Figure 12-22), accept the default context root for Business Process Choreographer, Business Process Rules Manager, and Business Space. Click **Next**.
21. On the Summary page (see Figure 12-23), verify the information of your new deployment environment.

![Figure 12-23  Summarizing the new deployment environment](image)

**Figure 12-23  Summarizing the new deployment environment**
Also, verify the Process Server information (Figure 12-24).

![Process Server Table]

**Figure 12-24  Summarizing the Process Server properties**

You have a choice to save the deployment environment definition, or to both save the definition and generate the deployment environment. Generally, save the deployment environment configuration without generating it, so you can examine and verify or modify the topology before you generate the environment.
To save the definition, perform the following steps:

a. Click **Finish** (see Figure 12-25). From the Messages window, click **Save** to save the deployment environment definition to the master configuration.

![Figure 12-25 Saving the deployment environment definition](image)

b. On the Deployment Environments window (Figure 12-26), the new deployment environment is created but it is in the **Not configured** state. Click the name of the deployment environment.

![Figure 12-26 Listing the unconfigured deployment environment](image)
c. On the Deployment Environment window (Figure 12-27), you can review and modify the deployment environment configuration, and complete any of the deferred configuration steps. Click **Generate Environment** to complete the configuration of the deployment environment.

![Deployment Environment window](image)

*Figure 12-27  Generating the deployment environment*
d. The Configuration Status window (Figure 12-28) shows the process of the configuration. After the process completes successfully, click **Save Changes**.

![Figure 12-28](image-url) Saving the configured deployment environment

e. On the Deployment Environments window (Figure 12-29), the new deployment environment is configured and is in the stop state.

![Figure 12-29](image-url) Listing the configured deployment environment

The generation of the deployment environment, the saving of the configuration to the master repository, and the synchronization with all the nodes take time to complete. Do not restart the deployment manager or any of the node agents. To ensure that the generation of the deployment
environment is successfully completed, see 15.1.1, “Checking database connectivity” on page 304.

**Important:** Do not start the Process Server or Process Center cluster before loading the database with system information by running the `bootstrapProcessServerData` command.

### 12.4 Using the command line

This section provides instructions to create a Remote Messaging, Remote Support, and Web deployment environment pattern by using the `wsadmin` command. From the deployment manager, you can create a new deployment environment by using the `createDeploymentEnvDef`, `addNodeToDeploymentEnvDef`, and `generateDeploymentEnv` commands.

**Remember:** The generation of the deployment environment can take a long time. To prevent incomplete configuration because of timeout, set the value of `com.ibm.SOAP.requestTimeout` to at least 1800 in the following file:

```
<dmgr_profile_path>/properties/soap.client.props
```

Ensure that the deployment manager and all nodes are running. In addition, you must have the database design file that was generated by the DDT imported by the Deployment Environment Configuration wizard. To create the deployment by using the command line, complete these steps:

1. Start the deployment manager and all nodes.
2. Log in to the deployment manager.
3. Create a deployment environment by using the `createDeploymentEnvDef` and `addNodeToDeploymentEnvDef` commands. The provided Jython script, `createEnvironment.py`, shown in Example 12-1 contains the commands to create a new deployment environment.

**Example 12-1 createEnvironment.py**

```python
import sys
import java

topologyName='BPMRMSW'
dbDesignFile='/tmp/bpm.advanced.nd.topology.dbDesign'
```

```python
topologyName='BPMRMSW'
dbDesignFile='/tmp/bpm.advanced.nd.topology.dbDesign'
```
AdminTask.createDeploymentEnvDef ([ '-topologyName', topologyName,
'-topologyPattern', 'RemoteMessagingSupportAndWeb',
'-topologyRuntime', 'BPMAPS', '-dbDesign', dbDesignFile ])

AdminTask.addNodeToDeploymentEnvDef ([ '-topologyName',
topologyName, '-topologyRole', 'ADT', '-nodeRuntime', 'BPMAPS',
'-nodeName', 'bpmPSNode01', '-serverCount', '1' ])
AdminTask.addNodeToDeploymentEnvDef ([ '-topologyName',
topologyName, '-topologyRole', 'Messaging', '-nodeRuntime',
'BPMAPS', '-nodeName', 'bpmPSNode01', '-serverCount', '1' ])
AdminTask.addNodeToDeploymentEnvDef ([ '-topologyName',
topologyName, '-topologyRole', 'Support', '-nodeRuntime', 'BPMAPS',
'-nodeName', 'bpmPSNode01', '-serverCount', '1' ])
AdminTask.addNodeToDeploymentEnvDef ([ '-topologyName',
topologyName, '-topologyRole', 'WebApp', '-nodeRuntime', 'BPMAPS',
'-nodeName', 'bpmPSNode01', '-serverCount', '1' ])
AdminTask.addNodeToDeploymentEnvDef ([ '-topologyName',
topologyName, '-topologyRole', 'ADT,Messaging,Support,WebApp',
'-nodeRuntime', 'BPMAPS', '-nodeName', 'bpmPSNode02',
'-serverCount', '1' ])

AdminTask.validateDeploymentEnvDef ([ '-topologyName', topologyName ])

AdminTask.showDeploymentEnvStatus ([ '-topologyName', topologyName ])
AdminConfig.save()

You can run this script as follows:

cd <dmgr_profile>/bin
./wsadmin.sh -lang jython -f createEnvironment.py -connType SOAP
-host <dmgr_host> -port <dmgr_SOAP_port> -user <dmgr_admin_user>
-password <dmgr_admin_user_password>

**Consideration:** Generally, save the deployment environment configuration
without generating it, so you can examine and verify or modify the topology
before you generate the environment.
4. Generate a new deployment environment by using the `generateDeploymentEnv` command. The provided Jython script, `generateEnvironment.py`, shown in Example 12-2 contains the commands to generate a new deployment environment. If the script detects any error conditions, it discards the changes and does not save the failed configuration to the master repository.

**Example 12-2  generateEnvironment.py**

```python
import sys
import java

topologyName='BPMRMSW'

try:
    AdminTask.generateDeploymentEnv (
        ['-topologyName', topologyName])
except:
    print "Caught Exception ", sys.exc_info()
    sys.exit(1)
#endTry

AdminConfig.save()
```

You can run this script as follows:

```bash
cd <dmgr_profile>/bin
./wsadmin.sh -lang jython -f generateEnvironment.py -connType SOAP -host <dmgr_host> -port <dmgr_port> -user <dmgr_admin_user> -password <dmgr_admin_password>
```

**Important:** The generation of the deployment environment, the saving of the configuration to the master repository, and the synchronization with all the nodes take time to complete. Do not restart the deployment manager or any of the node agents.

5. (Optional) Export existing deployment environment definitions by using the `exportDeploymentEnvDef` command. You can then use this deployment environment definition file to import into another deployment manager to create a deployment environment or replicate a working deployment environment.
The provided Jython script, `exportEnvironment.py`, shown in Example 12-3 contains the commands to export an existing deployment environment, BPMRMSW, and store the result to a file, `/tmp/BPMRMSW.xml`.

Example 12-3  `exportEnvironment.py`

```python
import sys
import java

topologyName='BPMRMSW'
topologyDefinitionFile='/tmp/BPMRMSW.xml'

AdminTask.exportDeploymentEnvDef ([ '-topologyName', topologyName,
                                 '-filePath', topologyDefinitionFile ])
```

You can run this script as follows:

cd <dmgr_profile>/bin
./wsadmin.sh -lang jython -f exportEnvironment.py -connType SOAP
-host <dmgr_host> -port <dmgr_port> -user <dmgr_admin_user>
-password <dmgr_admin_password>

6. (Optional) Import an existing deployment environment definition to create or replicate a deployment environment by using the `importDeploymentEnvDef` and `generateDeploymentEnv` commands.

The deployment manager from which you import the deployment environment definitions must meet the following conditions:

- Do not have a deployment environment with the same name as the deployment environment definitions.
- Must support all functions that are defined in the deployment environment definitions.

**Important:** Deleting the deployment environment does not remove the configuration of servers, nodes, and clusters of the deployment environment.

You might want to modify certain parameters in this existing deployment environment design file as necessary for this new deployment manager. For example, you might need to change the topology name, node name, or the database server name and port. In this example, the deployment environment design file was edited to change the topology name to `GoldTopology`, by replacing all string instances from `BPMRMSW` to `GoldTopology`. 
The provided Jython script, `importEnvironment.py`, shown in Example 12-4 contains the commands to import a deployment environment definition file and create a new deployment environment from this imported configuration.

**Example 12-4  importEnvironment.py**

```python
import sys
import java

topologyName='GoldTopology'
topologyDefinitionFile='/tmp/BPMRMSW.xml'

AdminTask.importDeploymentEnvDef ([ '-topologyName', topologyName,
'-filePath', topologyDefinitionFile ])
AdminTask.validateDeploymentEnvDef ([ '-topologyName', topologyName ])
AdminTask.showDeploymentEnvStatus ([ '-topologyName', topologyName ])

try:
    AdminTask.generateDeploymentEnv ([ '-topologyName', topologyName ])
except:
    print "Caught Exception ", sys.exc_info()
    sys.exit(1)
#endTry

AdminConfig.save()
```

You can run this script as follows:

```
cd <dmgr_profile>/bin
./wsadmin.sh -lang jython -f importEnvironment.py -connType SOAP
-host <dmgr_host> -port <dmgr_SOAP_port> -user <dmgr_admin_user>
-password <dmgr_admin_password>
```

### 12.5 Post-creation configuration

More steps must be done after the Deployment Environment generation is completed successfully. These steps apply to both Process Center and Process Server cells. For more information, see Chapter 15, “Post-creation configuration and verification” on page 303.
Remote Messaging, Remote Support, and Web topology with IBM Business Monitor

This chapter provides full instructions for creating a four cluster Remote Messaging, Remote Support, and Web (RMSW) topology for IBM Business Process Manager with IBM Business Monitor V8.0. This topology distributes functions across four separate clusters and also highlights a fundamental integration of the two products.

Although the deployment environment pattern can be created and configured incrementally, this chapter describes how to create this pattern by using the Deployment Environment wizard screens in WebSphere ICS. It can be used when you are creating either a Process Center or a Process Server installation. Most of the installation steps are almost identical for both cases.

This chapter includes the following sections:

- “Topology summary” on page 260
- “Prerequisites for creating this topology” on page 263
- “Configuring the deployment environment topology” on page 267
- “Post-creation configuration” on page 292
13.1 Topology summary

The RMSW deployment environment pattern for IBM Business Process Manager is suitable for production environments that require performance and flexibility. The RMSW applies to various use cases, including starting small and scaling up as more resources are required to meet demand. This deployment environment pattern is the suggested topology for IBM Business Process Manager plus IBM Business Monitor.

The name *Remote Messaging, Remote Support, and Web* reflects the relationship of the messaging engines, supporting functions, and web-based user interfaces to the application deployment target.

For more information about topologies, see the following pages:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.doc/topics/cpln_psvr_topologies.html
In this chapter the Remote Messaging, Remote Support, and Remote Web topology is deployed across two nodes (Figure 13-1).

![Remote Messaging, Remote Support, and Web topology for IBM Business Process Manager Advanced plus IBM Business Monitor](image)

**Remember:** Figure 13-1 depicts two IBM HTTP Server web servers, each providing load balancing for HTTP requests to the cluster members. This figure also depicts an IP sprayer for providing high availability to the web servers. Although it depicts the best practice, this chapter describes the use of only a single web server. In production environments in general, the network administrator dictates and provides the routing and load-balancing capabilities that meet the customer’s requirements.

Each of the six messaging engines is only actively running on one cluster node at any one time. The passive messaging engines, currently all on the second node, are depicted as gray shaded components in Figure 13-1.

The topology example uses multiple physical host systems. One system hosts the database installation, one hosts the deployment manager, and two systems each host a node that contains cluster members.
Table 13-1 provides a summary of the systems that are used in this chapter and how each is referenced. This can be used to install either a Process Center or Process Server.

Table 13-1  Summary of the host systems and values that are used in this chapter

<table>
<thead>
<tr>
<th>Component</th>
<th>Host system</th>
<th>Abbreviation for host</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DB2 Database server</td>
<td>itsodb2.itso.ral.ibm.com</td>
<td>&lt;DB2_host_name&gt;</td>
<td>Database server</td>
</tr>
<tr>
<td>IBM Tivoli Directory Server</td>
<td>itsodb2.itso.ibm.ral</td>
<td>&lt;LDAP_host_name&gt;</td>
<td>LDAP server</td>
</tr>
<tr>
<td>IBM HTTP Server</td>
<td>webserver.itso.ibm.ral</td>
<td>&lt;IHS_host_name&gt;</td>
<td>Front-end web server load-balancing network traffic between the cluster nodes</td>
</tr>
<tr>
<td>Deployment Manager</td>
<td>itsohost1.itso.ral.ibm.com</td>
<td>&lt;DMGR_host_name&gt;</td>
<td>Deployment manager node</td>
</tr>
<tr>
<td>Node 1</td>
<td>itsohost2.itso.ral.ibm.com</td>
<td>&lt;bpmNode01_host_name&gt;</td>
<td>Cluster Node bpmnode1</td>
</tr>
<tr>
<td>Node 2</td>
<td>itsohost3.itso.ral.ibm.com</td>
<td>&lt;bpmNode02_host_name&gt;</td>
<td>Cluster Node bpmnode2</td>
</tr>
</tbody>
</table>

The IBM Business Process Manager application components that are used in this deployment environment pattern are distributed across the four clusters based on usage and functional purpose. One cluster is used for messaging functions, one cluster for support functions, one cluster for core applications, and one cluster for web-based functions. The functional purposes are distributed as follows:

- **Messaging Infrastructure Cluster**
  - Messaging engines

- **Application Deployment Target Cluster**
  - The repository for managing process model and integration process applications
  - The run time for running process model and integration process applications
  - User applications for advanced integrations and monitor models
  - Business Process Choreographer containers
13.2 Prerequisites for creating this topology

Before you create this topology, complete the prerequisite steps as described in Chapter 8, “Downloading and installing binary files” on page 137:

1. Install supported DB2 database (or an alternative database), as described in “Installation order” on page 145.

2. Install IBM HTTP Server (or an alternative HTTP server) to the cell, as described in “Installing IBM HTTP Server and Web Server plug-in” on page 154. Alternatively, a proxy server can be installed and configured.

3. Install supported IBM Tivoli Directory Server (or an alternative user registry), as described in “Installation order” on page 145.

4. Define the appropriate users in your user registry, as described in “Defining the user registry” on page 141. The examples in this book use bpmadmin as the admin user account, and the related password is itso4you.

5. Install IBM Business Process Manager V8.0 Advanced, as described in “Installing IBM Business Process Manager Advanced” on page 149.

6. Install IBM Business Monitor V8.0, as described in “Installing IBM Business Monitor” on page 151.

7. Create the required databases and schemas, as described in Chapter 9, “Database tables and schema creation” on page 159 for DB2 and Oracle Database.

Important: The configuration activities for the deployment environment pattern are the same whether a Process Center or a Process Server component is being set up. However, within the deployment environment wizard, the names of the patterns reflect whether it is being applied to an Process Center or Process Server component.
For DB2, the following databases are created for either a separate Process Center or a Process Server environment:

- Common Database (CMNDB)
- Process Server Database (BPMDB)
- Performance Data Warehouse Database (PDWDB)
- IBM Business Monitor database tables (MONDB)
- IBM Cognos database tables (COGNOS)
- Messaging engine Database (MEDB)
- Business Process Choreographer Database (BPEDB)
- Business Process reporting schema (OBSVRDB)
- Business Space schema (created in CMNDB)

**Important:** Only the Common database tables, IBM Business Monitor database tables, and IBM Cognos database tables are required to exist when the deployment manager is started. The remaining databases and tables are not used until the deployment environment is created. However, the runtime administrator and the database administrator have already specified the database names, schema names, and user accounts. Also, the runtime administrator has already generated the scripts by using the Database Design Tool. It is likely most expedient to give all of the generated scripts to the database administrator immediately so that the database structure can be created in the database.

Do not reuse the generated SQL scripts for a Process Center database to create an Process Server database. For more information, see the Runtime server environments toggle in the Process Admin console for IBM Business Process Manager web page at:


8. Create a Process Server Deployment Manager profile, set up the federated user registry integration, add IBM HTTP Server to the cell, and modify certain configuration settings, as described in “Creating a Process Center or Process Server deployment manager profile” on page 174.

9. Create a deployment manager profile for IBM Business Process Manager and augment the deployment manager for IBM Business Monitor, as described in “Creating a Process Center or Process Server deployment manager profile” on page 174. Then, set up the federated LDAP user registry integration, as described in “Federating the LDAP repository into user registry” on page 178. Add IBM HTTP Server to the cell, and modify certain configuration settings, as described in “Configuring IBM Business Process Manager to use IBM HTTP Server” on page 131.
10. Create and federate two Process Server custom nodes, as described in “Creating a Process Center or Process Server custom profile” on page 187.

11. Create two custom nodes for IBM Business Process Manager, then augment them for IBM Business Monitor, as described in “Creating a Process Center or Process Server custom profile” on page 187.

Finally, federate each custom profile to the deployment manager, as described in “Federating a custom profile into a cell” on page 188.

12. Directory substitutions use the details in Table 8-2 on page 144.

Before running the WebSphere Integrated Solutions Console Deployment Environment wizard or command-line tools, ensure that the Deployment Manager (DMGR) and the node agents for the custom nodes are operational. Check that there are no errors or exceptions in the corresponding profile log directories, such as:

- Deployment manager
  <BPM_install_dir>/profiles/<dmgr_profile_name>/logs/dmgr/SystemOut.log
- bpmNode01 node agent
  <BPM_install_dir>/profiles/<custom_profile_name>/logs/nodeagent/ SystemOut.log
- bpmNode02 node agent
  <BPM_install_dir>/profiles/<custom_profile_name>/logs/nodeagent/ SystemOut.log

After you complete the prerequisite steps, it is assumed that the deployment manager, empty custom nodes, and database tables exist. This empty cell is ready for creating and configuring the clusters.

This chapter uses the values that are described in Table 13-2. Some of these values were created during the prerequisite steps.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>When created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell name</td>
<td>bpmCell01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Custom node 1 name</td>
<td>bpmNode01</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Description</td>
<td>Value</td>
<td>When created</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Custom node 2 name</td>
<td>bpmNode02</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;DMGR_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/&lt;dmgr_profile_name&gt;</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>&lt;Custom_profile_dir&gt;</td>
<td>&lt;BPM_install_dir&gt;/profiles/custom_profile_name</td>
<td>Chapter 10, “Creating IBM Business Process Manager profiles” on page 173</td>
</tr>
<tr>
<td>Deployment Environment name</td>
<td>BPMRMSW</td>
<td>Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259</td>
</tr>
<tr>
<td>AppTarget cluster name</td>
<td>BPMRMSW.AppTarget</td>
<td>Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259</td>
</tr>
<tr>
<td>Messaging cluster name</td>
<td>BPMRMSW.Messaging</td>
<td>Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259</td>
</tr>
<tr>
<td>Support cluster name</td>
<td>BPMRMSW.Support</td>
<td>Chapter 13, “Remote Messaging, Remote Support, and Web topology with IBM Business Monitor” on page 259</td>
</tr>
</tbody>
</table>
13.3 Configuring the deployment environment topology

This section provides instructions for configuring and deploying a Remote Messaging, Remote Support, and Web cluster topology pattern for IBM Business Process Manager and IBM Business Monitor. After you complete these activities, see “Post-creation configuration” on page 292, for information about extra configuration.

After completing these instructions, complete the steps that are detailed in subsequent sections in the documented order. This topology includes a database server (IBM DB2), an LDAP server (Tivoli Directory Server), two cell nodes to provide the horizontal clustering, and an IBM HTTP Server to serve as a web server and provide load balancing for the cluster nodes.

The process is divided into these parts:

1. Define the deployment pattern topology. In this example, it is completed by using the WebSphere Integrated Solutions Console.

2. Apply the definition by generating the deployment environment. This can be completed either by using the WebSphere Integrated Solutions Console or command-line tools.

Before you run the Integrated Solution Console Deployment Environment Wizard or command-line tools, ensure that the deployment manager and node agents are up and running, and that there are no errors in each server’s log files, such as:

- Deployment manager:
  
  `<BPM_install_dir>/profiles/<dmgr_profile_name>/logs/dmgr/SystemOut.log`
- bpmNode01 node agent:
  \<BPM\_install\_dir>/profiles/<custom\_profile\_name>/logs/nodeagent/SystemOut.log

- bpmNode02 node agent:
  \<BPM\_install\_dir>/profiles/<custom\_profile\_name>/logs/nodeagent/SystemOut.log

### 13.3.1 Using the WebSphere Integrated Solutions Console

The following procedure provides instructions to create the deployment environment by using the WebSphere Integrated Solutions Console. Before you begin, ensure that the deployment manager and nodes are running and there are no errors shown in the logs.

In the WebSphere Integrated Solutions Console, the Deployment Environments Wizard helps you define the Remote Messaging, Remote Support, and Web topology deployment pattern. After completing this wizard, you can save your definition and generate the topology.

You can export the deployment pattern definitions from the WebSphere Integrated Solutions Console administrative console and generate it later. For more information about how to use the exported topology definitions to generate the deployment environment using command-line tools as an alternative silent option, see “Using the command line” on page 291. This example defines and generates the topology by using the WebSphere Integrated Solutions Console.

For more information, see the following resources:

- For creating an Process Center environment using deployment patterns, see:
  http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_pc_db2.html

- For creating an Process Server environment using deployment patterns, see:
  http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_ps_db2.html

- For more deployment environment steps for IBM Business Monitor, see:
To create the four-cluster the Remote Messaging, Remote Support and Web deployment environment topology for IBM Business Process Manager Advanced and IBM Business Monitor, complete these steps:

1. Log in to the ISC as the primary administrative user that you defined when you created the deployment manager profile. Log in as a valid user: bpmuser

2. Click **Servers → Deployment Environments** as shown in Figure 13-2.

3. Click **New** as shown in Figure 13-3.
4. The system displays the first window of the Deployment Environment Configuration wizard with the **Create new deployment environment** option selected. Enter the name of our deployment environment (the example in Figure 13-4 uses BPMRMSW). The option to **Show all steps** is selected by default. Click **Next**.

![Create new deployment environment window: Name selection](image)

**Figure 13-4 Create new deployment environment window: Name selection**

5. The Deployment Environment Features window displays the options for the type of features to be included.
If you are creating an Process Center cell, select **BPMAPC** to create an IBM Business Process Manager Advanced Process Center, then click **Next** (see Figure 13-5).

