

WebSphere. Lombardi Edition Version 7.1

*Process Center Installation and
Configuration Guide for UNIX*



Table of Contents

Introduction	1
Lombardi product components	1
Lombardi architecture	1
Lombardi installation options	4
Installing Lombardi Process Center	5
Steps for installing Lombardi Process Center	5
Pre-installation setup	6
Hardware requirements for installing Lombardi Process Center	6
Supported software	6
Creating Lombardi databases	7
Creating databases in Microsoft SQL Server	8
Creating databases in Oracle	9
Creating databases in DB2	9
Installing X-Windows Virtual Frame Buffer	9
Process Center installation	10
Available methods for installing Lombardi Process Center	10
Installing the Process Center using Lombardi Installer	10
Post-installation configuration	13
Loading initial data	13
Starting and stopping Lombardi servers	13
Configuring an LDAP security provider	14
Setting up Lombardi user accounts	15
Changing internal Lombardi passwords	16
Configuring single sign-on	19
Optional configuration tasks for Lombardi Process Center	23
Changing Lombardi server properties	23
Running a Process Center Server without a Performance Data Warehouse	24
Preventing XSS vulnerability	24
Allocating Async and Sync threads	25
Specifying the run-time sender of tasks	25
Removing Lombardi components	26
Notices and Trademarks	27
Notices	27
Trademarks and service marks	29

Introduction

This guide explains how to install and configure Lombardi Process Center. The Process Center serves as the central development environment and repository for multiple process authors. Lombardi Process Center includes a Process Center Server and a Performance Data Warehouse, allowing authors to build and run process applications and also store performance data for testing and playback during development efforts. See [Lombardi installation options](#) for more information.

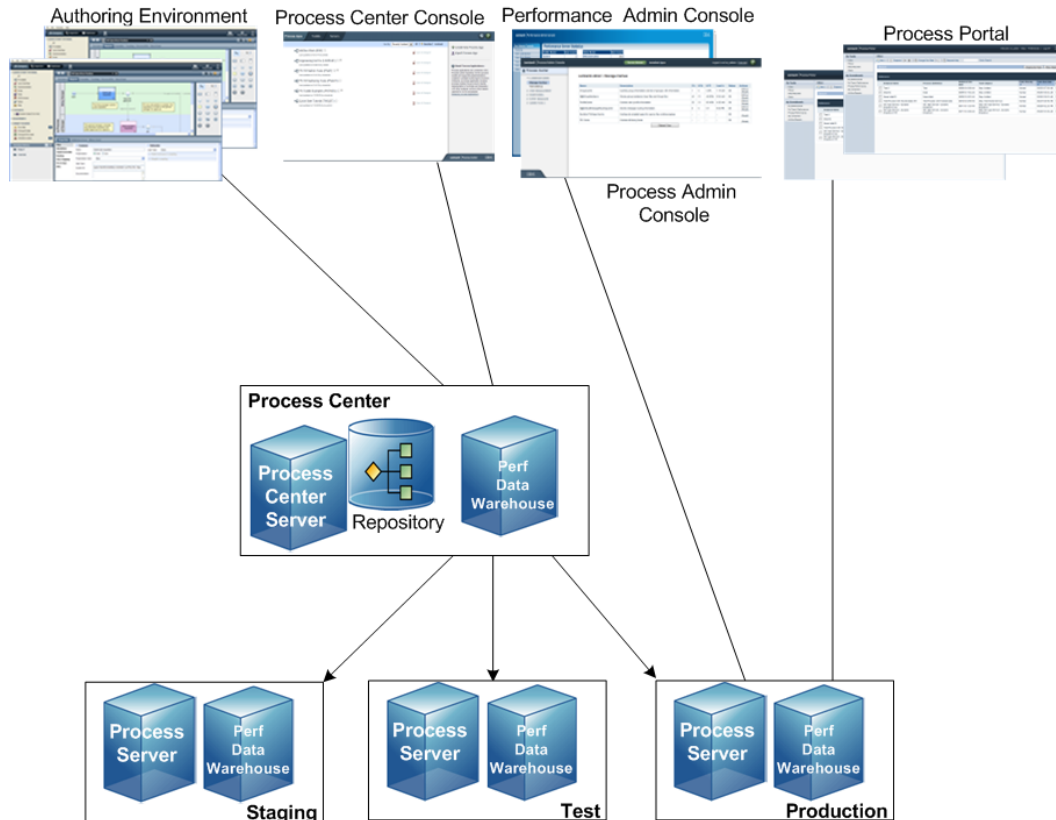
Lombardi product components

IBM WebSphere Lombardi Edition includes the following components. The following diagram illustrates how these components are commonly configured.