If you are creating an Process Server cell, select **BPMAPS** to create an IBM Business Process Manager Advanced Process Server, then click **Next**.

---

**Important:** The content of the Deployment Environment Features window varies depending on the features that are available to the deployment manager that you have created. In a Process Center cell, you see an option for BPMAPC, which creates an IBM Business Process Manager Advanced Process Center topology. In a Process Server cell, you see an option for BPMAPS, which creates an IBM Business Process Manager Advanced Process Server topology. When IBM Business Monitor is included in the cell, you see an option for IBM Business Monitor, WBS. When multiple features are applicable, a secondary window allows more selections.

---

![Figure 13-5  Select type for Process Center](image-url)
Important: WebSphere Enterprise Service Bus is included as a complete subset of the IBM Business Process Manager Advanced features. Therefore, it is not necessary to select WebSphere Enterprise Service Bus when you create a BPMAPS or BPMAPC deployment environment. For more information about the deployment environment feature choices, including the WebSphere Enterprise Service Bus feature, see the following references:

- Creating the Process Center deployment environment with IBM DB2:
  http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_pc_db2.html

- Creating the Process Server deployment environment with IBM DB2:
  http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_ps_db2.html

6. Because multiple features are applicable to this deployment environment, a secondary window is displayed. Select **WBM** to include IBM Business Monitor in this deployment environment, then click **Next** (Figure 13-6).

![Deployment Environments](image)

*Figure 13-6  Select WBM as the additional feature to be included*
7. The Deployment Environment Patterns window displays the two patterns that are available for IBM Business Monitor environments. Select **Remote Messaging, Remote Support, and Web** as shown in Figure 13-7, then click Next.

![Deployment Environments](image)

**Figure 13-7** Two pattern choices for environments with IBM Business Monitor
8. The wizard guides you through a series of steps to specify how the deployment environment can be created. Specify which nodes are to be used to create the environment. In this example for a Process Center (Figure 13-8), select both `bpmPCNode01` and `bpmPCNode02` that you created earlier. The selected nodes are intended to host members of the clusters.

![Create new deployment environment](image)

*Figure 13-8  Select nodes*
9. Select how many cluster members or Java virtual machines (JVMs) to create on each node for each cluster. You can use the default values to specify one cluster member per node (Figure 13-9).

![Figure 13-9 Specify how many members of each cluster are to be created on each node](image-url)
10. Modify the cluster name and each cluster member name for the AppTarget cluster if wanted. You can also accept the default values (Figure 13-10).
11. Modify the cluster name and each cluster member name for the messaging cluster, or use the default values (Figure 13-11).
12. Modify the cluster name and each cluster member name for the support cluster, or use the default values (Figure 13-12).
13. Modify the cluster name and each cluster member name for the web cluster, or use the default values (Figure 13-13).

**Figure 13-13  The web cluster and its members**

<table>
<thead>
<tr>
<th>Node Name</th>
<th>Cluster Member Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>bpmPCNode01</td>
<td>BPMRMSW.WebApp.bpmPCNode01.0</td>
</tr>
<tr>
<td>bpmPCNode02</td>
<td>BPMRMSW.WebApp.bpmPCNode02.0</td>
</tr>
</tbody>
</table>
Table 13-3 details the names that are used for both Process Center and Process Server clusters and their members. The Process Center cluster and cluster members are contained in one cell, and the Process Server cluster and cluster members in another. Do not attempt to mix Process Center and Process Server clusters in the same cell because each cluster shares and uses the same JDBC resources. Process Centers and Process Servers can use different JDBC resources.

### Table 13-3   Names that are used for clusters and members

<table>
<thead>
<tr>
<th>Cluster type</th>
<th>Cluster name</th>
<th>Cluster member node names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application deployment target</td>
<td>BPMRMSW.AppTarget</td>
<td>BPMRMSW.AppTarget.bp mPCNode01.0</td>
</tr>
<tr>
<td>(Process Center)</td>
<td></td>
<td>BPMRMSW.AppTarget.bp mPCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSW.AppTarget.bp mPSNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSW.AppTarget.bp mPSNode02.0</td>
</tr>
<tr>
<td>Application deployment target</td>
<td>BPMRMSW.AppTarget</td>
<td>BPMRMSW.AppTarget.bp mPCNode01.0</td>
</tr>
<tr>
<td>(Process Server)</td>
<td></td>
<td>BPMRMSW.AppTarget.bp mPCNode02.0</td>
</tr>
<tr>
<td>Messaging infrastructure</td>
<td>BPMRMSW.Messaging</td>
<td>BPMRMSW.Messaging.bp mPCNode01.0</td>
</tr>
<tr>
<td>(Process Center)</td>
<td></td>
<td>BPMRMSW.Messaging.bp mPCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSWPC.Messaging.bpmPCNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSWPC.Messaging.bpmPCNode02.0</td>
</tr>
<tr>
<td>Messaging infrastructure</td>
<td>BPMRMSW.Messaging</td>
<td>BPMRMSW.Messaging.bp mPCNode01.0</td>
</tr>
<tr>
<td>(Process Server)</td>
<td></td>
<td>BPMRMSW.Messaging.bp mPCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSWPC.Messaging.bpmPCNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPRMMSWPC.Messaging.bpmPCNode02.0</td>
</tr>
<tr>
<td>Supporting infrastructure</td>
<td>BPMRMSW.Support</td>
<td>BPMRMSW.Support.bpm PCNode01.0</td>
</tr>
<tr>
<td>(Process Center)</td>
<td></td>
<td>BPMRMSW.Support.bpm PCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.Support.bpm PSNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.Support.bpm PSNode02.0</td>
</tr>
<tr>
<td>Supporting infrastructure</td>
<td>BPMRMSW.Support</td>
<td>BPMRMSW.Support.bpm PCNode01.0</td>
</tr>
<tr>
<td>(Process Server)</td>
<td></td>
<td>BPMRMSW.Support.bpm PCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.Support.bpm PSNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.Support.bpm PSNode02.0</td>
</tr>
<tr>
<td>Web applications</td>
<td>BPMRMSW.WebApp</td>
<td>BPMRMSW.WebApp.bpm PCNode01.0</td>
</tr>
<tr>
<td>(Process Center)</td>
<td></td>
<td>BPMRMSW.WebApp.bpm PCNode02.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.WebApp.bpm PCNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.WebApp.bpm PCNode02.0</td>
</tr>
</tbody>
</table>
14. Enter the details for your REST endpoints. In this example topology, an IBM HTTP web server is being used as a front end for load balancing HTTP requests for the cluster members. Enter the host name and port of the web server as shown in Figure 13-14.

<table>
<thead>
<tr>
<th>Cluster type</th>
<th>Cluster name</th>
<th>Cluster member node names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web applications (Process Server)</td>
<td>BPMRMSW.WebApp</td>
<td>BPMRMSW.WebApp.bpm PSNode01.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BPMRMSW.WebApp.bpm PSNode02.0</td>
</tr>
</tbody>
</table>

![Figure 13-14 The web server host name and port value for REST endpoints](image)

15. Specify the database design files as shown in Figure 13-15. These files were output from the database design tool in “Creating a database design file” on page 396. The database design files that are used here automatically populate the database parameters during the next step of the wizard.

Alternatively, these values can be left blank. Leaving the entries blank causes the Deployment Environment wizard to populate default values for the database names, tables, and corresponding schemas.

In this example, a previously generated database design file is uploaded and used to specify the database configuration.
16. Check the values that are used to create the data source resources required to connect to the relevant database tables. Because you have already created the databases and schemas, the values that are used here must match exactly with the existing database and schema values. Confirm that the values are correct for the supplied database names and the corresponding schemas.

For each line, check that the **Create Tables** option is *not* selected. In the example shown in Figure 13-16 on page 284, all the Create Tables options are cleared.

For this example, all the **Create Tables** check boxes are not selected because the database structure has been previously created. This was done by using SQL scripts that were generated from the database design tool. For more information, see Appendix A, “Database design tool” on page 393.

**Important:** Do not reuse the generated database design file and corresponding SQL scripts for a Process Center database to create a Process Server database. For a Process Server environment, a different database design file needs to be generated and used for this configuration. For an example of where reusing Process Center database design files caused unexpected and inconsistent behavior and how to address this issue, see the Runtime server environments toggle in the Process Admin console for IBM Business Process Manager web page at:


**Important:** When using the create tables capabilities during Deployment Environment generation, it is not required to use the database design tool to generate the SQL scripts and run the database scripts for all components separately. Using the Deployment Environment wizard only requires that the databases have already been created.

If the Deployment Environment wizard is being used, ensure that the **Create Tables** check boxes are selected, which is default behavior. All the necessary tables can be created in the target schemas and databases, except for Business Space. Copy and run the Business Space database configuration scripts on the target database system after successfully generating the deployment environment.
### Figure 13-16  Confirm database design details

<table>
<thead>
<tr>
<th>Select</th>
<th>Name</th>
<th>Database Name</th>
<th>Schema</th>
<th>Create Tables</th>
<th>User Name</th>
<th>Password</th>
<th>Server</th>
<th>Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Business Monitor messaging engine data source</td>
<td>MEDB13C</td>
<td>MONME</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Business Process Choreographer data source</td>
<td>BPEDB13C</td>
<td>BPC</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Business Process Choreographer Messaging Engine data source</td>
<td>MEDB13C</td>
<td>BPCME</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Business Space data source</td>
<td>B5PB13C</td>
<td>BSPACE</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Cognos Content Store</td>
<td>COG13C</td>
<td></td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>CEI Messaging Engine data source</td>
<td>MEDB13C</td>
<td>CEIME</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Performance Data Warehouse data source</td>
<td>POWDB13C</td>
<td></td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Performance Data Warehouse Messaging Engine data source</td>
<td>MEDB13C</td>
<td>POWME</td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
<tr>
<td></td>
<td>Process Server</td>
<td>BPMDB13C</td>
<td></td>
<td></td>
<td>db2user</td>
<td>* * * * *</td>
<td>9.42.171.26</td>
<td>DB2</td>
</tr>
</tbody>
</table>
17. Leave the default user name and passwords for Process Server, Performance Data Warehouse, CEI, SCA and Business Process Choreographer JMS authentication alias, and IBM Cognos Administration access (Figure 13-17).

**Important:** The default user name is the user ID with which you logged in to the WebSphere Integrated Solutions Console. In this example, the administrative user is bpmuser.

<table>
<thead>
<tr>
<th>Name</th>
<th>User name</th>
<th>Password</th>
<th>Confirm Password</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Server JMS authentication alias</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
<tr>
<td>Performance Data Warehouse JMS authentication alias</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
<tr>
<td>CEI JMS authentication alias</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
<tr>
<td>SCA authentication alias</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
<tr>
<td>Business Process Choreographer JMS authentication alias</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
<tr>
<td>Cognos Administration access authentication</td>
<td>bpmuser</td>
<td>********</td>
<td>********</td>
</tr>
</tbody>
</table>

*Figure 13-17  JMS authentication security*
18. In an Process Server configuration, there is an extra step for identifying the Process Center to the Process Server. This window collects the Process Server Environment name (the name by which the Process Center identifies this Process Server environment). You also select a relevant environment type and provide the Process Center Connection information for the HTTP server address that is used to connect to the Process Center.

The Process Server environment type selected is **Production**. Other possible values are **Test** and **Staging** (Figure 13-18).

![Figure 13-18  Process Server specific settings](image)

For more information about Process Server specific settings, including environment types, and Process Center connection details, see item 12 on the Creating the Process Server deployment environment web page at:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_ps_db2.html
19. Specify the information that is required for the configuration of Business Process Choreographer as shown in Figure 13-19. Specify the JMS API, Escalation User, and Administration job user authentication using existing accounts in the user registry.

Click to clear the **Enable e-mail service** box because there is no defined email service for the human task manager.

**Figure 13-19  Users and groups that are used by Business Process Choreographer**
20. Modify the web application context roots properties for various IBM Business Process Manager components. These components include Business Space, Business Process Rules Manager, and Business Process Choreographer Explorer. This example uses the default values (Figure 13-20).

![Figure 13-20 Web application context roots](image)

21. Review the summary of the entire topology before it is created. To accept and use the specified details to generate the deployment environment, click Finish and Generate Environment (Figure 13-21 on page 289).

**Important:** You can optionally click Finish here to save the deployment environment definition without generating it. This gives you a chance to review and edit the definition first, or export a topology definition file for use in command-line generation. For more information, see “Using the command line” on page 291.
Summary

This summary shows an overview of your new deployment environment. To save the deployment environment definition, click on "Finish". To save the definition and generate the deployment environment, click on "Finish and Generate Environment".

Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployment Environment Pattern</td>
<td>Remote Messaging, Remote Support, and Web</td>
</tr>
<tr>
<td>Deployment environment name</td>
<td>BPMRMSW</td>
</tr>
<tr>
<td>Features</td>
<td>BPMAPC, WBM</td>
</tr>
<tr>
<td>Deployment Environment Status</td>
<td>Not configured</td>
</tr>
</tbody>
</table>

Deployment Targets

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Deployment Target</td>
<td>bpmFCNode01, bpmFCNode02</td>
</tr>
<tr>
<td>Messaging Infrastructure</td>
<td>bpmFCNode01, bpmFCNode02</td>
</tr>
<tr>
<td>Supporting Infrastructure</td>
<td>bpmFCNode01, bpmFCNode02</td>
</tr>
<tr>
<td>Web Applications</td>
<td>bpmFCNode01, bpmFCNode02</td>
</tr>
</tbody>
</table>

Data Sources

<table>
<thead>
<tr>
<th>Name</th>
<th>Database Name</th>
<th>Schema</th>
<th>Database Provider</th>
<th>Database Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Data Warehouse data source</td>
<td>PDWDB13C</td>
<td>PDWME</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.26</td>
</tr>
<tr>
<td>Performance Data Warehouse Messaging Engine data source</td>
<td>MEDE13C</td>
<td>PDWME</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.26</td>
</tr>
<tr>
<td>Process Server data source</td>
<td>BPMBD13C</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.26</td>
<td></td>
</tr>
<tr>
<td>Process Server Messaging Engine data source</td>
<td>MEDE13C</td>
<td>BMPME</td>
<td>DB2_DATASERVER</td>
<td>9.42.171.26</td>
</tr>
</tbody>
</table>

Figure 13-21  Summary of deployment environment details
Messages are displayed as the environment is generated. The successful output is similar to that shown in Figure 13-22. If any errors are displayed, do not save the generated environment, discard the changes, and address the problems before you attempt to create the deployment environment again.

When finished, click \textit{Save changes}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure13-22.png}
\caption{An example of output from a successful generation of a deployment environment}
\end{figure}
23. If there are no errors, **Save** the configuration changes. You will receive confirmation that deployment environment is successfully created as shown in Figure 13-23.

![Figure 13-23 Confirmation of successfully created deployment environment](image)

**Warning:** The deployment environment is not yet ready for use. You must first complete some more configuration steps, including the bootstrapping step, to initialize the system. Perform these tasks as described in “Post-creation configuration” on page 292.

### 13.3.2 Using the command line

To configure a topology by using the command line, you must produce a topology definition file. This file is typically created during the definition of a topology using the WebSphere Integrated Solutions Console and then exporting the topology definition. The exported topology definition file can be applied to a new WebSphere cell. It is not required to be used only within the WebSphere cell that is used to generate the topology definition in the first place.

To produce a topology definition file, complete the following steps:

1. Define a topology as described in “Using the WebSphere Integrated Solutions Console” on page 268. Save the topology environment definition by selecting **Finish** at the end of the process. The deployment environment is not generated.

2. Export the topology by opening the WebSphere Integrated Solutions Console, clicking **Servers → Deployment Environments**, selecting the relevant topology definition, and then clicking **Export**.
After you create a topology definition file, you can import it and generate the environment by using two \texttt{wsadmin} commands. To do so interactively, complete the following steps. You can also build this into a \texttt{wsadmin} script, with appropriate error checking.

1. Import the deployment environment definition:

   \begin{verbatim}
   AdminTask.importDeploymentEnvDef ([-filePath, fileLocation, -topologyName, topologyName])
   \end{verbatim}

   where \texttt{fileLocation} is the path and file name of the topology definition file, and \texttt{topologyName} is the name of the deployment environment. In this example, it is Remote Messaging, Remote Support and Web.

2. Assuming that this task completes successfully, ensure that this configuration change is saved with \texttt{AdminConfig.save()}. 

3. Generate the deployment environment itself:

   \begin{verbatim}
   AdminTask.generateDeploymentEnv ([-topologyName, topologyName])
   \end{verbatim}

4. Again, assuming that this task completes successfully, save the change with \texttt{AdminConfig.save()}. Do not save the changes if they do not complete successfully, or you will most likely save a broken deployment environment.

For more information about the topology generation with commands, see:

\url{http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_cli_intro.html}

\section*{13.4 Post-creation configuration}

A few steps must be done after the Deployment Environment generation is completed successfully. These steps apply to both Process Center and Process Server cells. For more information about these steps, see Chapter 15, “Post-creation configuration and verification” on page 303.
Cross-cell topology with IBM Business Monitor

This chapter describes how to set up IBM Business Monitor in its own cell based on the Remote Messaging, Support, and Web topology pattern. Process Server is deployed in a separate remote cell that hosts the Common Event Infrastructure (CEI) service.

This chapter addresses the following topics:

- 14.1, “Topology overview” on page 294
- 14.2, “Event delivery” on page 295
- 14.3, “Planning to install IBM Business Monitor” on page 296
- 14.4, “Installing the topology” on page 298
- 14.5, “Post-creation configuration” on page 299
### 14.1 Topology overview

When you install IBM Business Monitor in a separate cell from Process Server, you have multiple choices of which topology to use in the cell, just as you had multiple choices of topologies in the Process Server cell. The primary choices are the Single Cluster or the Remote Messaging, Remote Support, and Web (the Four-Cluster) topology. These topologies each have a deployment environment pattern. You can use the deployment environment wizard to configure the clusters, servers, and components.

This chapter describes using the Four-Cluster topology, which uses the Remote Messaging, Remote Support, and Web deployment environment pattern. This pattern groups the IBM Business Monitor applications into four clusters in a single cell. The components of IBM Business Monitor are distributed among the four clusters (Figure 14-1).

---

**Tip:** For the best performance, the Event emitter services and CEI event service can be on the same cluster. Event emitter services include both the REST event emitter and the JMS event emitter.
14.2 Event delivery

In a cross-cell topology, IBM Business Monitor is installed and configured as its own WebSphere Application Server plus an IBM Business Monitor cell. Common Business Events (CBEs) issued in the IBM Business Process Manager cell by a Process Server instance must be delivered to the monitor model applications in the IBM Business Monitor cell. There are the following options for this cross-cell delivery:

- Table-based event delivery
- Queue-based event delivery

**Choosing the delivery option:** The delivery option is chosen at application installation time for a monitor model. Generally, choose table-based event delivery (sometimes called *queue bypass*), both for reliability and for performance and scalability reasons.

14.2.1 Table-based event delivery

In table-based event delivery, the CBEs are delivered to IBM Business Monitor by using the monitor database (Figure 14-2).

![Queue-bypass event delivery](image)

*Figure 14-2 Table-based event delivery*

For more information about table-based event delivery, see:

14.2.2 Queue-based event delivery

An alternative option is to use a cross-cell bus link between the monitor bus in the Process Server cell and the monitor bus in IBM Business Monitor (Figure 14-3).

![Queue-based event delivery diagram](image)

For more information about queue-based event delivery, see:


14.3 Planning to install IBM Business Monitor

IBM Business Monitor can be installed and configured its own cell. You are not required to install IBM Business Process Manager for this IBM Business Monitor cell.
The installation and configuration of this IBM Business Monitor cell requires considerations for several components:

- **Profiles**

  The profiles that are needed for a cell that uses IBM Business Monitor include a deployment manager profile that is created or augmented for IBM Business Monitor, and a number of custom profiles that are created or augmented for IBM Business Monitor.

  For the IBM Business Monitor cell built in this chapter, the types of profiles to be created are the IBM Business Monitor deployment manager profile and the IBM Business Monitor custom profile. For more information about each of these, see the following resources:

  - Creating an IBM Business Process Monitor deployment manager profile by using the Profile Management Tool:
    

  - Creating an IBM Business Process Monitor custom profile by using the Profile Management Tool:
    

  - Creating IBM Business Process Monitor profiles by using the manageprofiles command:
    

  The main monitor database, named MONITOR, stores the IBM Business Monitor configuration, monitor model metadata, and monitored data. The IBM Cognos Business Intelligence configuration is stored in a separate IBM Cognos BI content store database named COGNOSCS. Profile creation assumes that both the MONITOR and COGNOSCS database are created in the same database instance.

  You can use the same database user name for the MONITOR database and for the COGNOSCS database. Remember that the IBM Cognos BI creates its own content store tables in the schema of the provided user name when IBM Cognos BI first starts.

  The MONITOR database is also used to store schemas for the following components during stand-alone profile creation:

  - Business Space
  - CEI messaging engine message store
  - IBM Business Monitor messaging engine message store
If you are not using a stand-alone profile, you can use the same database or different databases for these components. In addition, the EVENT data store used by the CEI to persist CBEs is not required, and therefore is not created or enabled by default.

Multiple types of data are stored in the MONITOR database. When you create the IBM Business Monitor profile or run the database scripts, you create database tables that contain configuration data for IBM Business Monitor. Later, when each monitor model is installed, more tables are created to store data for that monitor model. When events are processed, monitor model instance data is stored in these tables. The dashboards then refer to these tables.

**Tip:** In a network deployment environment, create the MONITOR and COGNOSCS databases before you start the deployment manager and create other custom profiles.

- **User registry considerations**
  
The user registry stores information that is used to authenticate users who request access to IBM Business Monitor. You can configure multiple user registry types under federated repositories. Most production deployments use a Lightweight Directory Access Protocol (LDAP) server.
  
You can select any of the following for your user account repository:
  - Federated Repositories
  - Local operating system
  - Stand-alone LDAP registry
  - Stand-alone custom registry

**Important:** For fine-grained security, the supported user registries are federated repositories (file-based), federated repositories (LDAP), and stand-alone LDAP registry.

### 14.4 Installing the topology

To install the IBM Business Monitor server and all required components using the four-cluster deployment environment, perform the following high-level steps:

1. Complete the pre-installation steps that are described in 8.2, “Prerequisite steps” on page 139.

3. Create a deployment manager profile by using either the Profile Management Tool or the manageprofiles command. Perform the steps in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174.

4. Unless you created the MONITOR database as part of creating the profile, run the scripts to create the database. Follow the instructions in Chapter 9, “Database tables and schema creation” on page 159.

5. Start the deployment manager.

6. Create custom nodes that are federated into the deployment manager cell, following the steps in 10.1.1, “Creating a Process Center or Process Server deployment manager profile” on page 174.


8. Configure extra components such as Business Space and IBM Cognos.

### 14.5 Post-creation configuration

Because your IBM Business Monitor is installed in a different cell from the CEI event service, you must complete extra configuration steps to enable the communication between the cells.

#### 14.5.1 Event service configuration across multiple cells

For secure environments, ensure that the following tasks are completed:

- If security is enabled in either the remote or local cell, it must be enabled in both.
- If security is enabled, you must enable server-to-server trust (SSL) between the remote CEI server and the local IBM Business Monitor server:
  

- LTPA keys must be shared across cells and the cells must have the same ID:
  
The Use identity assertion setting must be enabled in the local cell and the remote cell:


In a multiple-cell environment, where IBM Business Monitor is not installed on the remote cell that is emitting events, you must configure the deployment manager and CEI servers in the remote cell. This configurations allows them to emit events to the tables. Process Server Version 7.0 and later provide the files that are needed to support remote event emission. The following steps assume that the cell that is emitting events is a Process Server Version 7.0 or later. If not, see the following resource for more instructions:


14.5.2 Event delivery configuration across multiple cells

As described in 14.2, “Event delivery” on page 295, there are these options to receive events from a remote CEI event service:

► Table-based event delivery
► Queue-based event delivery

Configuration of table-based event delivery

In a multiple-cell environment, where IBM Business Monitor is not installed on the remote cell that is emitting events, configure the deployment manager and CEI servers in the remote cell so that they can emit events to the tables. Process Server Version 7.0 and later provides the files that are needed to support remote event emission. The following steps assume that the cell that is emitting events is a WebSphere Process Server Version 7.0 or later, or IBM Business Process Manager Version 7.5 or later.

Earlier versions than V 7.0: If the cell from which the events are being emitted is earlier than WebSphere Process Server Version 7.0, see the following Information Center article for more instructions:


To enable IBM Business Monitor to bypass the JMS queue and use the table-based method to receive events in a cross-cell environment, you must create a data source in the remote cell.
After you follow the instructions in 14.5.1, “Event service configuration across multiple cells” on page 299, run the `wbmConfigureQueueBypassDatasource` command on the remote deployment manager to create the data source. The `wbmConfigureQueueBypassDatasource` command creates a data source that enables the remote CEI server to send information to the IBM Business Monitor database. You must run the command on the remote deployment manager.

The data source name is `Monitor_<cell_name>_Routing_Database`, where `<cell_name>` is the name of the cell where IBM Business Monitor is installed.

For more information about setting up table-based event delivery, including the usage and parameters for the `wbmConfigureQueueBypassDatasource` command, see:

```
```

Running `wbmConfigureQueueBypassDatasource` is the final configuration step. After you run this command and save the configuration changes, restart the remote deployment manager.

**Configuration of bus for queue-based event delivery**

To receive events from a JMS queue in a cross-cell environment, see 14.2.2, “Queue-based event delivery” on page 296.
Post-creation configuration and verification

This chapter provides detailed instructions for post-creation configuration and verification steps. It contains the following sections:

- 15.1, “Post-creation configuration” on page 304
- 15.2, “Verification” on page 323
15.1 Post-creation configuration

You need to complete the following steps after the Deployment Environment generation is completed successfully:

- 15.1.1, “Checking database connectivity” on page 304
- 15.1.2, “Loading the database with system information” on page 306
- 15.1.3, “Configuring host aliases” on page 312
- 15.1.4, “Configuration for the web router” on page 313
- 15.1.5, “Sharing transaction and recovery logs” on page 317

15.1.1 Checking database connectivity

Before starting the clustered environment, check database connectivity to ensure that the deployment environment has been generated correctly:

1. Log in to the WebSphere Integrated Solutions Console as an administrative user.
2. Click Resources → JDBC → Data sources.
3. Set the scope to All scopes.
4. Select all of the data sources and click Test connection to ensure that they have connectivity. A message displays confirming that the connection was successful for each data source.

The scope settings for the WebSphere variables and data source can affect the test connection results. The associated WebSphere variables with the data source providers can cause test connection results that are inconsistent with the runtime behavior of the applications. Figure 15-1 on page 305 shows the failed test connections of the following data sources:

- WPS data source
- ESBLoggerMediationDataSource

WebSphere Application Server performs test connections at one scope only, in the JVM of the same scope as that of the data source configuration. The product attempts to resolve the driver class path variable at that scope only.

At run time, WebSphere Application Server starts a physical data source by resolving the appropriate WebSphere variable at each scope level. It starts with the server scope, then the cluster scope, then the node scope, and lastly the cell scope. Therefore, the WPS data source and ESBLoggerMediationDataSource physical data source function normally during application run time. You can ignore these error messages.
Figure 15-1  Testing data source connections
15.1.2 Loading the database with system information

To complete the database configuration for IBM Business Process Manager V8.0, an additional manual step is currently required to load the repository in the BPMDB database.

Important: Before you run the bootstrap command, ensure that you have applied Mandatory Interim Fix JR44669. For more information, see: http://www-01.ibm.com/support/docview.wss?uid=swg24033778

Run the command shown in Example 15-1 on the DMGR machine for single cluster topology.

Example 15-1 Bootstrap process server command

```
/opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/bin/bootstrapProcessServerData.sh -profilePath /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg -dbType DB2_UNIVERSAL -dbJDBCClasspath /opt/IBM/WebSphere/AppServer/jdbcdrivers/DB2 -clusterName BPMPCSingleCluster.AppTarget
```

This command is used to set up and initialize the shared Process Center database. The command needs to be executed once for a Process Center or Process Server single cluster topology environment.

The output is similar to Example 15-2 if the bootstrap process server command executes successfully. Check the output for errors.

Example 15-2 Output of bootstrap process server command

```
Bootstraping data into cluster BPMPCSingleCluster.AppTarget

WASX7357I: By request, this scripting client is not connected to any server process. Certain configuration and application operations will be available in local mode. bootstrapProcessServerData logged to /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/logs/bootstrapProcessServerData.BPMPCSingleCluster.AppTarget.Fri-Mar-01-15.06.34-2013.log

The bootstrapping of data began.....

was.install.root: /opt/IBM/WebSphere/AppServer
user.install.root: /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg

cellName: bpmPCcell
nodeName: null
serverName: null

clusterName: BPMPCSingleCluster.AppTarget
```
tempConfigRoot:
/opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/clusters/BPMPCSingleCluster.AppTarget/process-center
config.root:
/opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/nodes/bpmPCNode01/servers/BPMPCSingleCluster.AppTarget.bpmPCNode01.0/process-center
scopeString: Cell=bpmPCcell:ServerCluster=BPMPCSingleCluster.AppTarget
integratedSecurity: false
dbType: DB2
dbDriver: com.ibm.db2.jcc.DB2Driver
currentSchema:
username: db2inst1
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-toolkit.twx
deploy: false
latestSystemToolkit: true
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-toolkit.twx
Type: Teamworks V7
A retry of the request may need to occur if the socket times out while waiting for a prompt response. If the retry is required, note that the prompt will not be redisplayed if (y) is entered, which indicates the signer has already been added to the trust store.
Authorizing bpmadmin for the app ...
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-toolkit.twx imported successfully.....
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-coaches.twx
deploy: false
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-coaches.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/system-coaches.twx imported successfully.....
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/governance-toolkit.twx
deploy: false
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/governance-toolkit.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/governance-toolkit.twx imported successfully.....
importFile: 
/opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/content-integration-toolkit.twx
deploy: false
latestSystemToolkit: false
activateSnapshot: false
File:
/opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/content-integration-toolkit.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
File
/opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/content-integration-toolkit.twx imported successfully.....
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/process-portal.twx
deploy: true
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/process-portal.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
Action: Deploy
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/process-portal.twx imported successfully.....
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/saved-search-admin.twx
deploy: true
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/saved-search-admin.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
Action: Deploy
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/saved-search-admin.twx imported successfully.....
importFile:
/opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/standard-hiring-sample.twx
deploy: true
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/standard-hiring-sample.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
Action: Deploy
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/standard-hiring-sample.twx imported successfully.....
importFile:
/opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/advanced-hiring-sample.twx
deploy: false
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/advanced-hiring-sample.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/advanced-hiring-sample.twx
imported successfully.....
importFile: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/procurement-sample.twx
deploy: false
latestSystemToolkit: false
activateSnapshot: false
File: /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/procurement-sample.twx
Type: Teamworks V7
Authorizing bpmadmin for the app ...
File /opt/IBM/WebSphere/AppServer/BPM/Lombardi/imports/procurement-sample.twx
imported successfully.....
Importing ProcessPortal_ar.properties from lp_ar.zip
Importing process-portal.jar/ProcessPortal_ar.properties from lp_ar.zip
Importing ProcessPortal_pl.properties from lp_pl.zip
Importing process-portal.jar/ProcessPortal_pl.properties from lp_pl.zip
Importing ProcessPortal_de.properties from lp_de.zip
Importing process-portal.jar/ProcessPortal_de.properties from lp_de.zip
Importing ProcessPortal_zh_TW.properties from lp_zh_TW.zip
Importing process-portal.jar/ProcessPortal_zh_TW.properties from lp_zh_TW.zip
Importing ProcessPortal_nb.properties from lp_nb.zip
Importing process-portal.jar/ProcessPortal_nb.properties from lp_nb.zip
Importing ProcessPortal_pt.properties from lp_pt.zip
Importing process-portal.jar/ProcessPortal_pt.properties from lp_pt.zip
Importing ProcessPortal_fi.properties from lp_fi.zip
Importing process-portal.jar/ProcessPortal_fi.properties from lp_fi.zip
Importing ProcessPortal_pt_BR.properties from lp_pt_BR.zip
Importing process-portal.jar/ProcessPortal_pt_BR.properties from lp_pt_BR.zip
Importing ProcessPortal_el.properties from lp_el.zip
Importing process-portal.jar/ProcessPortal_el.properties from lp_el.zip
Importing ProcessPortal_tr.properties from lp_tr.zip
Importing process-portal.jar/ProcessPortal_tr.properties from lp_tr.zip
Importing ProcessPortal_en.properties from lp_en.zip
Importing process-portal.jar/ProcessPortal_en.properties from lp_en.zip
Importing ProcessPortal_sv.properties from lp_sv.zip
Importing process-portal.jar/ProcessPortal_sv.properties from lp_sv.zip
Importing ProcessPortal_sk.properties from lp_sk.zip
Importing process-portal.jar/ProcessPortal_sk.properties from lp_sk.zip
Importing ProcessPortal_ko.properties from lp_ko.zip
Importing process-portal.jar/ProcessPortal_ko.properties from lp_ko.zip
Importing ProcessPortal_iw.properties from lp_iw.zip
Importing process-portal.jar/ProcessPortal_iw.properties from lp_iw.zip
Importing ProcessPortal_no.properties from lp_no.zip
Importing process-portal.jar/ProcessPortal_no.properties from lp_no.zip
Importing ProcessPortal_da.properties from lp_da.zip
Importing process-portal.jar/ProcessPortal_da.properties from lp_da.zip
Importing ProcessPortal_zh.properties from lp_zh.zip
Importing process-portal.jar/ProcessPortal_zh.properties from lp_zh.zip
Importing ProcessPortal_fr.properties from lp_fr.zip
Importing process-portal.jar/ProcessPortal_fr.properties from lp_fr.zip
Importing ProcessPortal_he.properties from lp_he.zip
Importing process-portal.jar/ProcessPortal_he.properties from lp_he.zip
Importing ProcessPortal_it.properties from lp_it.zip
Importing process-portal.jar/ProcessPortal_it.properties from lp_it.zip
Importing ProcessPortal_ru.properties from lp_ru.zip
Importing process-portal.jar/ProcessPortal_ru.properties from lp_ru.zip
Importing ProcessPortal_ro.properties from lp_ro.zip
Importing process-portal.jar/ProcessPortal_ro.properties from lp_ro.zip
Importing ProcessPortal_cs.properties from lp_cs.zip
Importing process-portal.jar/ProcessPortal_cs.properties from lp_cs.zip
Importing ProcessPortal_es.properties from lp_es.zip
Importing process-portal.jar/ProcessPortal_es.properties from lp_es.zip
Importing ProcessPortal_ja.properties from lp_ja.zip
Importing process-portal.jar/ProcessPortal_ja.properties from lp_ja.zip
Importing ProcessPortal_nl.properties from lp_nl.zip
Importing process-portal.jar/ProcessPortal_nl.properties from lp_nl.zip
Importing ProcessPortal_hu.properties from lp_hu.zip
Importing process-portal.jar/ProcessPortal_hu.properties from lp_hu.zip
Importing SavedSearchAdmin_ar.properties from lp_ar.zip
Skipping importing due to null zip entry
Importing SavedSearchAdmin_pl.properties from lp_pl.zip
Importing process-portal.jar/SavedSearchAdmin_pl.properties from lp_pl.zip
Importing SavedSearchAdmin_de.properties from lp_de.zip
Importing process-portal.jar/SavedSearchAdmin_de.properties from lp_de.zip
Importing SavedSearchAdmin_zh_TW.properties from lp_zh_TW.zip
Importing process-portal.jar/SavedSearchAdmin_zh_TW.properties from lp_zh_TW.zip
Importing SavedSearchAdmin_nb.properties from lp_nb.zip
Skipping importing due to null zip entry
Importing SavedSearchAdmin_pt.properties from lp_pt.zip
Importing process-portal.jar/SavedSearchAdmin_pt.properties from lp_pt.zip
Importing SavedSearchAdmin-fi.properties from lp_fi.zip
Skipping importing due to null zip entry
Importing SavedSearchAdmin_pt_BR.properties from lp_pt_BR.zip
Importing process-portal.jar/SavedSearchAdmin_pt_BR.properties from lp_pt_BR.zip
Importing SavedSearchAdmin_el.properties from lp_el.zip
Importing `process-portal.jar/SavedSearchAdmin_el.properties` from `lp_el.zip`.
Importing `SavedSearchAdmin_tr.properties` from `lp_tr.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_en.properties` from `lp_en.zip`.
Importing `SavedSearchAdmin_sv.properties` from `lp_sv.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_sk.properties` from `lp_sk.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_ko.properties` from `lp_ko.zip`.
Importing `process-portal.jar/SavedSearchAdmin_ko.properties` from `lp_ko.zip`.
Importing `SavedSearchAdmin_iw.properties` from `lp_iw.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_no.properties` from `lp_no.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_da.properties` from `lp_da.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_zh.properties` from `lp_zh.zip`.
Importing `SavedSearchAdmin_fr.properties` from `lp_fr.zip`.
Importing `SavedSearchAdmin_he.properties` from `lp_he.zip`.
Skipping importing due to null zip entry.
Importing `SavedSearchAdmin_it.properties` from `lp_it.zip`.
Importing `process-portal.jar/SavedSearchAdmin_it.properties` from `lp_it.zip`.
Importing `SavedSearchAdmin_ru.properties` from `lp_ru.zip`.
Importing `process-portal.jar/SavedSearchAdmin_ru.properties` from `lp_ru.zip`.
Importing `SavedSearchAdmin_ro.properties` from `lp_ro.zip`.
Importing `process-portal.jar/SavedSearchAdmin_ro.properties` from `lp_ro.zip`.
Importing `SavedSearchAdmin_cs.properties` from `lp_cs.zip`.
Importing `SavedSearchAdmin_es.properties` from `lp_es.zip`.
Importing `process-portal.jar/SavedSearchAdmin_es.properties` from `lp_es.zip`.
Importing `SavedSearchAdmin_ja.properties` from `lp_ja.zip`.
Importing `SavedSearchAdmin_nl.properties` from `lp_nl.zip`.
Importing `process-portal.jar/SavedSearchAdmin_nl.properties` from `lp_nl.zip`.
Importing `SavedSearchAdmin_hu.properties` from `lp_hu.zip`.
Importing `process-portal.jar/SavedSearchAdmin_hu.properties` from `lp_hu.zip`.
The bootstrapping of data completed.

'BootstrapProcessServerData admin command completed.....'
15.1.3 Configuring host aliases

Ensure that each host alias contains the host and port information for each cluster member to be serviced. If you are using a web server or a proxy server, also include the corresponding host name and port number.

1. Determine the port numbers that are used by each cluster member. Log in to the WebSphere Integrated Solutions Console as an administrative user.

2. Click **Servers → Server Types → WebSphere Application Servers**.

3. For every cluster member, click the name of the IBM WebSphere Application Server, and, under Communications, expand **Ports**. Record the port number for each member. In the example in Figure 15-2, the port assigned to **WC_defaulthost portname** is 9080.

![Communication Ports Table](image)

*Figure 15-2  Ports value for WC_defaulthost*

**Note:** Depending on your requirements, you might also need extra port values, such as **WC_defaulthost_secure**.
4. The host names and port numbers that are used by the cluster members must exist in the virtual hosts. From the left navigation area of the WebSphere Integrated Solutions Console, click **Environment → Virtual hosts**.

5. Click the **default_host** name.

6. Under Additional Properties, click **Host Aliases**.

7. Check the list for the host name and port number that is used by each cluster member.

   **Note:** An asterisk (*) is a wildcard character. It can be used to match to all host names. It might be a good practice to remove entries where the host name is an asterisk.

8. If the host name and port number for the cluster members is not displayed on the list, click **New** to add the missing entry to the list.

9. If you add an entry, click **Save → Synchronize**.

If you have a web server defined, any updates that are made to the virtual host list are important information to the web server. The plug-in file that is referenced by the web server must be generated and propagated:

1. After you map virtual hosts, regenerate the plug-in configuration file. From the left navigation area, click **Servers → Server Types → Web servers**.

2. From the Web servers panel, select the check box next to the name of the web server for which you want to generate a plug-in. Click **Generate Plug-in**.

### 15.1.4 Configuration for the web router

In this example, IBM HTTP Server is used to route HTTP requests to each member of the appropriate clusters. You might have alternatively chosen to use a WebSphere Proxy Server.

**Adding IBM HTTP Server to cell**

First, IBM HTTP Server must be added to the cell, as described in 16.1.2, “Adding the HTTP server to the Business Process Manager cell” on page 346.
After the HTTP server is added to the cell as in Figure 15-3, all the existing web modules can be mapped to the HTTP Server automatically. These mappings to the HTTP server are needed to enable the web plug-in of the HTTP server to route the HTTP requests to the web modules that run on the cluster.

Figure 15-3  Mapping for web modules

You can check for the correct mapping by using the administrative console. The following example illustrates how to check the mapping for the Business Process Choreographer Explorer application:

1. Log in to the administrative console and click Applications → Enterprise Applications → BPCExplorer_BPMPCSINGLECluster.AppTarget → Modules → Manage Modules.
2. Check the mapping for web module BPCExplorer. It can include IBM HTTP Server, which is the server entry that contains server=webserver1 (Figure 15-4).

![Figure 15-4  Mapping for web modules](image-url)
You can customize the environment to enable it to function properly as a cluster with the web server. The default configuration for each cluster member is for its generated URLs to point to itself as opposed to the load-balancing HTTP server. Therefore, the configuration must be changed so that URLs generated by all nodes in the system point to the common HTTP server URL.

There are several configuration values to be replaced with the HTTP Server URL, including `portal-prefix`, `teamworks-webapp-prefix`, `servlet-prefix`, `webapi-prefix`, and so on. Such configuration settings are recorded in the `99Local.xml` configuration file. However, the custom configuration override XML
file, 100Custom.xml, is being used. This file enables overriding the default installation configuration without directly editing the 99Local.xml configuration file that contains the relevant configuration settings. For more information about using the configuration overrides, see Appendix B, “Configuring IBM Business Process Manager configuration settings” on page 409.

The 100Custom.xml file is used for setting the HTTP configuration. You must save it to the node-level configuration and the cluster-level configuration within the Dmgr configuration folder. The example environment uses these configuration files:

- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/nodes/bpmPCNode01/servers/BPMPCSingleCluster.AppTarget.bpmPCNode01.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/nodes/bpmPCNode02/servers/BPMPCSingleCluster.AppTarget.bpmPCNode02.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/clusters/BPMPCSingleCluster.AppTarget/process-center/config/100-custom.xml

**Note:** 100Custom.xml is also replicated within each node folder, but you do not need to modify these. Only the files within the Deployment Manager profile require modification because the Deployment Manager synchronizes the 100custom.xml configuration file from the Deployment Manager profile to the affected nodes.

For more information about customizing the Process Server and Process Center cluster to work with a web server, see the following website:


### 15.1.5 Sharing transaction and recovery logs

To enable correct failover handling, the transaction and recovery log of each cluster member must be shared. Sharing means that the log files can be commonly accessed by each node or cluster member. From the multiple technologies available today to establish a shared filestore among systems, choose whatever fits your needs best.
The shared filestore technique that is used for this example is NFS. For NFS, complete these steps to share transaction and recovery logs:

1. Enable each cluster:
   
a. Log in to the WebSphere Integrated Solutions Console.
   
b. Click **Servers** → **Clusters** → **WebSphere application server clusters**.
   
c. The IBM WebSphere Application Server clusters window, displays the names of the clusters (Figure 15-5). Click the name of the cluster, **BPMPCSingleCluster.AppTarget**.

   ![WebSphere application server clusters](image)

   **Figure 15-5** The single cluster that is used in this topology

---

**Note:** The high availability of the transaction service enables any server in a cluster to recover the transactional work for any other server in the same cluster. For more information, see the WebSphere Application Server Information Center at:

d. In the window for the selected cluster, select **Enable failover of transaction log recovery** as shown in Figure 15-6, then click **OK** and **Save** the change.

![Figure 15-6 Select the Enable failover of transaction log recovery check box](image)

2. On the shared file system and as a user with sufficient administrative authority, create **translog** and **recoverylog** directories.

3. When the shared directory is ready, configure each cluster member to its newly created shared transaction log folder:
   a. Log in to the WebSphere Integrated Solutions Console.
   b. Click **Servers** → **Server types** → **WebSphere application servers**.
   c. The IBM WebSphere Application Server window displays the names of each of the servers (cluster members). Click the name of the cluster member **BPMRMSW.AppTarget.bpmNode01.0**.
d. On the upper right, under Container Settings, expand **Container Services** and click **Transaction Service** (Figure 15-7).

Figure 15-7  Under Container Settings, expand Container Services to find Transaction service
e. In the Transaction service panel:
   i. Specify the tranlog directory that corresponds to this server, such as:
      /BPMdata/SharedLogs/tranlogs/BPMPCSingleCluster.AppTarget.bpmPCNode01.0
   ii. Clear the **Enable file locking** check box (Figure 15-8).

![Transaction service configuration](Figure 15-8 Transaction service configuration)
iii. Click **OK** and **Save** the change.

![Note: If Network File System Version 3 is used for storing transaction recovery logs and automated peer recovery is used, file locking must be disabled. For more information, see: http://publib.boulder.ibm.com/infocenter/wasinfo/v8r0/index.jsp?topic=com.ibm.websphere.nd.doc/info/ae/ae/tjta_disable_lock.html]

f. Repeat steps 2a - 2e for the remaining cluster members to configure the tranlogs:

BPMPCSingleCluster.AppTarget.bpmPCNode02.0

4. Configure each member of the AppTarget cluster to its newly created shared recovery folder:

a. In the WebSphere Integrated Solutions Console, click **Servers** → **Server types** → **WebSphere application servers**.

b. Click BPMPCSingleCluster.AppTarget.bpmPCNode01.0.

c. On the upper right, under Container Settings, expand **Container Services** and click **Compensation Service**.

d. In the Compensation service window:

- Enter the recovery log directory:
  
  /BPMdata/SharedLogs/recoverylogs/BPMPCSingleCluster.bpmPCNode01.0

- Click **OK** and **Save** the change.

e. In the WebSphere Integrated Solutions Console, click **Servers** → **Server types** → **WebSphere application servers** and click the remaining application cluster member, BPMPCSingleCluster.appTarget.bpmPCNode02.0.

f. On the upper right, under Container Settings, expand **Container Services** and click **Compensation Service**.

g. In the Compensation service window:

i. Enter the recovery log directory:

  /BPMdata/SharedLogs/recoverylogs/BPMPCSingleCluster.bpmPCNode02.0

ii. Click **OK** and **Save** the change.
15.2 Verification

The IBM Business Process Manager V8.0 consists of several components that include Process Center, Business Space, Human Task Manager, and Business Process Engine. You need to verify each component’s functionality:

- 15.2.1, “Restarting the deployment manager” on page 323
- 15.2.2, “Checking that CEI event persistence is disabled” on page 324
- 15.2.3, “Checking that IBM WebSphere Application Server Cluster can start successfully” on page 325
- 15.2.4, “Verifying Process Center function” on page 325
- 15.2.5, “Verifying Business Space” on page 330
- 15.2.6, “Verifying Human task manager” on page 332
- 15.2.8, “Verifying the Business Process Choreographer engine” on page 340

15.2.1 Restarting the deployment manager

Restart the deployment manager. It is essential to ensure that the deployment environment generation has completed successfully or you might encounter problems. This is an asynchronous process, so a successful response from the IBM WebSphere Application Server Integrated Solutions Console or \texttt{wsadmin} stating that the deployment environment is created is not sufficient confirmation.

To ensure that the process is complete, monitor the logs on each of your node agents (not the deployment manager). Toward the end of the deployment environment being created, you will see messages like Example 15-3.

\textit{Example 15-3 Messages from node agents}

\begin{verbatim}
\end{verbatim}

Note: When this cell is actively running in production, remember that the transaction log files must not be deleted from a production environment. For more information, see:

There are several sorts of these messages in the logs of both node agents as the standard applications are deployed to both nodes in the deployment environment. Wait for these messages to stop displaying and for the logs to quiesce, which indicates that the deployment environment generation is complete.

Restart your deployment manager. Monitor the deployment manager startup logs to ensure that there are no errors or exceptions.

Start all the node agents after the deployment manager is started, navigate to each node folder, and issue the `startNode` command. Monitor the node agent startup log for the node startup status.

For more information about restarting deployment environments, see the following website:


### 15.2.2 Checking that CEI event persistence is disabled

For a production system, it is best to disable persistence of CEI events to a database, as this can have a significant performance effect. It can be disabled by default. Check that it is disabled by performing these steps on the Integrated Solutions Console:

1. Open the IBM WebSphere Application Server Integrated Solutions Console and click **Service Integration** → **Common Event Infrastructure** → **Event Service** → **Event Services**.

   **Note:** If this menu item does not display, you might not have restarted your deployment manager since generating your deployment topology. In that case, restart it now.

2. Click **Default Common Event Infrastructure event server**. Ensure that the **Enable event data store** option is not selected.
15.2.3 Checking that IBM WebSphere Application Server Cluster can start successfully

After the deployment manager and both node agents are started successfully, you can start the cluster. To do this, complete the following steps:

1. Open the IBM WebSphere Application Server Integrated Solutions Console.
2. Click Servers → Clusters → WebSphere application server clusters.
3. Select the single cluster.
4. Click Start.

Wait until the cluster starts completely, which is indicated by the status icon becoming green. IBM WebSphere Application Server clusters are now started successfully.

Check the startup log of each cluster member for any errors or exceptions.

15.2.4 Verifying Process Center function

This section explains how to verify the Process Center.
Verifying the Process Center Web applications

There are a few Process Center Web applications, including Process Center repository, Process Portal, and Process Admin, that you need to confirm are accessible. You can do so by using the web server:

- Process Admin Console (Figure 15-9):
  - http://hostName/ProcessAdmin/, using IBM HTTP Server for HTTP requests
  - http://bpmPCNode01.itso.ibm.com:9080/ProcessAdmin/, direct HTTP requests to Node01

---

![Process Admin Console Login window](image)
To verify Process Admin Console, complete these steps:

a. Log in as a valid user (in this case bpmadmin).

b. Reset caches under the IBM BPM Admin → Manage Caches → Actions (Figure 15-10).

c. Pause and resume the Event Manager component under Event Manager → Monitor.
Process Portal
- http://hostname/ProcessPortal/, using IBM HTTP Server for HTTP requests
- http://bpmPCNode01.itso.ibm.com:9080/ProcessPortal/, direct HTTP requests to Node01 (Figure 15-11)

Figure 15-11 Process Portal Inbox

Performance Server Admin Console
- http://itsodb2/PerformanceAdmin/, using IBM HTTP Server for HTTP requests
- http://Node01.PC:9081/PerformanceAdmin/, direct HTTP requests to Node01 (see Figure 15-12)

Figure 15-12 Performance Server Admin Console

To verify the Performance Admin Console, complete these steps:
- Log in as the tw_admin user.
- Inspect all menu items, ensuring that there are no errors or exceptions.

WebService API
- http://itsodb2/webapi/services/, using IBM HTTP Server for HTTP requests
Chapter 15. Post-creation configuration and verification

To verify the WebService API, complete these steps:

a. Log in as a valid user (in this case bpmadmin).

b. Check that the following WDSLs render without errors:
   - http://yourwebserver/webapi/services/AdminService?wsdl
   - http://yourwebserver/webapi/services/WebAPISoap?wsdl
   - http://yourwebserver/webapi/services/WebAPIService?wsdl

Enter the Process Center console URL http://yourwebserver/ProcessCenter and log in using bpmadmin. A Getting Started panel displayed as shown in Figure 15-13.

**Figure 15-13  Getting Started with Process Center window**

**Downloading and installing the IBM Process Designer**

Download the IBM Process Designer tool and install it to verify the functionality of Process Center. It only takes a few clicks to install:

1. Open a web browser and enter the Process Center console URL:
   http://yourwebserver/ProcessCenter
This displays the Getting Started panel (Figure 15-13 on page 329).

2. Click **Download**, select a local folder in which to save the file, click **Save**, and the IBM Process Designer download starts. Wait until the download is completed.

3. Find the downloaded file with the name IBM Process Designer.zip and extract to a folder.

4. Go to the extracted folder and double-click **installProcessDesigner_admin.bat** if you want to install IBM Process Designer to default folder C:\IBM\ProcessDesigner\v8.0. Otherwise, open a command window and issue the command to specify another folder such as C:\IBMPD:

   ```
   installProcessDesigner_admin.bat C:\IBMPD
   ```

5. Navigate to the installation destination folder and double-click **eclipse.exe** to start the IBM Process Designer.

**Verifying with running sample BPD**

The Process Center server includes a sample named Hiring Sample. It is run by initiating the process by using with IBM Process Designer. Follow the Hiring Sample Tutorial for IBM Process Designer to open the sample and play back the process. It can also be used to verify the entire runtime environment. Ensure that you have given users access to the hiring sample process application as the tutorial indicated. It is required for the hiring sample tutorial.

The overview and steps to run the hiring sample can be found on the Hiring Sample Tutorial page in the IBM Business Process Manager V8.0 information center:


**15.2.5 Verifying Business Space**

To ensure that the Business Space infrastructure is operating correctly, complete these steps:

**Note:** These instructions assume that you have set up your web server and that it is configured to accept HTTPS connections. For more information see Chapter 16, “Configuring IBM Business Process Manager for web server products” on page 343.
1. Open a web browser, enter the Business Space URL http://yourwebserver/BusinessSpace, and log in using bpmadmin.

2. Click Go to Spaces, click Problem Determination, and click the System Health tab.

3. A page similar to Figure 15-14 is displayed that shows the various deployment environments, clusters, and node agents that you have, and that they are running. Explore the other tabs and check other components in your environment if you want.

Figure 15-14  Business Space System Health widget
15.2.6 Verifying Human task manager

The following steps verify that the Human Task Manager component is working correctly:

1. Start your cluster if it is not yet started.

2. Open the Business Process Choreographer Explorer on the web server for your topology (that is, http://yourwebserver/bpc). You might need to log in. Use the user name and password that you configured previously.

3. Click Task Templates → My Task Templates to see preconfigured sample human tasks. Click the box next to Widget Message, and click Create Instance (Figure 15-15).

Figure 15-15  Business Process Choreographer Explorer: Creating a widget message, step 1
4. Enter values for the subject and message fields of the human task (Figure 15-16), then click **Submit**.

![Business Process Choreographer Explorer](image)

*Figure 15-16  Business Process Choreographer Explorer: Creating a widget message, step 2*

5. Click **Task Instances → Initiated By Me** to see an instance of the task that you created. Click the task name itself, **Widget Message**.
6. Click the **Custom Properties** tab and click the empty space next to the htm_assigned_to field (this is an editable property, although it does not look like one at first). Enter a valid user to own the task (see Figure 15-17). Click **Save**, then **Start**, then **Submit**. The task now has an owner.

![Business Process Choreographer Explorer: Creating a widget message, step 3](image)

*Figure 15-17  Business Process Choreographer Explorer: Creating a widget message, step 3*
7. Click the check box next to the widget message task and click **Work on**. In the response comments field, enter text (Figure 15-18), then click **Complete**.

![Business Process Choreographer Explorer](image)

*Figure 15-18  Business Process Choreographer Explorer: Creating a widget message, step 4*

8. The human task is now finished and you have verified that the human task manager is working correctly. If you want to delete it, click **Task Instances → Administered By Me**, select the task, and click **Delete**.
15.2.7 Installing and running the classic Business Process Choreographer IVT application

The Business Process Choreographer installation verification application is included in the product installation, and can be found at:

<BPM_install_dir>/installableApps/bpcivt.ear

**Consideration:** In a network deployment environment, you can deploy only one instance of the Business Process Choreographer installation verification application. For example, if you have two Business Process Choreographer clusters in the same network deployment cell, you can deploy the bpcivt.ear application on only one of the clusters. Later, if you want to deploy it on the second cluster, you must first remove it from the first cluster.

To install and run the application, complete the following steps:

1. Ensure that at least one member of the AppTarget cluster is running.
2. Log in to the WebSphere Integrated Solutions Console as an administrative user.
3. Click **Applications** → **New application** → **New enterprise application**.
4. For the path to the new application, browse to and select bpcivt.ear → OK → Next.
5. On the Preparing for the application installation window, select **Fast Path - Prompt only when additional information is required**. Click **Next**.
6. In Step one: Select installation options, the default options are acceptable. Click **Next**.
7. In Step two: Map modules to servers, verify that this module is deployed to the BPMRMSW.AppTarget cluster (Figure 15-19). Click **Next**.

![Image of mapping modules to servers](image.png)

*Figure 15-19  The Business Process Choreographer IVT application must be deployed to the AppTarget cluster*

**Important:** If you are also using an IBM HTTP Server web server, be sure to map the module to the AppTarget cluster and the web server.

8. Step three: Summary is a summary of the application to be installed. Click **Finish**.
9. Verify that the Business Process Choreographer IVT application installs successfully (Figure 15-20). Click **Save**.

![Image showing successful installation](image)

*Figure 15-20*  Output shown when the Business Process Choreographer IVT application installation is successful

10. If you are using an IBM HTTP Server web server, remember to generate and propagate the plugin-cfg.xml file.

11. Start the application. In the WebSphere Integrated Solutions Console, click **Applications** → **Application Types** → **WebSphere enterprise applications**.

12. Select **BPCIVTApp**, then click **Start**.
13. Verify that the application status switches from a red X to the green arrow, and that the feedback at the top of the panel indicates that the application is started (Figure 15-21).

```
Messages
- Application BPCIVTApp on server BPMRMSW.AppTarget.bpmNode01.0 and node bpmNode01 started successfully.
- Application BPCIVTApp on server BPMRMSW.AppTarget.bpmNode02.0 and node bpmNode02 started successfully.
- Application BPCIVTApp started successfully on all of the servers in cluster BPMRMSW.AppTarget.
```

**Figure 15-21** The Business Process Choreographer IVT application started successfully

14. Using a web browser, open the Business Process Choreographer IVT’s URL, either through the web server or proxy server, or by going directly to a cluster member’s host and port:
   - http://<IHS_host>/bpcivt
   - http://<host_name>:<port>/bpcivt

15. Check the output in the browser to make sure the last two lines say Passed and Done.

Extra Business Process Choreography samples are available on the web at:
http://publib.boulder.ibm.com/bpcsamp/
15.2.8 Verifying the Business Process Choreographer engine

Verify that the Business Process Choreographer is working correctly and can be aligned with the Process Designer and Integration Designer interaction verification. The latest IBM Business Process Manager V8.0 sample page on the official IBM Business Process Manager Samples and Tutorials site has interaction samples to demonstrate the interaction capabilities:

http://publib.boulder.ibm.com/bpcsamp/

Among these samples, the procurement sample shows how to develop the interaction that is part of the workflow and run by the BPEL process engine. This sample can be used to verify the function of the business process engine.

Navigate to Interaction Samples → Procument sample: Calling a human task from a BPEL process for instructions. Under the Build it yourself link, you can find instructions about how to build the application and deploy it to IBM Business Process Manager Server. Under the Run the Sample link, you can find instructions about how to run the sample by using the Business Process Choreographer Explorer and Business Space. This process verifies that the Business Process Choreographer is working correctly.
Post installation

This section includes the following chapters:

- Chapter 16, “Configuring IBM Business Process Manager for web server products” on page 343
- Chapter 17, “IBM Business Process Manager configuration” on page 385
Chapter 16. Configuring IBM Business Process Manager for web server products

This chapter provides detailed instructions for configuring the IBM Business Process Manager V8.0 topology environment to work with the web server products, including IBM HTTP Server and WebSphere proxy server. The IBM HTTP Server or WebSphere proxy server can be used to spread the http requests among the cluster members. After the IBM Business Process Manager deployment environment is ready, you can further configure it to use IBM HTTP Server or WebSphere proxy server.

This chapter includes the following sections:

- 16.1, “Configuring Business Process Manager to use IBM HTTP Server” on page 344
- 16.2, “Configuring IBM Business Process Manager to use WebSphere proxy server” on page 366
- 16.3, “Verifying the web server configuration” on page 380
16.1 Configuring Business Process Manager to use IBM HTTP Server

In this example, IBM HTTP Server is used to route HTTP requests to each member of the appropriate clusters. You can also use a WebSphere proxy server as explained in 16.2, “Configuring IBM Business Process Manager to use WebSphere proxy server” on page 366

Important: In a three-cluster or four-cluster topology, a web server (either IBM HTTP Server or WebSphere proxy server) must be configured to make the IBM Business Process Manager Process Portal work correctly. You need a web server for three and four-cluster configurations because Process Portal uses web components that are distributed across two clusters. If you do not configure a suitable server to redirect requests to the appropriate clusters, the same origin policy for the web browser prevents Process Portal from working correctly.

For more information about configuring a routing server for IBM Business Process Manager Process Portal in a three or four-cluster topology, see: http://www-01.ibm.com/support/docview.wss?uid=swg21590115

To configure IBM Business Process Manager to use IBM HTTP Server, perform these general steps:

1. Install an IBM HTTP Server and configure the plug-in.
   The IBM HTTP Server and plug-in must be installed and configured properly.

2. Add IBM HTTP Server to the IBM Business Process Manager cell.
   The IBM HTTP Server must be added to the IBM Business Process Manager cell as a web server.

3. Check web modules mapping to the web server.
   After IBM HTTP Server is added to the cell, all the existing web modules are mapped to IBM HTTP Server automatically. If you already created the IBM HTTP Server configuration before the generation of the deployment environment, you must manually map these modules.

4. Configure the host aliases.
   Ensure that each host alias in the virtual host default_host contains the host and port information for each cluster member and web server to be serviced.
5. Configure the IBM HTTP Server plug-in properties.

You must configure IBM HTTP Server plug-in properties to make it work properly with Business Space and Process Portal component of IBM Business Process Manager.

6. Customize the Process Center or Process Server cluster to use IBM HTTP Server.

You must customize the Process Center or Process Server environment to enable it to function properly as a cluster with IBM HTTP Server.

The following sections provide the detailed instructions to configure IBM Business Process Manager to use IBM HTTP Server.

16.1.1 Configuring IBM HTTP Server plug-in

This section assumes that IBM HTTP Server and the plug-in are installed. For detailed installation instructions, see “Installing IBM HTTP Server and Web Server plug-in” on page 154. The example environment includes IBM HTTP Server V8.0, IBM HTTP Server Plug-in for WebSphere Application Server V8.0, and WebSphere Customization Toolkit V8.0 together using command line with the response file.

Use the WCT command-line utility that is provided by the WebSphere Customization Toolkit V8.0, and specify the pct tool and a response file to configure the IBM HTTP Server plug-in as follows:

```
/opt/IBM/WebSphere/Toolbox/WCT/wctcmd.sh -tool pct -defLocName webserver1 -defLocPathname /opt/IBM/WebSphere/Plugins -response webserver1_response_file.txt
```

Example 16-1 shows the response file that is used in this book.

```
Example 16-1  A response file to configure the IBM HTTP Server plug-in

configType=remote
enableAdminServerSupport=true
enableUserAndPass=true
enableWinService=false
ihsAdminCreateUserAndGroup=true
ihsAdminUserID=bpmadmin
ihsAdminPassword=itso4you
ihsAdminPort=8008
ihsAdminUnixUserID=bpmuser
ihsAdminUnixUserGroup=bpmuser
mapWebServerToApplications=true
wasMachineHostName=sa-w310-5.itso.ral.ibm.com
```
Figure 16-1 shows that the WCT command-line utility ran successfully.

```
[bpmuser@sa-w310-2 WCT]$ pwd
/opt/IBM/WebSphere/Toolbox/WCT
[bpmuser@sa-w310-2 WCT] $/wctcmd.sh -tool poc -defLocName webserver1 -defLocPathname /opt/IBM/WebSphere/Plugins -response webserver1_response_file.txt
Importing definition location...
Definition location successfully imported
Launching tool poc ...
Tool execution completed successfully.
```

Figure 16-1 Using the PCT command to configure IBM HTTP Server plug-in

Now, you can start the IBM HTTP server and the IBM HTTP administrative server with the root user by running the following commands:

- To start the IBM HTTP server:
  
  /opt/IBM/HTTPServer/bin/apachectl start

- To start the IBM HTTP administrative server:
  
  /opt/IBM/HTTPServer/bin/adminctl start

**Note:** Automatic propagation of the plug-in configuration file requires the IBM HTTP administrative server to be up and running.

You can confirm if they are started successfully by checking the

/opt/IBM/HTTPServer/logs/error_log and the

/opt/IBM/HTTPServer/logs/admin_error.log.

### 16.1.2 Adding the HTTP server to the Business Process Manager cell

This section explains how to add IBM HTTP Server to the deployment manager as a web server. Make sure that the deployment manager is running before you perform the steps in this section.
Using the Integrated Solutions Console
To add the HTTP server to the cell with the Integrated Solutions Console, complete the following steps:

1. Start the Integrated Solutions Console.

2. Add an unmanaged node to the WebSphere cell:
   a. Click System administration → Nodes.
   b. Click Add Node.
   c. On next window, click Unmanaged node and then Next (Figure 16-2).

![Image of Adding an unmanaged node](image)

*Figure 16-2   Adding an unmanaged node*
d. Enter IHSNode as the name and sa-w310-2.itso.ral.ibm.com as the host name. Select Linux from the Platform Type menu and click OK (Figure 16-3).

Figure 16-3   New unmanaged node

3. Add IBM HTTP Server to the cell:
   a. Click Server → Server Types → Web servers.
   b. On top of the empty table, click New (Figure 16-4).

Figure 16-4   Creating a web server
c. Select the newly created node **IHSNode** in the Choose Node menu, enter `webserver1` in the Server Name field, and select **IBM HTTP Server** in the Type menu (Figure 16-5). Click **Next**.

![Image](image1.png)

*Figure 16-5  Defining the new http server*


d. Select **IHS template** and click **Next** (Figure 16-6).

![Image](image2.png)

*Figure 16-6  Selecting a web server template*
e. Enter the following values (Figure 16-7) and click **Next**:

- Port: 80
- Web server installation location: /opt/IBM/HTTPServer
- Plug-in installation location: /opt/IBM/WebSphere/Plugins
- Application mapping to the web server: **All**
- Administration Server Port: 8008
- Username: bpmadmin in this example
- Password and Confirm password <your password>

**Note:** Confirm that you input the same values in the response file when you configured the IBM HTTP Server plug-in in Example 16-1 on page 345.
Chapter 16. Configuring IBM Business Process Manager for web server products

4. Save your configuration.

5. Verify that the IBM HTTP Server Administration server is started by running the following command:

   /opt/IBM/HTTPServer/bin/adminctl start

6. Go back to the Integrated Solutions Console, select the new IBM HTTP Server, and click **Start** (Figure 16-8).

7. Verify that the **Status** icon changes from a red cross to a green circle.

8. Check the box next to the new web server and click **Generate Plug-in**.
   Success or error messages are displayed (Figure 16-9).

---

f. Review the details in the summary and click **Finish**.
9. Check the box next to the new web server and click **Propagate Plug-in** to copy the plug-in XML file to IBM HTTP Server. Success or error messages are displayed (Figure 16-10).

![Feedback messages from a successful plug-in propagation](image)

**Figure 16-10** Feedback messages from a successful plug-in propagation

### Using the command line

During the installation of the IBM HTTP Server plug-in, a `configure[webserver_name]` script is produced by the installation process on the web server. In the example environment, this file is at the following path:

```
/opt/IBM/WebSphere/Plugins/bin/configurewebserver1.sh
```

To configure an IBM HTTP Server called `webserver1` to the deployment environment, complete the following steps:

1. In the deployment manager, copy this script to the `bin` directory of the deployment manager profile. In the example environment, copy this script from IBM HTTP Server to the following directory:

   `/opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/bin`

2. Run the `configure[webserver_name]` script to configure the web server:

   ```
   cd /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/bin
   ./configurehttpserver1.sh -profileName bpmPCDmg -user bpmadmin -password bpmadmin -ihsAdminPassword itso4you
   ```

   **Note:** The `configure[webserver_name]` script automatically maps all web application modules to IBM HTTP Server. Therefore, run this script after the generation of the deployment environment. Otherwise, you must manually map these web modules.

On the web server system, start the IBM HTTP Server administrative server:

```
/opt/IBM/HTTPServer/bin/adminctl start
```

Verify the new configured web server in the deployment environment by completing these steps:

1. Log in to the WebSphere Integrated Solutions Console as an administrative user.
2. Click **Servers → Server Types → Web servers.**
3. From the Web servers pane, select the web server and click **Start**. The arrow should turn green.

**Enabling SSL on the HTTP Server**

The Business Process Choreographer Explorer, Business Space and Process Portal web applications that are verified in the following section only accept HTTPS connections in IBM Business Process Manager V8.0. You can access these web applications by using the HTTP URLs, which are redirected to the corresponding HTTPS URLs automatically.

**Default SSL setting on the HTTP Server:** By default, SSL is not enabled on IBM HTTP Server. Because the Business Process Choreographer Explorer, Business Space and Process Portal web applications in IBM Business Process Manager V8.0 only accept HTTPS connections, you must enable SSL on IBM HTTP Server.

Enabling SSL can be done through the Integrated Solutions Console by completing these steps:

1. In the Integrated Solutions Console, click **Servers** → **Server Types** → **Web servers** to display the list of configured HTTP servers.
2. Click **webserver1** to display the IBM HTTP server configuration page.
3. Click **Configuration Settings** → **Web Server Virtual Hosts** to display the virtual host configuration page.
4. On the web server virtual hosts page, click **New**.
5. On the first page of the new web server virtual host wizard, click **Security enabled virtual host**, then click **Next** (Figure 16-11).

![Figure 16-11  Creating a new security-enabled virtual host](image-url)
6. In the Key store file name field, enter webserver1. In the Target key store directory field, enter ${WEB_INSTALL_ROOT}/conf. In the Key store password and Verify key store password fields, enter <your password>. In the Certificate alias field, enter selfSigned (Figure 16-12). Click Next.

![Figure 16-12  Entering SSL keystore properties](image)

7. Enter the IP address of the HTTP server in the IP Address field, leave the default SSL port as 443, and click Next (Figure 16-13).

![Figure 16-13  Configuring the HTTP server IP address](image)
8. Review the summary information and click **Finish**.

9. Stop and start IBM HTTP Server to activate the secured virtual host by clicking **Stop**, then **Start**.

### 16.1.3 Checking the web modules mapping to the web server

After IBM HTTP Server is added to the cell, all of the existing web modules are mapped to it automatically. These web module mappings to the HTTP server are required to enable the web plug-in of IBM HTTP Server to route the HTTP requests to the target web modules that run in the cluster.

To check the correct mapping, you can use the WebSphere Integrated Solutions Console. To check the mapping for the Business Process Choreographer Explorer application, complete these steps:

1. Log in to the administrative console and click **Applications** → **Application Types** → **WebSphere enterprise applications** → **BPCExplorer_BPMPCSINGLECluster.AppTarget** → **Modules** → **Manage Modules**.

2. Check the mapping for web module BPCExplorer. It should include IBM HTTP Server, which is the server entry that contains `server=webserver1` (Figure 16-14).

![Figure 16-14   Mapping for web modules](image-url)
For each WebSphere enterprise application that you want the web server to serve, click it, go to **Manage Modules**, and ensure that all of its web modules are mapped to *both* the appropriate cluster *and* IBM HTTP Server.

Table 16-1 contains a list of the enterprise applications that contain web modules. You might have some or all applications in this list, based on which products you are using with IBM HTTP Server.

**Table 16-1  Components with web modules that can be mapped to a web server in addition to their deployment cluster**

<table>
<thead>
<tr>
<th>Components</th>
<th>Enterprise applications that contain web modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Server</td>
<td>▶ IBM_BPM_Portal&lt;br▶ IBM_BPM_ProcessAdmin&lt;br▶ IBM_BPM_Process_Portal_Notification&lt;br▶ IBM_BPM_Repository (only for Process Center)&lt;br▶ IBM_BPM_Teamworks&lt;br▶ IBM_BPM_WebAPI&lt;br▶ IBM_BPM_Help</td>
</tr>
<tr>
<td>Performance Data Warehouse</td>
<td>▶ IBM_BPM_PerformanceDW</td>
</tr>
<tr>
<td>Business Space</td>
<td>▶ BSpaceEAR&lt;br▶ BSpaceHelp&lt;br▶ PageBuilder2&lt;br▶ mm.was</td>
</tr>
<tr>
<td>Widgets</td>
<td>▶ BPMAdministrationWidgets&lt;br▶ HumanTaskManagementWidgets&lt;br▶ BusinessRules&lt;br▶ wesbWidget</td>
</tr>
<tr>
<td>REST services</td>
<td>▶ REST Services Gateway&lt;br▶ REST Services Gateway Dmgr</td>
</tr>
<tr>
<td>Business flow manager</td>
<td>▶ BPEContainer&lt;br▶ BPCExplorer</td>
</tr>
<tr>
<td>Human task manager</td>
<td>▶ TaskContainer&lt;br▶ HTM_PredefinedTaskMsg_V8000&lt;br▶ HTM_PredefinedTasks_V8000</td>
</tr>
<tr>
<td>Business rules</td>
<td>▶ BusinessRulesManager</td>
</tr>
</tbody>
</table>

If you have already created the IBM HTTP Server configuration in the IBM Business Process Manager cell (16.1.2, “Adding the HTTP server to the Business Process Manager cell” on page 346) before the generating the
deployment environment, the web modules are NOT mapped to the web server automatically. In this situation, you must manually map these modules by completing these steps:

1. Go to the **Manage Modules** panel as shown in Figure 16-14 on page 355.
2. Select the check box next to the name of the modules.
3. In the Clusters and servers pane, select the application deployment target (where the application is already deployed) and the web server (if any). Use the Ctrl key to select multiple targets. For example, to have a web server serve your application, press the Ctrl key and select the application server cluster and the web server together.

Figure 16-15 shows an example web module and mapping.

![Figure 16-15 The web module is mapped to the application cluster and a web server](image)

4. Click **Apply**.
5. Click **OK** and **Save** to save any changes.

For each enterprise application that you want the web server to serve, map all of its web modules to IBM HTTP Server with the same approach here.

**Note:** You might discover later that accessing web pages with IBM HTTP Server does not work, but accessing each cluster member works well. The most likely cause is that the web module is not mapped to IBM HTTP Server correctly. To validate, check the mapping of each module with the same approach here, and add the mapping to IBM HTTP Server if it is missing.
16.1.4 Configuring host aliases

Ensure that each host alias in the virtual host default_host contains the host and port information for each cluster member and web server to be serviced. You can do so by completing these steps:

1. Determine the port numbers that are used by each cluster member. Log in to the WebSphere Integrated Solutions Console as an administrative user.
2. Click Servers → Server Types → WebSphere application servers.
3. For every cluster member, click the name of the application server.
   a. Under Communications, expand Ports.
   b. For the port name, WC_defaulthost, record its port number.
The value for the port number can be 9080, 9081, or similar. The port that is assigned to the *WC_defaulthost* port name in this example uses port 9081 as shown in Figure 16-16.

![Figure 16-16 Ports value for WC_defaulthost](image)

**Note:** Depending on your requirements, you might also need more port values, such as *WC_defaulthost_secure*.

c. Note all the host names and port numbers that are used by the cluster members.
4. The host names and port numbers that are used by the cluster members must exist in the virtual hosts. From the left navigation area of the WebSphere Integrated Solutions Console, click **Environment → Virtual hosts**.

5. Click the **default_host** name as shown in Figure 16-17.

![Figure 16-17 Virtual hosts](image)

6. Under Additional Properties, click **Host Aliases**.

7. Check the list for the host name and port number that is used by each of the cluster members. If the host name and port number for the cluster members is not displayed in the list, click **New** to add the missing entry to the list.

   **Note:** An asterisk (*) is a wildcard character. It can be used to match to all host names. Generally, remove entries where the host name is an asterisk.

8. If the host name and port number for IBM HTTP Server is not displayed in the list, click **New** to add the missing entry to the list as well.

9. If you add an entry, click **Save** and **Synchronize**.
16.1.5 Configuring IBM HTTP Server plug-in properties

Configure the IBM HTTP Server plug-in properties to make it work properly with Business Space and Process Portal component of IBM Business Process Manager V8.0. To do so, complete these steps:

1. Log in to the WebSphere Integrated Solutions Console and click Servers → Server Types → Web servers.
2. From the Web servers panel, select the check box next to the name of the web server for which you want to generate a plug-in. Click Generate Plug-in.
3. Check the box next to the new web server and click Propagate Plug-in to push the plug-in configuration file to IBM HTTP Server.

Note: Any update that you made to the virtual host list is important information to IBM HTTP Server. The plug-in file that is referenced by IBM HTTP Server must be generated and propagated. To do so, complete these steps:

1. After you map the virtual hosts, regenerate the plug-in configuration file. From the left navigation area, click Servers → Server Types → Web servers.
2. From the Web servers panel, select the check box next to the name of the web server for which you want to generate a plug-in. Click Generate Plug-in.
3. Check the box next to the new web server and click Propagate Plug-in to push the plug-in configuration file to IBM HTTP Server.
3. Set **Accept content for all requests** to **true** for the web server plug-in (Figure 16-18).

![Figure 16-18   HTTP Plug-in properties](image)

### 16.1.6 Customizing Process Center cluster to use IBM HTTP Server

Customize the environment to enable it to function properly as a cluster with the web server. To achieve this, complete these steps:

1. Stop the deployment manager.
2. Configure the `100Custom.xml` file in the Process Server or the Process Center environment to point to a web server.
3. Start the deployment manager, then use a full resynchronize to copy the `100Custom.xml` configuration files from the deployment manager to the managed nodes.
4. Restart the affected application cluster so the modifications take effect.

In a Process Center or Process Server environment, the default configuration for each cluster member is for its generated URLs to point to itself as opposed to the
load-balancing web server. Therefore, the configuration must be changed so that URLs generated by all nodes in the system point to the common web server URL.

For more information about customizing the Process Server or Process Center cluster to work with a web server, see:


There are several configuration values to be replaced with the web server URL, including portal-prefix, teamworks-webapp-prefix, servlet-prefix, and webapi-prefix. Such configuration settings are recorded in the 99Local.xml configuration file. However, the custom configuration override XML file, 100Custom.xml, is being used. This file overrides the default installation configuration without directly editing the 99Local.xml configuration file that contains the relevant configuration settings. For more information about using the configuration overrides, see Appendix B, “Configuring IBM Business Process Manager configuration settings” on page 409.

Example 16-2 on page 364 is a sample 100Custom.xml for overriding existing configuration settings. Save it to the node-level configuration and the cluster-level configuration within the Dmgr configuration folder. The example environment has these configuration files:

- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/nodes/bpmPCNode01/servers/BPMPCSingleCluster.AppTarget.bpmPCNode01.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/nodes/bpmPCNode02/servers/BPMPCSingleCluster.AppTarget.bpmPCNode02.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCDmg/config/cells/bpmPCcell/clusters/BPMPCSingleCluster.AppTarget/process-center/config/100Custom.xml

**Note:** 100Custom.xml is also replicated within each node folder. However, you do not need to modify these. Only the files within the Deployment Manager profile require modification because the Deployment Manager synchronizes the 100custom.xml configuration file from the Deployment Manager profile to the affected nodes.

Synchronize these files to the managed cluster nodes by using the Full Synchronize option in the IBM WebSphere Application Server web-based administration console. In this example, the two nodes being used have the following locations of the synchronized custom configuration override files.
Within the Node1 profile:

- /opt/IBM/WebSphere/AppServer/profiles/bpmPCNode01/config/cells/bpmPCcell/nodes/bpmPCNode01/servers/BPMPCSingleCluster.AppTarget.bpmPCNode01.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCNode01/config/cells/bpmPCcell/clusters/BPMPCSingleCluster.AppTarget/process-center/config/100Custom.xml

Within the Node2 profile:

- /opt/IBM/WebSphere/AppServer/profiles/bpmPCNode02/config/cells/bpmPCcell/nodes/bpmPCNode02/servers/BPMPCSingleCluster.AppTarget.bpmPCNode02.0/process-center/config/100Custom.xml
- /opt/IBM/WebSphere/AppServer/profiles/bpmPCNode02/config/cells/bpmPCcell/clusters/BPMPCSingleCluster.AppTarget/process-center/config/100Custom.xml

Example 16-2 shows the 100Custom.xml for IBM HTTP Server.

Example 16-2  100Custom.xml for IBM HTTP Server

```xml
<properties>

<!--
To use [load balancer or proxy], insert the Fully Qualified Name (FQN)
for the Virtual IP or DNS name that load balances between http://[app
server node 1]:[port] and http://[app server node 2]:[port].
-->

  <authoring-environment merge="mergeChildren">
  <!--
  Used by the Process Designer debugger, if there is no direct HTTP
  access to the nodes
  -->
  <repository-prefix merge="replace">http://sa-w310-2.itso.ral.ibm.com:80/ProcessCenter</repository-prefix>
```

Example 16-2  100Custom.xml for IBM HTTP Server
<servlet-prefix

<webapi-prefix

</authoring-environment>

<common merge="mergeChildren">
<!--
The next 6 URLs should load balance or proxy to all nodes, using the
Virtual IP or DNS name with sticky sessions.
--> 

<portal-prefix

<process-admin-prefix

<teamworks-webapp-prefix

<webservices merge="mergeChildren">
<base-url
</webservices>
<xml-serialization merge="mergeChildren">
<default-namespace-uri
</xml-serialization>
</common>

<server merge="mergeChildren">
<email merge="mergeChildren">
<mail-template merge="mergeChildren">
<!--
The next URLs should load balance to all nodes, using the using the
Virtual IP or DNS name with sticky sessions for task URLs in generated
e-mails.
-->
You can also edit 99Local.xml directly, which is not recommended and requires backing up the default configuration files in advance before you make any changes.

**Note:** Modifying the XML configuration files on the deployment manager profile is the correct thing to do. Make sure to work only in the file system of the deployment manager profile. Then, use a full resynchronize to copy all files from the deployment manager to the nodes.

Now, you have completed the IBM Business Process Manager configuration steps to use IBM HTTP Server. You can verify your web server configuration as described in 16.3, “Verifying the web server configuration” on page 380.

### 16.2 Configuring IBM Business Process Manager to use WebSphere proxy server

In this example, the WebSphere proxy server is used to route HTTP requests to each member of the appropriate clusters. You can also choose to use a IBM HTTP Server as described in 16.1, “Configuring Business Process Manager to use IBM HTTP Server” on page 344.

WebSphere proxy server is built into WebSphere Application Server Network Deployment product, which the IBM Business Process Manager products are based on. If you decide not to use a stand-alone product such as IBM HTTP Server, the easiest solution is to configure the built-in WebSphere proxy server by using the administrative console. This solution does not require you to install any other products or purchase extra licenses.
WebSphere proxy server is simpler to set up than IBM HTTP Server for these reasons:

- WebSphere proxy server is built into WebSphere Application Server Network Deployment product that the IBM Business Process Manager products are based on. So no additional installation is required.
- Because WebSphere proxy server is created in the same cell of IBM Business Process Manager and shares the IBM Business Process Manager network deployment configuration, there are no static configuration files to generate and propagate like with IBM HTTP Server.

To configure IBM Business Process Manager to use WebSphere proxy server, complete these general steps:

1. Create the WebSphere proxy server in the IBM Business Process Manager cell.
   
   Create the WebSphere proxy server in the IBM Business Process Manager cell as a web server.

2. Check that web modules are enabled for the proxy server.
   
   For each WebSphere enterprise application that you want the proxy server to serve, verify that its web modules are enabled for the proxy server.

3. Configure the host aliases.
   
   Ensure that each host alias in the virtual host `default_host` contains the host and port information for each cluster member and web server to be serviced.

4. Configure the proxy server settings.
   
   You must configure proxy server settings to make it use the HTTP protocol properly.
5. Customize Process Center or Process Server cluster to use WebSphere proxy server

You can customize the Process Center or Process Server environment to enable it to function properly as a cluster with the proxy server.

The following sections provide the detailed instructions to configure IBM Business Process Manager to use the WebSphere proxy server.

16.2.1 Creating WebSphere proxy server in the IBM Business Process Manager cell

This section explains how to create a WebSphere proxy server as a web server. Make sure that the deployment manager is running before starting these steps.

To configure a WebSphere proxy server, complete the following steps:

1. Start the Integrated Solutions Console.
2. Click Servers → Server Types → WebSphere proxy servers.
3. At the top of the empty table, click New (Figure 16-19).

4. Select a node to host the proxy server, and enter proxyserver1 in the Server Name field (Figure 16-20 on page 369). Click Next.

**Note:** Decide which node will host the proxy server first. If necessary, you can create and federate a new custom node.
5. Make sure that the **HTTP** protocol and **Generate unique ports** are selected on next page (Figure 16-21). You can optionally select the **SIP** protocol as well. Click **Next**.
6. Click the `proxy_server_foundation` template on next page and click **Next** (Figure 16-22).

![Figure 16-22 Select a proxy server template](image)

7. Review the details in the summary and click **Finish**.

8. Save your configuration.

9. Select the new proxy server, and click **Start** (Figure 16-23).

![Figure 16-23 List of proxy server and run status](image)

10. Verify that the **Status** icon changes from a red cross to a green circle.

### 16.2.2 Checking the web modules that are enabled for proxy server

After the WebSphere proxy server is created in the cell, all the existing web modules should be enabled for the proxy server automatically.
To check the web modules enablement for proxy server, you can use the administrative console. To check the mapping for the BPCExplorer application, complete these steps:

1. Log on to the administrative console as an administrative user.

2. Click **Applications → Application Types → WebSphere enterprise applications**, click **BPCExplorer_BPMPCSingleCluster.AppTarget**.

3. On the Configuration tab, click **Virtual hosts** under the Web Module Properties, and verify that it uses the value **default_host** (Figure 16-24).

4. On the Configuration tab, under Modules, click **Manage Modules**.
5. On the Manage Modules page, click the **BPCExplorer** web module, and select **Web Module Proxy Configuration**. Verify that **Enable Proxy** is selected (Figure 16-25).

![Configuration Panel](image)

*Figure 16-25  Enable proxy for web modules*

For each of the WebSphere enterprise applications that you want the proxy server to serve, click it and verify that all the web modules listed in **Manage Modules** page are enabled for the proxy server.

You need to check the following enterprise applications that contain web modules. You might have some or all applications in this list, based on which products you are using with the proxy server.

- For all products:
  - BSpaceEAR
  - BSpaceForms
  - BSpaceHelp
  - BusinessSpaceHelpEAR
  - REST Services Gateway
  - mm.was
  - PageBuilder2
For IBM Business Process Manager:
- BPCExplorer (only for IBM Business Process Manager Advanced)
- BPEContainer (only for IBM Business Process Manager Advanced)
- BPMAdministrationWidgets (only for IBM Business Process Manager Advanced)
- HumanTaskManagementWidgets (only for IBM Business Process Manager Advanced)
- IBM_BPM_Help
- IBM_BPM_PerformanceDW
- IBM_BPM_Portal
- IBM_BPM_ProcessAdmin
- IBM_BPM_Process_Portal_Notification
- IBM_BPM_Process_Portal
- IBM_BPM_Repository (only for Process Center)
- IBM_BPM_Teamworks
- IBM_BPM_WebAPI
- REST Services Gateway Dmgr (only for IBM BPM Advanced)
- TaskContainer (only for IBM Business Process Manager Advanced)
- wesbWidgets (only for IBM Business Process Manager Advanced)

For IBM Business Monitor:
- HumanTaskManagementWidgets
- WBMDashboardWeb

16.2.3 Configuring host aliases

Ensure that each host alias in the virtual host default_host contains the host and port information for each cluster member and proxy server to be serviced. To do so, complete these steps:

1. Determine the port numbers that are used by each cluster member. Log in to the Integrated Solutions Console as an administrative user.

2. Click **Servers → Server Types → WebSphere application servers.**
3. For every cluster member, click the name of the application server and complete these steps:

   a. Under Communications, expand **Ports**.

   b. For each port name, `WC_defaulthost` in this example, record its port number.

       The value for the port number can be 9080, 9081, or similar. The port assigned to the `WC_defaulthost` port name in this example is 9081 (Figure 16-26).

**Note:** Depending on your requirements, you might also need extra port values, such as `WC_defaulthost_secure`.

![Figure 16-26 Ports value for WC_defaulthost and WC_defaulthost_secure](image)
c. Note all the host names and port numbers that are used by the cluster members.

4. Identify the proxy server’s port numbers:
   a. Click **Servers** → **Server types** → **WebSphere proxy servers** → **proxyserver1** → **Ports**.
   b. Note the port values `proxy_http_port` and `proxy_https_port` that correspond to the port values of the end points named `PROXY_HTTP_ADDRESS` and `PROXY_HTTPS_ADDRESS` (Figure 16-27).

![Figure 16-27 Proxy server port values](image)
5. The host names and port numbers that are used by the cluster members and the proxy server must exist in the virtual hosts. From the left navigation area of the WebSphere Integrated Solutions Console, click Environment → Virtual hosts.

6. Click the default_host name.


8. Check the list for the host name and port number that is used by each of the cluster members. If the host name and port number for the cluster members is not displayed in the list, click New to add the missing entry to the list.

9. If the host name and port numbers (proxy_http_port and proxy_https_port) for the proxy server are not displayed in the list, click New to add the missing entries to the list as well (Figure 16-28).

   | sa-w310-4.itso.ral.ibm.com | 1024   
   | sa-w310-4.itso.ral.ibm.com | 1025   

   Figure 16-28   Add Host Aliases into default_host

10. If you add an entry, click Save and Synchronize.
16.2.4 Configuring proxy server settings

Configure the WebSphere proxy server settings to make it use the HTTP protocol properly by completing these steps:

1. Log on to the WebSphere Integrated Solutions Console as an administrative user.

2. Click **Servers** → **Server Types** → **WebSphere proxy servers**, and then click the proxy server `proxyserver1` that you previously created.

3. Expand **HTTP Proxy Server Settings** so you can see **Proxy settings** and **Rewriting rules** (Figure 16-29).

4. Add rewrite rules.
   a. For each cluster member in the application and web clusters in your deployment environment, note the port value of the endpoint named `WC_defaulthost_secure` as `cluster_member_https_port`. In the example environment, both the cluster members use 9444 (Figure 16-26 on page 374).
   
   b. Click **Rewriting rules** under **HTTP Proxy Server Settings**.
c. For all the host names and port numbers that are used by the cluster members that you noted in step a, click **New** to add the following rewriting rule to the proxy server (Figure 16-30):

- **From URL Pattern:**
  https://proxy_hostname:cluster_member_https_port/*

- **To URL Pattern:** https://proxy_hostname:proxy_https_port/*

![Figure 16-30   Create rewriting rules for proxy server](image)

5. Set the `cache.query.string` custom property:

   a. Click into **Proxy settings** under **HTTP Proxy Server Settings**, then click **Custom properties**.
b. Click **New** to add a custom property to the proxy server settings (Figure 16-31):

- **Name**: `cache.query.string`
- **Value**: `true`

![Figure 16-31 New custom property for proxy server](image)

6. Click **OK** and **Save**, then restart the proxy server.

### 16.2.5 Customizing Process Center cluster to use proxy server

You must customize the Process Center or Process Server environment to enable it to function properly as a cluster with IBM HTTP Server or proxy server. The default configuration for each cluster member is for its generated URLs to point to itself, instead of the router. Therefore, you must replace it with IBM HTTP Server or proxy server URL. For more information about this procedure, see 16.1.6, “Customizing Process Center cluster to use IBM HTTP Server” on page 362.

When you configure the `100Custom.xml` file, you must change all values to point to the proxy server host name and port with the actual host name and port of the proxy server. In this book, all the URLs `http://sa-w310-2.itso.ral.ibm.com:80` as shown in Example 16-2 on page 364 are replaced by `http://sa-w310-4.itso.ral.ibm.com:1024`.

Now, you have completed the IBM Business Process Manager configuration steps to use WebSphere proxy server. You can verify your web server...
configuration as explained in 16.3, “Verifying the web server configuration” on page 380.

16.3 Verifying the web server configuration

After you configure IBM Business Process Manager to use IBM HTTP Server or WebSphere proxy server, validate and verify the web server configuration.

This is a simple check to verify that the various web applications for the Process Center and Process Server function can be accessed by using the web server URLs.

You can access each of the web applications and confirm that the web server URLs work without issue:

1. Process Center Console
   This procedure applies to the Process Center environment only.
   a. Access the web application:
      http://<webserver_host_name>:<webserver_port>/ProcessCenter/

      In the example environment:
      • IBM HTTP Server URL:
        http://sa-w310-2.itso.ral.ibm.com/ProcessCenter/
      • Proxy URL:

   b. Log in as a valid user: bpmadmin
   c. Ensure that the web application renders without errors.
   d. Download Process Designer from the Process Center.

2. Process Server Admin Console
   a. Access the web application:
      http://<webserver_host_name>:<webserver_port>/ProcessAdmin/

      In the example environment:
      • IBM HTTP Server URL:
      • Proxy URL:

   b. Log in as a valid user: bpmadmin
   c. Ensure that the web application renders without errors.
3. Performance Server Admin Console
   a. Access the web application:
      \[ \text{http://<webserver_host_name>:<webserver_port>/PerformanceAdmin/} \]
      In the example environment:
      - IBM HTTP Server URL:
        \[ \text{http://sa-w310-2.itso.ral.ibm.com/PerformanceAdmin/} \]
      - Proxy URL:
        \[ \text{http://sa-w310-4.itso.ral.ibm.com:1024/PerformanceAdmin/} \]
   b. Log in as a valid user: \text{bpmadmin}
   c. Ensure that the web application renders without errors.

4. WebService API
   a. Access the web application:
      \[ \text{http://<webserver_host_name>:<webserver_port>/webapi/services/} \]
      In the example environment:
      - IBM HTTP Server URL:
        \[ \text{http://sa-w310-2.itso.ral.ibm.com/webapi/services/} \]
      - Proxy URL:
        \[ \text{http://sa-w310-4.itso.ral.ibm.com:1024/webapi/services/} \]
   b. Log in as a valid user: \text{bpmadmin}
   c. Check that the following WDSLs render without errors:
      \[ \text{http://<webserver_host_name>:<webserver_port>/webapi/services/WebAPISoap?wsdl} \]
      In the example environment:
      - IBM HTTP Server URL:
        \[ \text{http://sa-w310-2.itso.ral.ibm.com/webapi/services/WebAPISoap?wsdl} \]
      - Proxy URL:
        \[ \text{http://sa-w310-4.itso.ral.ibm.com:1024/webapi/services/WebAPISoap?wsdl} \]

For the Business Process Choreographer Explorer, Business Space and Process Portal web applications that only accept HTTPS connections in IBM Business Process Manager V8.0. You can access these web applications by using the HTTP URLs that are redirected to the corresponding HTTPS URLs automatically.
Note: By default, SSL is not enabled on IBM HTTP Server. However, the Business Process Choreographer Explorer, Business Space and Process Portal web applications in IBM Business Process Manager V8.0 only accept HTTPS connections. If you are required to access these web applications by using the IBM HTTP Server URLs, further enable SSL on IBM HTTP Server according to “Enabling SSL on the HTTP Server” on page 353.

If the WebSphere proxy server is used in your topology, you can ignore this because SSL is enabled by default on the proxy server.

1. Process Portal
   a. Access the web application:
      
      http://<webserver_host_name>:<webserver_port>/portal/
   
   In the example environment:
   
   • IBM HTTP Server URL: http://sa-w310-2.itso.ral.ibm.com/portal/
   • Proxy URL: http://sa-w310-4.itso.ral.ibm.com:1024/portal/
   
   b. Log in as a valid user: bpmadmin
   
   c. Ensure that the web application renders without errors.

2. Business Space
   a. Access the web application:
      
      http://<webserver_host_name>:<webserver_port>/BusinessSpace/
   
   In the example environment:
   
   • IBM HTTP Server URL:
   • Proxy URL:
   
   b. Log in as a valid user: bpmadmin
   
   c. Ensure that the web application renders without errors.

3. Business Process Choreographer Explorer
   a. Access the web application:
      
      http://<webserver_host_name>:<webserver_port>/bpc/
   
   In the example environment:
   
   • IBM HTTP Server URL: http://sa-w310-2.itso.ral.ibm.com/bpc/
   • Proxy URL: http://sa-w310-4.itso.ral.ibm.com:1024/bpc/
b. Log in as a valid user: bpmadmin

c. Ensure that the web application renders without errors.
IBM Business Process Manager configuration

This chapter describes IBM Business Process Manager configuration. It includes the following chapters:

- 17.1, “Configuring the Simple Mail Transfer Protocol (SMTP) server” on page 386
- 17.2, “Converting an offline Process Server to online” on page 387
- 17.3, “Connect IBM Process Designer with Process Center” on page 388
- 17.4, “Connect IBM Integration Designer with Process Center” on page 388
- 17.4.1, “Connect a Process Center with another Process Center” on page 389
17.1 Configuring the Simple Mail Transfer Protocol (SMTP) server

To allow IBM Business Process Manager to send notifications through email, you must define and configure the SMTP server that the IBM Business Process Manager environment uses.

This must be done in the IBM Business Process Manager configuration files. These configuration override changes must be applied by using the 100Custom.xml configuration override file on each node. These changes apply to the Process Center and to every Process Server.

For more information about how to apply changes in the IBM Business Process Manager configuration files, see Appendix B, “Configuring IBM Business Process Manager configuration settings” on page 409.

Add a custom XML file like 101Custom_mail.xml and include the code in Example 17-1, or you can also change your existing 100Custom.xml file. Replace the following values with those for your target Process Center or Process Server environment:

smtp.yourdomain.com
bpmadmin@yourdomain.com

Example 17-1 Configuration override for configuring SMTP server

```xml
<properties>
  <server merge="mergeChildren">
    <email merge="mergeChildren">
      <!-- SMTP server that mail should be sent to -->
      <smtp-server merge="replace">smtp.yourdomain.com</smtp-server>
      <!-- If this is set to true then the from address set on external email will -->
      <!-- include a valid email address, which is either the user's contact email -->
      <!-- address or the default address below if no contact address is found. -->
      <valid-from-required merge="replace">true</valid-from-required>
      <!-- Used when sending external email if the sender has no email contact info set -->
      <default-from-address merge="replace">bpmadmin@yourdomain.com</default-from-address>
      <send-external-email merge="replace">true</send-external-email>
    </email>
  </server>
</properties>
```
17.2 Converting an offline Process Server to online

After you install and configure your IBM Business Process Manager runtime server, you can change the Process Server from an offline server to a Process Center connected server, and vice versa.

This process must also be done in the IBM Business Process Manager configuration files. These configuration override changes must be applied by using the 100Custom.xml configuration override file on each node. They apply to the Process Center and to every registered Process Server.

For more information about how to apply changes in the IBM Business Process Manager configuration files, see Appendix B, “Configuring IBM Business Process Manager configuration settings” on page 409.

To customize the settings that are used by Process Server to connect to a Process Center, complete the following steps:

1. Stop the deployment manager and the Process Server cluster or server if they are running.
2. Edit the connection values in your custom XML file.
   
   – Before the update:
     `<repository-server-url>/ProcessCenter</repository-server-url>`
     `<repository-server-interval>-1</repository-server-interval>`
   
   – After the update:
     `<repository-server-url>http://localhost:9190/ProcessCenter</repository-server-url>`
     `<repository-server-interval>10</repository-server-interval>`

   **Note:** An offline server is indicated with -1 as a value, such as `<repository-server-interval>-1</repository-server-interval>.

3. Restart the deployment manager.

   **Note:** If you have a network deployment environment, synchronize the node agents from the administrative console. Deployment manager and node agent synchronization are not needed for a stand-alone server.

4. Restart the Process Server cluster or server.
17.3 Connect IBM Process Designer with Process Center

By default, the downloaded IBM Process Designer connects to the Process Center it was downloaded from. In some cases, it cannot connect because you have configured a proxy server or an IBM HTTP Server.

Generally, the connection information to connect IBM Process Designer to the Process Center is stored in the `eclipse.ini`, which is in the IBM Process Designer installation directory. To modify the connection parameter, complete the following steps:

1. Navigate to the installation folder of the Process Designer, for example `C:\IBM\ProcessDesigner\v8.0`.
2. Open the `eclipse.ini` file and locate `-Dcom.ibm.bpm.processcenter.url`.
3. Modify the URL to match with your environment, such as `https://PC_hostname:port`.
4. Save and close the `eclipse.ini` file.
5. Start Process Designer to verify whether you can log in.

17.4 Connect IBM Integration Designer with Process Center

To be able to work with process applications or toolkits developed in IBM Business Process Manager you must connect your IBM Integration Designer to the Process Center.

Because there is no relation between IBM Integration Designer and Process Center, there is no predefined connection available. To connect your IBM Integration Designer to the Process Center, complete the following steps:

1. Open the IBM Integration Designer.
2. In the upper-right corner of the IBM Integration Designer, click Process Center.
3. In the repository window, enter the URL to connect to the Process Center repository in the following format: `http://<server name>:<port number>/ProcessCenter`. For example, `http://myserver.ibm.com:9080/ProcessCenter`.
4. Enter your user ID and password, and click Connect.
17.4.1 Connect a Process Center with another Process Center

A new function in IBM Business Process Manager is the ability to share toolkits between registered Process Center. When you register two Process Centers with each other, you can share toolkits with other authors, or subscribe to toolkits that other authors share.

You can share toolkits with other authors, even if those authors are working in a different Process Center.

The supported protocols are HTTPS (HTTP over Secure Socket Layer) and HTTP. To be able to share toolkits, your administrator must connect the Process Centers.

**Important:** If you want to use the HTTPS protocol to connect Process Centers in different cells of IBM WebSphere Application Server, you must set up a security trust between the participating Process Centers. For more information about configuring cross-cell security, see:


If you want to use the HTTP protocol, the user name and password must be the same on both Process Centers.

To register a Process Center, complete the following steps:

1. In the Process Center console, click the **Admin** tab.
2. Click **Registration**.
3. On the Registration window, select **Enable Registration and Sharing**, and then enter a unique name for this Process Center.
4. Click **Create Registration**.
5. In the **Register a content source** field, select **Remote Process Center**.
**Requirement:** If you use a proxy server, you must specify the proxy server URL. This restriction applies only to a clustered environment.

For more information about sharing toolkits and how to enable it, see the following website:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.admin.doc/topics/sharing_pa_toolkit.html
Appendixes

This part includes the following appendixes:

- Appendix A, “Database design tool” on page 393
- Appendix B, “Configuring IBM Business Process Manager configuration settings” on page 409
- Appendix C, “Different approach for installing IBM products” on page 427
- Appendix D, “Additional material” on page 445
Database design tool

This appendix describes the database design tool (DDT) and the database design file that it generates. This appendix also shows how you use DDT and presents examples.

This appendix includes the following sections:

- “Overview of database design tool” on page 394
- “Overview of database design file” on page 394
- “Using the database design tool” on page 395
- “Using the database design file” on page 405
- “Quick reference” on page 408
Overview of database design tool

The database design tool (DDT) is a command-line tool that generates or edits a database design file iteratively. The database design file is the main output of DDT. Therefore, the database design tool also generates the database script files. These files are created based on the properties of a database design file.

DDT can run iteratively or using command-line options.

When you create a database design file, you run DDT iteratively. DDT prompts you for the information necessary to create the database design file. For most inputs, DDT shows a default value. After you enter all of the data, you can choose to exit and generate the database design file.

You can run DDT with the command-line options when you want to generate the database script files.

Overview of database design file

The database design file is generated by DDT. It contains the definition of the database objects necessary to configure and run IBM Business Process Manager or IBM Business Monitor.

The database design file is a configuration file that can be used to perform these tasks:

- Provide database information during profile creation.
- Specify database configuration properties during deployment environment creation.
- Generate database script files that are used to create databases, tables, indexes, table spaces, and other database objects.

The database design file is a text file with the configuration that you chose during the iterative execution of the DDT.

When you create a deployment environment, you use only one database design file for the entire process. This file is the only source for the profile management tool (pmt), for the manageprofile command-line tool (manageprofile), and for the deployment environment wizard in the WebSphere Integrated Solutions Console. It is also used to generate the database script files. The use of this unique file simplifies configuration of the deployment environment, no matter what topology that you choose.
Using the database design tool

This section provides examples of using DDT. After it is created, the database design file can be changed manually by editing it or by using the DDT. To change the database design file by using DDT, select option 3 on the first option menu. You can also run DDT with the -e command-line option to automatically open a database design file and change it.

**Limitations:** The DDT does not perform the following tasks:

- It does not generate database scripts for the Common Event Infrastructure. The Common Event Infrastructure database scripts are created after the generation of the deployment environment.

- It does not generate a `create database` command for all database components (for example, the messaging engine database).

- It does not generate a master script to run all database scripts.
Creating a database design file

This section provides an example of how to create a database design file for a Process Server or Process Center dmgr profile.

1. Run the DDT, entering `<install_dir>/util/dbUtils/DbDesignGenerator.sh`. Figure A-1 shows the initial options that you have when you enter the DDT.

   Note: This example is created on a UNIX system. If you are using another operating system, the options might be displayed in another way.

   ![Figure A-1](image)

   2. Select option 1 to create a new database design file for a deployment environment.
3. Figure A-2 shows the available pattern options available. Select option 1 to create the database config file for a network deployment topology for Process Server or Process Center.

```
Please enter the number for the design option :1

[INFO] Please pick one of the following [database pattern(s)] :

(1)bpm.advanced.nd.topology
(2)bpm.advanced.standalone
(3)bpm.standard.nd
(4)bpm.standard.standalone
(5)monitor.nd.topology
(6)monitor.standalone
(7)wesb.nd.topology
(8)wesb.standalone

Please enter the number for the database pattern :1
```

*Figure A-2   Database pattern options*

4. The DDT shows all the database components for a deployment environment. (Figure A-3 on page 398). Each database component has status information about whether it is completed. At this moment, all components have the status not complete.

**Note:** Also, the CommonDB component is listed as the master component (Figure A-3). This means that all other components inherit the configuration that is defined for the CommonDB. When you configure CommonDB, most properties are defined for the other components.
5. After you select the database component that you want to configure, you are presented with the databases types available (Figure A-4). In this example, DB2-distributed is selected.

Figure A-3  Database components

Figure A-4  Database types
6. The next step is to define properties for the component and database type that you selected. You might have to provide a database name, user name, table space configuration, and so on. For the CommonDB in DB2, you must enter the properties that are shown in Figure A-5.

![Properties for CommonDB in a DB2 database](image)

Figure A-5  Properties for CommonDB in a DB2 database
7. Provide the data source values. Figure A-6 shows the configuration for the example environment.

[info] You have completed database objects section properties needed for database scripts generation.

To skip data source properties, enter 's'; or enter anything else to continue:

[info] Please pick one of the following [database provider(s)]:

(1) DB2 Universal JDBC Driver Provider # XA data source # DB2 Universal JDBC Driver Provider (XA)
(2) DB2 Using IBM JCC Driver # XA data source # DB2 Using IBM JCC Driver (XA)

Please enter the number for the database provider: 1

[info] Please enter the values for the properties in the data source properties section.

Database server host [default=] : db2itso.itso.ral.ibm.com
Database server port [default=50000] :
Data source user name [default=bpm1Inst] :
Data source password [default=] : its04you
DB2 Universal JDBC driver path [default=\${WAS_INSTALL_ROOT}/jdbcdrivers/DB2] :
Universal JDBC driver path [default=\${WAS_INSTALL_ROOT}/jdbcdrivers/DB2] :

Figure A-6  Data source configuration
8. DDT displays the main menu after you configure the CommonDB component. Because this component is the master one, the other components inherit its properties. As you see in Figure A-7, almost all components are marked with the status complete.

![Figure A-7   Main menu](image)

9. You must configure all the components until they show the status complete. To do so, select each component that shows a status of not complete and complete its configuration.

10. If you need to change any property of a component, select it from the menu and go through the configuration steps again. The default properties shown this time are those that you entered in the previous step.
11. After you configure all components, create the database design file. Select the **Save and exit** option (Figure A-8). You are prompted with the path and name for the database design file.

![Figure A-8   Saving and exiting DDT](image)

<table>
<thead>
<tr>
<th>File</th>
<th>Edit</th>
<th>View</th>
<th>Terminal</th>
<th>Tabs</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6)[BSpace]</td>
<td>WBI_BSPACE : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7)[SibME]</td>
<td>WBI_BPC_ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8)[SibME]</td>
<td>WBI_CEI ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9)[SibME]</td>
<td>WBI_SCA_APP_ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10)[SibME]</td>
<td>WBI_SCA_SYS_ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(11)[SibMe]</td>
<td>BPM_PerformanceDW_ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(12)[SibMe]</td>
<td>BPM_ProcessServer_ME : [status = complete]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(13)[save and exit]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please enter the number for the database component :13

```
[status] bpm.advanced.nd.topology is complete with 0 remaining item(s):
```

Please enter the output directory [default=/opt/IBM/WebSphere/AppServer/util/dbUtils] :

Please enter the output filename [default=bpm.advanced.nd.topology.dbDesign] :

```
[info] The database design has been generated in /opt/IBM/WebSphere/AppServer/util/dbUtils/bpm.advanced.nd.topology.dbDesign
```

generate database scripts? (y/n) [default=y] : n
[info] thanks, quitting now ...

```
[root@itso dbUtils]# 
```

Figure A-8  Saving and exiting DDT

12. You can generate the database scripts file by entering `y`.

**Generating the database scripts**

There are two ways to generate the database scripts after you create the database design file. You can create them iteratively or directly using the command line with options.
Generating the database scripts iteratively

To generate the database scripts files iteratively, complete these steps:

1. Run the DDT, entering `<install_dir>/util/dbUtils/DbDesignGenerator.sh`.
2. Select option 4 to generate the database scripts from a database design file, then enter the database design file name (Figure A-9).

![Generating script files iteratively](image)
3. DDT opens the database design file and validates its content. If it is okay, DDT prompts you to create the database scripts (Figure A-10).

```
[root@itso dbUtils]# ./DbDesignGenerator.sh
[info] running DbDesignGenerator in interactive mode...
[info] Enter 'q' to quit without saving; '-' for back to previous menu; '?' for help at any time.
[info] To accept the given default values, simply press the 'Enter' key.

[info] Please pick one of the following [design option(s)] :
(1) Create a database design for Standalone profile or Deployment Environment
(2) Create a database design for a single component
(3) Edit an existing database design
(4) Generate database scripts from a database design
(5) exit [q]
Please enter the number for the design option : 4
Please enter the database design file : bpm.advanced.nd.topology.dbDesign

generate database scripts? (y/n) [default=y] : y
Please enter the output directory for WBI_CEI_ME [default=DB2-distributed-SibME/WBI_CEI_ME] :
```

Figure A-10  Generating the database scripts

4. For each component, DDT prompts you for the output directory. The directory that you select will contain one or more database script files.

5. After the files of the last component are generated, DDT quits.

**Generating the database scripts by using a command line**

You can generate the database script files by running the DDT with the `-g` option. When you use the `-g` option, you must specify the name of the database design file. The DDT syntax with the `-g` option is:

```
./DbDesignGenerator.sh -g <dbDesign_file> [-d <generate_dir>]
```
The -d option defines the directory to generate the database script files (Example A-1). If you omit the -d option, DDT uses the current directory.

**Using the -d option:** If you use the -d option, DDT generates all database design files in this directory. This means that if you are creating database design files for different databases, each new one overrides the previous one because they have the same name.

**Example A-1  Generating database script files with the -g option**

```bash
./DbDesignGenerator.sh -g bpm.advanced.nd.topology.dbDesign
[info] running DbDesignGenerator in generating mode...
[info] The script(s) have been generated in
/opt/IBM/WebSphere/AppServer/util/dbUtils/DB2-distributed-SibME/WBI_CEI_ME
[info] The script(s) have been generated in
/opt/IBM/WebSphere/AppServer/util/dbUtils/DB2-distributed-BPM_ProcessServer

...                                          

[info] The script(s) have been generated in
/opt/IBM/WebSphere/AppServer/util/dbUtils/DB2-distributed-CommonDB
[info] thanks, quitting now ...
```

**Using the database design file**

The database design file is used to create the database scripts file running DDT. It can also be used to create a dmgr profile and deployment environment.

The following examples show how to use the database design file.
Creating a profile with Profile Management Tool

When using the Profile Management Tool to create a dmgr profile, you can use a database design file. Figure A-11 shows the pmt step where you select the database design file that was generated by DDT.

![Profile Management Tool 7.0](image)

*Figure A-11  Selecting the database design file in Profile Management Tool*

Creating a profile with manageprofile

The database design file can be used to create a dmgr profile by using the `manageprofile` command-line tool:

```
./manageprofiles.sh -create -templatePath <TemplateLocation>
-adminUserName bpmadmin -adminPassword itso4you -bpmdbDesign
ps.bpm.advanced.nd.topology.dbDesign -dbDelayConfig true
```

The database design file can also be used to create a dmgr profile by using the `manageprofile` command-line tool with the response file:

```
./manageprofile.sh -response <response_file>
```
Example A-2 shows the response file.

Example A-2  Response file using database design file

```plaintext
create
templatePath=/opt/IBM/BPM/profileTemplates/BPM/dmgr.procsvr.ad
adminUserName=bpmadmin
adminPassword=itso4you
bpmdbDesign=/home/bpmuser/ps.bpm.advanced.nd.topology.dbDesign
dbDelayConfig=true
```

Creating a deployment environment with the admin console

The same database design file is used during the deployment environment wizard to define the database properties (Figure A-12).

*Figure A-12  Using the database design file during deployment environment creation*
Quick reference

This section provides a quick reference for the database design tool:

- DDT location and command:
  
  `<install_dir>/util/dbUtils/DbDesignGenerator.sh`

- DDT options are:
  
  `-e <db_design_file>`
  to edit a previous created database design file

  `-g <db_design_file> [-d <output_directory>]`
  to generate the database design scripts using the
  `<db_design_file>` information

  `-v <db_design_file>`
  to validate the `<db_design_file>`

  `-?`
  to show the DDT options

- Database design file name that is created by DDT:
  
  `<file_name>.dbDesign`

- The database design file is used to help perform these tasks:
  
  - Generate the database scripts files using DDT.
  - Create a DMGR profile by using pmt.sh(bat) or manageprofile.sh(bat).
  - Create a deployment environment by using the admin console.
Configuring IBM Business Process Manager configuration settings

This appendix describes the IBM Business Process Manager server configuration files that determine the settings that are applied to a IBM Business Process Manager Environment.

The configuration files contain a specific variant or dialect of Extensible Markup Language (XML) used to parameterize, set, and expose configuration settings for the Business Process Modelling Notation (BPMN) components of all IBM Business Process Manager editions. These BPMN configuration settings are managed by configuration, usually by manually creating and editing custom override configuration XML files, such as 100Custom.xml and 101CustomSMTP.xml. They are not managed from within the IBM Business Process Manager web-based administration console or the WebSphere Integrated Solutions Console web-based administration console.

For more information, see the following resources:

- Managing Process Servers
  
IBM Business Process Manager Config File Overview and Explanation

Enhance your 100Custom.xml

Search IBM documentation for 100Custom.xml

This appendix contains the following sections:

- “Configuration file overview and explanation” on page 411
- “Scope of configuration settings and dependencies” on page 411
- “Configuration file details” on page 416
- “Overriding configuration settings” on page 418
- “Examples” on page 421
Configuration file overview and explanation

There are a number of areas in which the IBM Business Process Manager product configuration settings are managed. Usually, the tool that is used to manage the relevant configuration settings has a direct relationship to where the configuration settings are applied (Figure B-1).

Scope of configuration settings and dependencies

This section describes the scope of various configuration settings and where they are managed to put the configuration override XML file into context.
Network-specific configuration dependencies and settings

The network configuration dependencies are set up using the appropriate network management tools. The following settings, among others, can affect the installation and management of the IBM Business Process Manager product:

- Load balancer settings
- Virtual IP (VIP) address settings
- Domain Name System (DNS) settings

The relevant IBM Business Process Manager configuration settings are managed by using the configuration override XML file, `100 Custom.xml`. For more information, see “Overriding configuration settings” on page 418.

Operating-system-specific configuration dependencies and settings

For the target operating system, the configuration dependencies are set up by using the appropriate operating system management tools. The following settings, among others, can affect the installation and management of the IBM Business Process Manager product:

- Creating, stopping, and starting Windows Services
- User account environment variable that is used for the temporary directory

The relevant IBM Business Process Manager configuration settings are managed by using the configuration override XML file, `100 Custom.xml`. For more information, see “Overriding configuration settings” on page 418.

Java Platform, Enterprise Edition Application Server-specific configuration dependencies and settings

The Java Platform, Enterprise Edition application server used is IBM WebSphere Application Server. It usually provides a number of enterprise Java services, also known as container-based services. For more information about the Java Platform, Enterprise Edition Application Server specification and IBM WebSphere Application Server in particular, see these resources:

- IBM WebSphere Application Server online documentation: [http://publib.boulder.ibm.com/infocenter/wasinfo/v8r0/index.jsp](http://publib.boulder.ibm.com/infocenter/wasinfo/v8r0/index.jsp)

Java Platform, Enterprise Edition application server configuration settings for IBM WebSphere Application Server are primarily accomplished by using the
product-supplied WebSphere Integrated Solutions Console. The following enterprise services, among others, are provided and can affect the installation and management of IBM WebSphere Application Server:

- Java Database Connectivity (JDBC) data sources and connection pooling
- Java Message Service (JMS) queues and connection factories
- Java Transaction API (JTA)
- Java API for XML (JAX)

**Business Process Modelling Notation engine-specific settings**

The Business Process Modelling Notation engine can also use Java-based services that are provided directly by the IBM Business Process Manager product. It can do so by applying configuration settings that are defined by using XML files. That is, the Custom.xml configuration overrides the XML file that is used to configure the following items:

- Business Process Modelling Notation engine temporary directory.
- Simple Mail Transfer Protocol (SMTP) server to use for sending or relaying generated email for user task notification.
- For the Process Portal, generate target load balancer URLs for Business Process Diagram (BPD) coaches, Process Portal URLs, Process Task URLs, task emails, XML namespaces, and so on.

For IBM Business Process Manager, the default XML configuration files are in the <IBM Business Process Manager Installation Directory>/Process Center or Process Server profile configuration directory>/config directory. They are created during installation of the product, and are loaded in numerical name order.

The directory path location of the configuration XML files depends on whether you have installed a stand-alone server environment, a clustered network deployment environment, or a single server network deployment environment:

- For a stand-alone server configuration:
  
  `<stand-alone-profile-root>/config\cells\<cell-name>\nodes\<stand-alone-node-name>\servers\<server-name>\process-server\config`

- For a network deployment cluster configuration:
  
  - In the network deployment Process Server cluster:
    
    `<DMGR-profile-root>/config\cells\<cell-name>\clusters\<cluster-name>\process-server\config`
Each Process Server cluster member at:

<DMGR-profile-root>\config\cells\<cell-name>\nodes\<custome-node-name>\servers\<cluster-member-name>\process-server\config

For a network deployment single server configuration:

<DMGR-profile-root>\config\cells\<cell-name>\nodes\<custome-node-name>\servers\<server-name>\process-server\config

The standard files are loaded in the following order:

1. ./config/system/00Static.xml
2. ./config/system/50AppServer.xml
3. ./config/system/60Database.xml
4. ./config/system/80EventManager.xml
5. ./config/system/98Database.xml
6. ./config/system/99Local.xml
7. ./config/system/99Sharepoint.xml
8. ./config/100Custom.xml

These files are merged to produce the overall configuration that is used by either a Process Center or a Process Server. For more information about Process Center and a Process Server components of IBM Business Process Manager, see Chapter 2, “Business Process Manager, Business Monitor, and WebSphere Application Server” on page 13.
The full and final configuration space is written to the TeamWorksConfiguration.running.xml file after it is merged and loaded from the various individual configuration files at startup time. The TeamWorksConfiguration.running.xml file shows the actual configuration values that are applied from merging all of the xml config files present in the ./config/ directory on the target running Process Center or Process Server. See Figure B-2 for a high-level breakdown of server components.

Note: Currently, the contents and XML configuration settings within TeamWorksConfiguration.running.xml do not have fully documented references. Information is spread across technote, wiki pages, and so on. Changes to the configuration can be requested by IBM support or services. This section facilitates those sorts of configuration update activities.

![Process Center
Governance of Entire BPM Life Cycle
BPM Repository
Versioned Assets
Server Registry
Shared Assets
Design
Measure
Deploy
Improve

Process Server
BPMN Rules Monitoring BPEL ESB
Out-of-box Process Portal Configurable Business Space Optional Microsoft Add-ons

Figure B-2 IBM Business Process Manager server components

The rest of this appendix focuses on details about the use, editing, and settings that are configured in the 100Custom.xml configuration override file and examples.
Configuration file details

By default, the first time that a configuration element is loaded from an IBM Business Process Manager configuration XML file, it is present in the final generated configuration. For example, if both 99Local.xml and 100Custom.xml contain the configuration XML tag <environment-name>, the configuration XML tag in 99Local.xml is the final version. This occurs unless the merge attribute is set to replace it in 100Custom.xml. The actual mechanics for overriding previously set configuration settings are detailed later in this section.

Custom configuration override XML files are designed to hold the configuration customizations, overrides, and changes that are made to any part of the IBM Business Process Manager configuration space (for example, 100Custom.xml). These are merged from the individual configuration files into the final TeamWorksConfiguration.running.xml configuration file that details the configuration settings used.

Generally, use custom configuration override XML files (for example, 100Custom.xml) for configuration overrides, as opposed to directly editing the XML configuration files that are generated during the product installation.

For more information, see “Managing IBM Business Process Manager configuration settings” at:


If a brand new installation of IBM Business Process Manager is performed, apply a corresponding, existing 100Custom.xml for that version. All the changes that have been made are applied and used, overriding the current configuration values.

This is the suggested approach to use for overriding the default installation configuration. If for any reason a reinstall is required or any existing configuration settings in the individual default configuration files must be updated, apply these configuration changes by using the 100Custom.xml configuration override file. This process is self-documenting, and ensures consistent application of the required changes.

For example, place any additional columns or views for your Process Portal task manager in the 100Custom.xml configuration override file. Add any changes to default values, such as your system lane user, in the 100Custom.xml file.

You can have separate custom configuration override XML files for a set of configuration settings that are related to a specific function. For example, you can create 101CustomSMTP.xml to override relevant SMTP configuration settings and
To override relevant Load balancer configuration settings, ensure that the file name used for the custom configuration override XML file is unique and preceded by a numerical increment, one higher than the lowest custom configuration file. For example, because `100Custom.xml` already exists, the next file can be `101CustomSMTP.xml`.

**Tip:** When moving to a new version of the software, always review the configuration changes applied using the current custom configuration override files. This review check point ensures that the current configuration overrides being applied are still relevant for the new version. For example, some of the default settings or database queries that you use to customize the Process Portal task manager might change between releases or even fix pack. Other configuration override settings might no longer apply.

### Backing up existing config files

Use an XML file editor that validates XML documents, and make a backup copy of any files you are editing. But these configuration XML files are one area in which some caution must be exercised when you are making backup copies. Specifically, always change the extension from `.xml` when backing up these files.

All of the files in the `[IBM Business Process Manager Installation Directory]/[IBM Business Process Manager Component Server Directory]/config` directory that have the `.xml` file extension are loaded by IBM Business Process Manager upon startup. These configuration XML files are loaded in the following order:

1. Files starting with letters are loaded first.
2. Files starting with numbers in numerical order are loaded next. For example, if you have the following configuration of XML files in the `[IBM Business Process Manager Installation Directory]/[IBM Business Process Manager Component Server Directory]/config` directory, they are loaded in the order shown:
   
   a. `./config/system/Copy of 99Local.xml`
   b. `./config/system/00Static.xml`
   c. `./config/system/50AppServer.xml`
   d. `./config/system/60Database.xml`
   e. `./config/system/80EventManager.xml`
   f. `./config/system/98Database.xml`
   g. `./config/system/99Local.xml`
   h. `./config/100Cusom.xml`
Therefore, any settings in the Copy of 99Local.xml take effect and any settings in the 99Local.xml are ignored (except for elements that include the merge=replace attribute).

Tip: Ensure that a different extension, like .bak, is used when you back up configuration XML files.

Overriding configuration settings

For IBM Business Process Manager, there are two types of server components:

- Process Center or Process Server
- Performance Data Warehouse (PDW)

The following types of IBM Business Process Manager environments can be set up:

- Development Process Center
- Test Runtime Process Server
- Stage Runtime Process Server
- Production Runtime Process Server

For the IBM Business Process Manager, configuration overrides can apply based on the following scope:

- Server component type (that is, either a Process Center or a Process Server)
- System Environment (that is, development, test, staging, or production)
- IBM Business Process Manager environment

For more information, see Chapter 2, “Business Process Manager, Business Monitor, and WebSphere Application Server” on page 13.

The following section describes the configuration overrides, and applies and provides examples.
For a Process Center or Process Server component, the configuration XML file has the high-level structure that is shown in Figure B-3.

```
<folder
  name="root"
  <folder
    <folder
      <folder
        <folder
          <folder
            <authoring-environment
              <common
                <server
                  <event-manager
```

Figure B-3  Process Center or Process Server configuration XML file structure

For a Performance Data Warehouse (PDW) component, the configuration XML file has the high-level structure that is shown in Figure B-4.

```
<properties
  <authoring-environment
    <common
      <eventmanager
        <server
          <performance-server
```

Figure B-4  Performance Data Warehouse (PDW) configuration XML file structure

The 100Custom.xml configuration XML override file is used to replace existing, extend existing, or add new configuration settings. The 100Custom.xml configuration XML has the high-level structure that is shown in Figure B-5.

```
<properties
```

Figure B-5  00Custom.xml configuration

Figure B-5 just shows an empty <properties> configuration XML tag. All other configuration XML tags to be contained within the <properties> tag must be valid XML tags that override or extend existing configuration XML tags, which are achieved by using the merge attribute.
Using the merge attribute

When loading or replacing values by using the 100Custom.xml configuration override file, take care when you select the merge setting to use for each configuration XML tag element. For each defined configuration XML tag element, the merge attribute supports the following values:

- **append**
  This value appends the newly defined configuration XML tag element.

- **mergeChildren**
  This value merges the new newly defined configuration XML tag element with the first of any existing ones. This is the default behavior. The mergeChildren attribute is supposed to combine a child configuration XML tag element with a parent configuration XML tag element. The mergeChildren attribute does not combine a child configuration XML tag element with a parent-child configuration XML tag element if the parent does not have any attributes and the child has only text values.

- **replace**
  This value replaces all existing configuration XML tag elements with the override configuration XML tag elements defined.

There are examples of the use of the append, replace, and merge attributes in 50AppServer.xml and 60DataBase.xml that overrides items in 00Static.xml depending on the database/application server. Using an example from the sample 100Custom.xml file, if you want to change the <environment-name>, in the 99Local.xml file, you have something like Example B-1.

**Example B-1  Extract from 99Local.xml**

```xml
<properties>
  ...
  <common merge="mergeChildren">
    ...
    <environment-name>Environment_from_99Local</environment-name>
    ...
  </common>
  ...
</properties>
```
To change the environment name in an override file that is called
104CustomEnvironmentNameOverride.xml, create something like Example B-2.

Example B-2  Custom configuration XML override file -
101CustomEnvironmentNameOverride.xml

```xml
<properties>
  <!-- 104CustomEnvironmentNameOverride.xml -->
  <common merge="mergeChildren">
    <environment-name
      merge="replace">Environment_from_101Custom</environment-name>
  </common>
</properties>
```

For more information, see “Changing Process Server properties” at:
http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.ad
min.doc/topics/changing_server_props.html

**Troubleshooting custom settings**

Use an XML text editor to create and modify custom configuration override XML
files to avoid common issues. You can, for example, close XML tags, and validate
the file to ensure that it is a proper XML document. Do not use the Windows
default text editor, Notepad, to edit XML files, as it might introduce hidden control
characters that create an invalid XML file.

Inspect the current TeamWorksConfiguration.running.xml file to confirm the
correct structure of the XML document and the tags to override.

**Examples**

This section details typical configuration override sample XML files. Each sample
shows the details for a complete individual 100Custom.xml file. To use more than
one sample, aggregate the relevant entries.
The directory path location of 100Custom.xml depends on whether you have installed a stand-alone server environment, a clustered network deployment environment, or a single server network deployment environment:

- For a stand-alone server configuration:
  <stand-alone-profile-root>\config\cells\<cell-name>\nodes\<stand-alone-node-name>\servers\<server-name>\process-server\config\100Custom.xml

- For a network deployment cluster configuration:
  - In the network deployment Process Server cluster:
    <DMGR-profile-root>\config\cells\<cell-name>\clusters\<cluster-name>\process-server\config\100Custom.xml
  - Each Process Server cluster member:
    <DMGR-profile-root>\config\cells\<cell-name>\nodes\<custome-node-name>\servers\<cluster-memeber-name>\process-server\config\100Custom.xml

- For a network deployment single server configuration:
  <DMGR-profile-root>\config\cells\<cell-name>\nodes\<custome-node-name>\servers\<server-name>\process-server\config\100Custom.xml

**Typical IBM Business Process Manager configuration overrides**

These configuration overrides apply to both the Process Center and to every registered Process Server. These configuration override changes must be applied by using the 100Custom.xml configuration override file on each node.

You must alter the generated URLs. Alter the generated URLs to use load balancer, front-end proxy or web server, Virtual IP address or DNS host name specific to your configuration (Example B-3).

*Example B-3  Configuration override for generating URLs*

```xml
<properties>
  <!--
  Instructions:
  Replace "<load balancer or proxy host name>" with the appropriate Fully qualified name (FQN) for load balancer or proxy.
  Replace "<load balancer or proxy host port>" with the appropriate port number for load balancer or proxy.
  To use [load balancer or proxy], insert the Fully Qualified Name (FQN) for the Virtual IP or DNS name that load balances between http://[app server node 1]:[port] and http://[app server node 2]:[port].
  -->
</properties>
```
<authoring-environment merge="mergeChildren">
  
  <!--
  Used by the Process Designer debugger, if there is no direct HTTP access to the nodes
  -->
  <images-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/teamworks</images-prefix>
  <portal-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/portal</portal-prefix>
  <servlet-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/teamworks</servlet-prefix>
  <webapi-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/webapi</webapi-prefix>
  <repository-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/ProcessCenter</repository-prefix>
</authoring-environment>

<common merge="mergeChildren">
  
  <!--
  The next 5 URLs should load balance or proxy to all nodes, using the Virtual IP or DNS name with sticky sessions.
  -->
  <webservices merge="mergeChildren">
    <base-url merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/teamworks/webservices</base-url>
  </webservices>
  
  <portal-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/portal</portal-prefix>
  <process-admin-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/ProcessAdmin</process-admin-prefix>
  <teamworks-webapp-prefix merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/teamworks</teamworks-webapp-prefix>
</common>

<xml-serialization merge="mergeChildren">
  
  <default-namespace-uri merge="replace">http://<load balancer or proxy host name>:<load balancer or proxy host port>/schema/</default-namespace-uri>
</xml-serialization>

<office merge="mergeChildren">
  <sharepoint merge="mergeChildren">
Typical Process Server environment configuration overrides

For each Process Server registered with a specific Process Center, the configuration overrides discussed in this section can be applied, wherever relevant.
You must alter the Process Server installation permissions. To deploy process applications to an online Process Server, you must have the following access permissions to the process application to be deployed:

- Administrative access to install to Process Server in production environments
- Write access to deploy to any non-production Process Server
- Read access to deploy to Process Server in Development environments

Example B-4 shows the configuration override.

**Example B-4  Configuration override for Process Server installation permissions**

```xml
<properties>
  <server merge="mergeChildren">
    <!-- [group_name] = Name of the Process Server group members that are allowed to deploy process applications. -->
    <process-center-install-group merge="replace">[insert group_name]</process-center-install-group>
  </server>
</properties>
```

For more information, see the following reference:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.ad
min.doc/topics/managing_users_g.html

For more information about using the 100Custom.xml configuration override file, search the following IBM documentation for 100Custom.xml:

http://publib.boulder.ibm.com/infocenter/dmndhelp/v8r0m1/advanced/searc
hView.jsp?searchWord=100custom.xml&maxHits=500&group=None
Different approach for installing IBM products

This appendix provides a different approach for installing IBM products. The technique is based on creating a centralized installation repository instead of copying a product’s binary files to all systems that you must install the product to.

Important: Although the example given in this appendix is the IBM Business Process Manager product, this approach can be applied to installing any IBM product based on the IBM Installation Manager installer.

This appendix includes the following sections:

- “Introduction” on page 428
- “Preparing your environment in ten steps” on page 429
- “References” on page 444
Introduction

A repository is a directory that contains all the binary installation products and fixes. This chapter illustrates how to configure the remote repository that is accessed using the http protocol for installing product binary files and fixes remotely by using the installation manager GUI or command line.

IBM already provides a public repository available on the internet for all clients. However, most clients' production environment do not have access to internet due security reasons. For this reason, some clients use other methods to speed up their installations.

The most common approach is to copy the product's binary files to all systems, but this approach it is time consuming and error prone. You also must allocate disk space for all systems.

Some customers like to create a virtual machine image with the products already installed. With this approach, you can have a master image that is always updated with the latest version of the product that includes applied fixes. Sometimes, you do not want to create one master image for each product you have because the management cost might be high. You can use the approach that is specified to have a centralized installation repository that you can implement with minimum effort resources.
Preparing your environment in ten steps

This section covers preparing your environment for this solution.

Installing the web server

Decide what type of web server you are willing to install. You can use one web server of your preference such as Apache, Microsoft Internet Information Services (IIS), or IBM HTTP Server. This chapter explains how to set up Apache web server and prepare IBM Business Process Manager to be installed.
These examples use the Red Hat Linux operating system. It is simple to install and configure the Apache web server. You can use the yum utility or the graphical interface to do it.

To use the graphical interface to install the Apache web server, complete these steps:

1. Click **System → Administration → Add/Remove Software** (Figure C-2).

   ![Add/Remove software option on Red Hat Linux](image1)

   **Figure C-2**   Add/Remove software option on Red Hat Linux

2. Choose **Apache HTTP Server and dependencies** and click **Apply** (see Figure C-3).

   ![Installing Apache HTTP Server on Red Hat Linux](image2)

   **Figure C-3**   Installing Apache HTTP Server on Red Hat Linux

In Red Hat Enterprise Linux, the httpd package provides the Apache HTTP Server. Run `rpm -q httpd` to see whether the httpd package is already installed. If it is not installed and you want to use the Apache HTTP Server, run the following command as the root user to install it:

```
Yum install httpd
```
After you install the Apache web server, the default installation directory root is in 
/var/www and your document root is in /var/www/html by default, as shown in 
Figure C-4.

![Image](Figure C-4 Directory root of Apache web server)

You do not need to change any configuration related to the document root of 
Apache web server, but you can change if you want.

**Creating the configuration and naming conventions**

After you install Apache web server, think about how to organize your directory 
structure and define your naming conventions for your binary files so that you can 
find a specific product easily. Table C-1 shows an example structure. Create 
these directories from the document root of your web server. In Apache, if you 
are using the default document root, create the directories inside of 
/var/www/html.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Operating system</th>
<th>Version of the product</th>
<th>Repository directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM HTTP Server</td>
<td>Linux x86 32/64 bits</td>
<td>8.0</td>
<td>/ibm/ihs/v801/linux_x32_64/</td>
</tr>
<tr>
<td>IBM HTTP Server</td>
<td>IBM AIX®</td>
<td>8.0</td>
<td>/ibm/ihs/v801/aix/</td>
</tr>
<tr>
<td>IBM HTTP Server</td>
<td>Windows</td>
<td>8.0</td>
<td>/ibm/ihs/v801/windows/</td>
</tr>
<tr>
<td>IBM Business Process Manager</td>
<td>Linux x86 32/64 bits</td>
<td>8.0.1</td>
<td>/ibm/bpm/v801/linux_x32_64/</td>
</tr>
<tr>
<td>IBM Business Monitor</td>
<td>Linux x86 32/64 bits</td>
<td>8.0.1</td>
<td>/ibm/wbm/v801/linux_x32_64/</td>
</tr>
</tbody>
</table>
Creating directories

Use the Linux command `mkdir` to create your directories in the operating system. To speed up this process, create a file with your directory entries and run the following bash script commands to create your directory structure:

1. Create a file, for example, `/tmp/directory_structure.txt`, with the following content (type one directory per line):
   
   ibm/ihs/v80/linux_x32_64/
   ibm/ihs/v80/aix/
   ibm/bpm/v801/linux_x32_64/
   ibm/bpm/v801/aix/
   ibm/wbm/v801/linux_x32_64/
   ibm/wbm/v801/aix/

2. Run the commands that are shown in Example C-1.

   Example C-1  Creating directories based on the input file with directory names
   
   ```bash
   cd /var/www/html
   cat /tmp/directory_structure.txt | while read line
do
       mkdir -p $line
   done
   ```

Copying and unpacking the binary files

Copy and unpack the binary files of the IBM Business Process Manager products to their specific folders that you created in “Creating directories” on page 432.

Table C-2 illustrates some IBM products and their part numbers so that you can download them to test this tutorial.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM HTTP Server</td>
<td>CZM91ML.zip</td>
</tr>
<tr>
<td></td>
<td>CZM94ML.zip</td>
</tr>
<tr>
<td></td>
<td>CZM95ML.zip</td>
</tr>
<tr>
<td></td>
<td>CZXR9ML.zip</td>
</tr>
<tr>
<td>IBM Business Process Manager</td>
<td>BPM_ADV_8.0.1_LNX_X86_32_64B-1_3.tar.gz</td>
</tr>
<tr>
<td></td>
<td>BPM_ADV_8.0.1_LNX_X86_32_64B-2_3.tar.gz</td>
</tr>
<tr>
<td></td>
<td>BPM_ADV_8.0.1_LNX_X86_32_64B-3_3.tar.gz</td>
</tr>
</tbody>
</table>
To unpack the products to the specific folders, use the following commands:

1. If the extension of the file is `.zip`, use the following command to unpack to a specific directory:
   ```bash
   unzip <zip_file> -d <target_dir>, where:
   <zip_file> is a name of the file
   <target_dir> is your target directory for unpacked files, for example: /var/www/html/ibm/ihs.
   ```

2. If the extension of the file is `.tar.gz`, use the following command to unpack to a specific directory:
   ```bash
   tar xvfz <tar_gz_file> -C <target_dir>
   <tar_gz_file> is a name of the packed file
   <target_dir> is your target directory for unpacked files, for example: /var/www/html/ibm/ihs/v80/linux_x32_64.
   ```

### Securing the web server

To secure the web server, define a user at the operating system level, define a password for that user, and add entries for a basic realm by editing the file `httpd.conf` on your Apache server. To do so, complete the following steps:

1. Create a user with the default configuration by running the following command:
   ```bash
   useradd ibmrepo
   ```

2. Create an http password file for the user `ibmrepo` by running the following command:
   ```bash
   htpasswd -c /var/www/passwd/passwords ibmrepo
   ```
   The password file that is generated is for web server use only.

   **Important:** Place this generated credential file, with the password for the repository, somewhere that is not accessible from the web. Doing so prevents people from downloading it through the browser.

   For example, if your documents are served from `/var/www/html`, you can put the password files in `/var/www/passwd`. 

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Business Monitor</td>
<td>Monitor_V801_Linux_x86_1_of_4.tar.gz</td>
</tr>
<tr>
<td></td>
<td>Monitor_V801_Linux_x86_2_of_4.tar.gz</td>
</tr>
<tr>
<td></td>
<td>Monitor_V801_Linux_x86_3_of_4.tar.gz</td>
</tr>
<tr>
<td></td>
<td>Monitor_V801_Linux_x86_4_of_4.tar.gz</td>
</tr>
</tbody>
</table>
3. Add the following entries to the file `httpd.conf` to define the basic authentication.
   a. To edit the file, run the following command:
      ```bash
      vi /etc/httpd/conf/httpd.conf
      ```
   b. Add the following entries in the Directory section of the file `httpd.conf` as shown in Example C-2.

   **Example C-2 Adding entries for basic authentication on httpd.conf file**
   ```
   <Directory "/var/www/html">
   AuthType Basic
   AuthName "Restricted Files"
   AuthBasicProvider file
   AuthUserFile /var/www/passwd/passwords
   Require user ibmrepo
   AllowOverride None
   Order allow,deny
   Allow from all
   </Directory>
   ```

   **Testing the remote repository**

   You can test your remote repository by using IBM Installation Manager GUI and command-line options. But first you must install the IBM Installation Manager on the client machine. You can add the Installation Manager binary file on the web server too, so that you can retrieve it using the `wget` or `curl` Linux commands. You can then extract and install the binary files later. To extract and install them, complete the following steps:

   1. Retrieve the binary files by using the following commands:
      ```bash
      wget <REPOSITORY_URL> --http-user <IM_REPOSITORY_USERNAME>
      --http-passwd <IM_REPOSITORY_PASSWORD>
      --directory-prefix=<TARGET_BINARY_DIR>
      ```
   2. Extract the binary files by using the following command:
      ```bash
      unzip <TARGET_BINARY_DIR>/* -d <TARGET_EXTRACT_DIR>
      ```
3. Install the binary files by using the following commands:

```
<TARGET_EXTRACT_DIR>/imcl install com.ibm.cic.agent -repositories
<TARGET_EXTRACT_DIR>/IM -installationDirectory <IM_HOME>
-acceptLicense
```

- `<IM_REPOSITORY_URL>` is the address of http remote repository. For example,
  http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_64bit/.

- `<IM_REPOSITORY_USERNAME>` is the user name such as ibmrepo.

- `<IM_REPOSITORY_PASSWORD>` is the password for user ibmrepo.

- `<TARGET_BINARY_PATH>` is the target directory to copy the Installation Manager binary file to.

- `<TARGET_EXTRACT_DIR>` is the directory for extracted files of the Installation Manager binary.

- `<IM_HOME>` is the home directory of Installation Manager, for example /opt/IBM/InstallationManager/eclipse.

Example C-3 shows the installation of the remote repository in the example environment.

**Example C-3  Installing IBM Installation Manager from the remote repository**

```
gtk.x86_64_1.6.0.20120831_1216.zip --http-user ibmrepo --http-passwd ibmrepo --directory-prefix=/tmp/IBM/IM

unzip /tmp/IBM/IM/*.zip -d /tmp/IBM/IM_extracted

/tmp/IBM/IM_extracted/imcl install com.ibm.cic.agent -repositories
/tmp/IBM/IM_extracted/IM64 -installationDirectory
/opt/IBM/InstallationManager/eclipse -acceptLicense
```
You can also retrieve and install the binary files by using the IBM Installation Manager GUI. Figure C-5 illustrates how to open IBM Installation Manager from the menu.

![IBM Installation Manager GUI](image)

*Figure C-5  Starting the IBM Installation Manager by using the menu option*

**Note:** You can also open the IBM Installation Manager GUI from the command line by using the following command:

```
/opt/IBM/InstallationManager/eclipse/IBMIM
```

4. To connect to your remote repository, click **File → preferences → Add repository**. Add the repository URL of the IBM Business Process Manager product.

**Important:** Point your URL to the directory that contains the `repository.config` file.
5. Provide the correct credentials as shown in Figure C-6, and click **OK**.
6. To test the setup, click **Install** to continue the procedure (Figure C-7).

Figure C-7  Click **Install** on the IBM Installation Manager to see whether the repository is working
If the repository is working, the Install Packages window shown in Figure C-8 is displayed.

![Install Packages](image)

**Figure C-8** Testing the remote http repository for IBM Business Process Manager

You can automate the process of adding repositories if you have many installations to do.

### Creating the credential keyring file

This section shows you how to create the credential keyring file used to connect to a secure repository during the silent installation of IBM products. To create a keyring, run the following command:

```
<IM_HOME>/tools/imutilsc saveCredential -url <IM_REPOSITORY_URL> -userName <IM_REPOSITORY_USERNAME> -userPassword <IM_REPOSITORY_PASSWORD> -keyring <IM_REPOSITORY_KEYRING_FILE>
```

- `<IM_HOME>` is the home directory of IBM Installation Manager, for example `/opt/IBM/InstallationManager/eclipse`
- `<IM_REPOSITORY_URL>` is the address of http remote repository, for example: http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_64bit/

- `<IM_REPOSITORY_USERNAME>` is the user name, for example ibmrepo

- `<IM_REPOSITORY_PASSWORD>` is the password for user ibmrepo

- `<IM_REPOSITORY_KEYRING_FILE>` is the file path of the keyring, for example /tmp/im_keyring

The results of the command are shown in Example C-4.

**Example C-4  Example of the Linux command**

```
```

In Example C-4, the command creates a file called `im_keyring` in the `tmp` directory. This file contains the encrypted repository password.

### Installing the IBM Business Process Manager binary file

This section shows how to install the binary file of the IBM Business Process Manager product by using the remote http repository from the command line. There are two ways to do perform this task:

- Pass parameters to the command line
- Use a response file

You can use which one that best fit to your needs.

- The following is the command line with argument options:
  ```
  ```

  – `<IM_HOME>` is the home directory of IBM Installation Manager, for example: `/opt/IBM/InstallationManager/eclipse`

  – `<BPM_HOME>` is the directory `/opt/IBM/BPM/v80`
– `<BPM_REPOSITORY_URL>` is the URL of your http repository, for example:
  http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_64bit/

– `<KEYRING_FILE>` is the file that you generated in “Creating the credential keyring file” on page 439, such as /tmp/im_keyring

Example C-5 shows the output of the command.

Example C-5  Installing IBM Business Process Manager V8 by command line

```
/opt/IBM/InstallationManager/eclipse/tools/imcl install
com.ibm.bpm.ADV.V80,bpmAdv.prod
com.ibm.websphere.ND.v80,core.feature,ejbdeploy,thinclient,embeddable
econtainer,com.ibm.sdk.6_64bit -acceptLicense -installationDirectory
/opt/IBM/BPM/v80 -repositories
http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_6
4bit/ -keyring /tmp/im_keyring -properties
user.select.64bit.image,,com.ibm.websphere.ND.v80=true
-showVerboseProgress -log silent_bpm_install.log
```

The following is the command with the response file:

```
<IM_HOME>/tools/imcl input <PATH_RESPONSE_FILE> -keyring
<KEYRING_FILE> -acceptLicense
```

– `<IM_HOME>` is the home directory of IBM Installation Manager, for example:
  /opt/IBM/InstallationManager/eclipse

– `<PATH_RESPONSE_FILE>` is the path for the response file, such as
  /tmp/response_file_bpm.xml

– `<KEYRING_FILE>` is the file that you generated in “Creating the credential keyring file” on page 439, such as /tmp/im_keyring

Example C-6 shows an example of the command.

Example C-6  Installing IBM Business Process Manager V8 by response file

```
/opt/IBM/InstallationManager/eclipse/tools/imcl input
/tmp/response_file_bpm.xml -keyring /tmp/im_keyring -acceptLicense
```

Example C-7 shows the output of the command.

Example C-7  Using a response file to install IBM Business Process Manager V8 using a remote http repository

```
<agent-input>
<server>
  <!-- ===IBM Installation Repository Location ===-->
```

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<repository location="http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_64bit/" />
</server>
<preference value="/opt/IBM/BPMShared" name="com.ibm.cic.common.core.preferences.eclipseCache" />
<preference value="/opt/IBM/BPM/v80" name="com.ibm.cic.common.core.preferences.eclipseCache" />
<preference value="/opt/IBM/BPM/v80" name="com.ibm.cic.common.core.preferences.connectTimeout" />
<preference value="/opt/IBM/BPM/v80" name="com.ibm.cic.common.corepreferences.readTimeout" />
<preference value="0" name="com.ibm.cic.common.core.preferences.downloadAutoRetryCount" />
<preference value="false" name="offering.service.reposito ries.areUsed" />
<preference value="false" name="com.ibm.cic.common.core.preferences.ssl.nonsecureMode" />
<preference value="false" name="com.ibm.cic.common.corepreferences.http.disablePreemptiveAuthentication" />
<preference value="true" name="com.ibm.cic.common.core.preferences.preserveDownloadedArtifacts" />
<preference value="false" name="PassportAdvantageIsEnabled" />
<preference value="false" name="com.ibm.cic.common.corepreferences.searchForUpdates" />
</preference>
</install>
<offering profile="IBM Business Process Manager Advanced V8.0.1" id="com.ibm.websphere.ND.v80" features='core.feature,ejbdeploy,thinc illusion,embeddablecontainer,samples,com.ibm.sdk.6_64bit'/>
<offering profile="IBM Business Process Manager Advanced V8.0.1" id="com.ibm.bpm.ADV.V80" features='wps.client.feature,wps.server.feature,bpmAdv.prod'/>
<preference value="30" name="com.ibm.cic.common.core.preferences.connectTimeout" />
<preference value="30" name="com.ibm.cic.common.core.preferences.readTimeout" />
<preference value="0" name="com.ibm.cic.common.core.preferences.downloadAutoRetryCount" />
<preference value="false" name="offering.service.repositories.areUsed" />
<preference value="false" name="com.ibm.cic.common.core.preferences.ssl.nonsecureMode" />
<preference value="false" name="com.ibm.cic.common.corepreferences.http.disablePreemptiveAuthentication" />
<preference value="true" name="com.ibm.cic.common.corepreferences.preserveDownloadedArtifacts" />
<preference value="false" name="PassportAdvantageIsEnabled" />
<preference value="false" name="com.ibm.cic.common.corepreferences.searchForUpdates" />
</preference>
</install>

Listing the available packages

This section shows how to list available packages for a specific product in the repository. This command is useful for troubleshooting.

Run the following command to check the available packages:

```bash
<IM_HOME>/tools/imcl listAvailablePackages -repositories <REPOSITORY_URL> -keyring <KEYRING_FILE>
```

- `<IM_HOME>` is the home directory of IBM Installation Manager, for example: `/opt/IBM/InstallationManager/eclipse`.
- `<REPOSITORY_URL>` is the URL of your http repository. For example, if you want to see the packages available for IBM BPM, use a URL like `http://itweb.us.ibm.com/ibm/bpm/v801/linux_x32_64/repository/repos_64bit/`.
- `<KEYRING_FILE>` is the file that you generated in “Creating the credential keyring file” on page 439, for example `/tmp/im_keyring`.

Example C-8 shows an example of the command.

**Example C-8  Listing available packages for IBM business process management**

```
```

Installing fix packs with a remote repository

This section shows how to install fix packs by using a remote repository from the command line. This example illustrates how to install the IBM HTTP Server binary file and fix pack together.

If you want to install the fix pack 8.0.0.5 for IBM HTTP Server, use the following command:

```bash
<IM_HOME>/tools/imcl install com.ibm.websphere.IHS.v80 installationDirectory <IHS_HOME> -properties user.ihs.httpPort=80
```
-acceptLicense -repositories <REPOSITORY_URL_BASE_VERSION>, <REPOSITORY_URL_FIX_VERSION> -keyring <KEYRING_FILE>

- <IM_HOME> is the home directory of IBM Installation Manager, for example /opt/IBM/InstallationManager/eclipse
- <IHS_HOME> is the home directory of your IBM HTTP Server, for example /opt/IBM/HTTPServer
- <REPOSITORY_URL_BASE_VERSION> is the URL address that points to the base version of IBM HTTP Server, for example http://itweb.us.ibm.com/ibm/ihs/v80/linux_x32_64
- <REPOSITORY_URL_FIX_VERSION> is the URL address that points to the fix pack for IBM HTTP Server, for example http://itweb.us.ibm.com/ibm/ihs/v805/linux_x32_64
- <KEYRING_FILE> is the file that you generated in “Creating the credential keyring file” on page 439, for example /tmp/im_keyring

Example C-9 shows installing the IBM HTTP Server.

Example C-9 Installing IBM HTTP Server from the command line with a remote repository

```
/opt/IBM/InstallationManager/eclipse/tools/imcl install
com.ibm.websphere.IHS.v80 installationDirectory /opt/IBM/HTTPServer
-properties user.ihs.httpPort=80 -acceptLicense -repositories
-keyring /tmp/im_keyring
```

References

For more information about implementing this solution, see the following documentation:

IBM Business Process Manager V8.0:

http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0mx/index.jsp

IBM Installation Manager:

dline.doc/topics/r_tools_imcl.html

Apache documentation:

http://httpd.Apache.org/docs/2.2/howto/auth.html
Additional material

This book refers to additional material that can be downloaded from the Internet as described in the following sections.

Locating the web material

The web material associated with this book is available in softcopy on the Internet from the IBM Redbooks web server. Point your web browser at:

ftp://www.redbooks.ibm.com/redbooks/SG248135

Alternatively, you can go to the IBM Redbooks website at:

ibm.com/redbooks

Select the Additional materials and open the directory that corresponds with the IBM Redbooks form number, SG248135.
Using the web material

The additional web material that accompanies this book includes the following files:

File name | Description
----------|-------------
SG248135.zip | Zipped configuration files

System requirements for downloading the web material

The web material requires the following system configuration:

Hard disk space: 10 MB minimum
Operating System: Windows/Linux

Downloading and extracting the web material

Create a subdirectory (folder) on your workstation, and extract the contents of the web material .zip file into this folder.
Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this book.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Note that some publications referenced in this list might be available in softcopy only.

- *Building IBM Business Process Management Solutions Using WebSphere V7 and Business Space*, SG24-7861
- *IBM Business Process Manager V7.5 Production Topologies*, SG24-7976
- *Scaling BPM Adoption: From Project to Program with IBM Business Process Manager*, SG24-7973
- *Understanding LDAP - Design and Implementation*, SG24-4986

You can search for, view, download or order these documents and other Redbooks, Redpapers, Web Docs, draft and additional materials, at the following website:

ibm.com/redbooks

Online resources

These websites are also relevant as further information sources:

- IBM Process Designer system requirements:
  

- IBM Integration Designer system requirements:
  
IBM Business Space powered by WebSphere:


Configuring a routing server for Process Portal in a three or four-cluster topology:


IBM Business Process Manager Advanced V8.0 hardware and software prerequisites:


IBM Installation Manager V 1.6 documentation:


Installing IBM Installation Manager silently:


Applying Mandatory Interim Fix JR44669:


Managing Process Servers


IBM Business Process Manager Config File Overview and Explanation Technote

http://www-01.ibm.com/support/docview.wss?uid=swg21439614

Enhance your 100Custom.xml

http://bpmwiki.blueworkslive.com/display/commwiki/Enhance+your+100Custom.xml

Search IBM documentation for 100Custom.xml

http://publib.boulder.ibm.com/infocenter/dmndhelp/v8r0mx/advanced/searchView.jsp?searchWord=100custom.xml&maxHits=500&group=None

JSR 316: Java Platform, Enterprise Edition 6 (Java EE 6) Specification

http://www.jcp.org/en/jsr/detail?id=316
IBM WebSphere Application Server online documentation
http://publib.boulder.ibm.com/infocenter/wasinfo/v8r0/index.jsp

Creating a Process Center environment using deployment patterns:
http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_pc_db2.html

Creating a Process Server environment using deployment patterns:
http://pic.dhe.ibm.com/infocenter/dmndhelp/v8r0m1/topic/com.ibm.wbpm.imuc.ebpm.doc/topics/ndenv_wiz_ps_db2.html

Additional deployment environment steps for IBM Business Monitor:

IBM Business Process Manager for iPhone and iPad:
https://www.blueworkslive.com/bpmmobile/

Help from IBM

IBM Support and downloads
ibm.com/support

IBM Global Services
ibm.com/services
This IBM Redbooks publication describes how to build production topologies for IBM Business Process Manager V8.0. This book is an update of the existing book IBM Business Process Manager V7.5 Production Topologies, SG24-7976. It is intended for IT Architects and IT Specialists who want to understand and implement these topologies. Use this book to select the appropriate production topologies for an environment, then follow the step-by-step instructions to build those topologies.

Part 1 introduces IBM Business Process Manager and provides an overview of basic topology components, and Process Server and Process Center. This part also provides an overview of the production topologies described in this book, including a selection criteria for when to select a topology. IBM Business Process Manager security and the presentation layer are also addressed in this part.

Part 2 provides a series of step-by-step instructions for creating production topology environments by using deployment environment patterns. This process includes topologies that incorporate IBM Business Monitor. This part also describes advanced topology topics.

Part 3 covers post installation instructions for implementing production topology environments such as configuring IBM Business Process Manager to use IBM HTTP Server and WebSphere® proxy server.