Component	Function
Process Center	Provides a central development environment and repository for multiple process authors working in the Process Center Console and other interfaces in Lombardi Authoring Environment. The Process Center includes a Process Center Server and a Performance Data Warehouse, allowing you to build and run process applications and also store performance data for testing and playback purposes during development efforts.
Process Server	Executes the processes and services built in Lombardi Authoring Environment, stored in the Process Center repository, and then installed in a runtime environment.
Performance Data Warehouse	Collects and aggregates process data according to tracking requirements established in Lombardi Authoring Environment.
Process Center Console	Enables you to manage and maintain the Lombardi repository, including management of process applications, workspaces, and snapshots. Also enables installation of process applications on Process Servers in runtime environments.
Authoring Environment	Lombardi Authoring Environment consists of several interfaces to enable process authors to model, implement, simulate, and inspect business processes.
Process Portal	Provides an interface that enables process participants to perform assigned tasks, view the history of tasks, and view the performance of their processes and teams. Using Process Portal, process participants can connect to the Process Center Server or a Process Server in any configured runtime environment, such as test or production environments.
Process Admin Console	Provides an interface that enables administrators to configure and maintain Lombardi Process Servers in any configured runtime environment, such as test or production environments. Also enables administrators to configure and maintain the Process Center Server.
Performance Admin Console	Provides an interface that enables administrators to configure and maintain Lombardi Performance Data Warehouses in any configured runtime environment, such as test or production environments. Also enables administrators to configure and maintain the Performance Data Warehouse included in the Process Center.

Lombardi architecture

The following diagram illustrates a typical IBM® WebSphere® Lombardi Edition configuration:




- From Lombardi Authoring Environment, multiple users connect to the Process Center.
- In Lombardi Authoring Environment, users create process models and supporting implementations (process applications) and store those applications and associated items in the Process Center repository. Authoring Environment users connected to the Process Center can share items.
- The Process Center includes a Process Center Server and Performance Data Warehouse, allowing users working in Lombardi Authoring Environment to run their process applications and store performance data for testing and playback purposes during development efforts.
- From the Process Center Console, administrators install process applications that are ready for staging, testing, or production on the Process Servers in those environments.
- From the Process Center Console, administrators manage running instances of process applications in all configured environments.
- From the Process Portal, end users perform assigned tasks. The Process Center Server and Process Servers in configured runtime environments can run the process applications that create the assigned tasks.
- Using the Process Portal, process participants can connect to the Process Center Server or a Process Server in any configured runtime environment, depending on whether a process is being developed, tested, or has been released to a production environment.
- Lombardi Performance Data Warehouse retrieves tracked data from the Process Server or Process Center Server at regular intervals. Users can create and view reports that leverage this data in Lombardi Authoring Environment and Process Portal.

- From the Process Admin Console and Performance Admin Console, administrators can manage and maintain all Lombardi servers.

Lombardi installation options

When you install Lombardi Process Center or runtime environment, the Lombardi Installer installs WebSphere® Application Server Version 7.0. The application server handles basic connections and containers for Lombardi product components, as well as underlying security and permissions.

The following table describes Lombardi installation options:

If you want to...	You should install...	For instructions, see...
Create process models, implement the process steps, and share your work by connecting to a central repository.	Lombardi Authoring Environment (Windows® only)	<i>Lombardi Authoring Environment Installation and Configuration Guide</i>
Provide a central repository and shared development environment for process authors.	Lombardi Process Center (includes Process Center Server and Performance Data Warehouse)	Installing Lombardi Process Center
Automate installation of Lombardi Process Center.	Lombardi Process Center using the Automated Installer	<i>Lombardi Automated Process Center Installation and Configuration Guide</i>
Install an isolated Process Center for a single local user for demonstration purposes only.	Lombardi Process Center using Lombardi Installer's Simple option (Windows only)  Do not use the Simple option to install a shared Process Center. For a shared installation, follow the instructions in <i>Lombardi Process Center Installation and Configuration Guide</i> .	<i>Lombardi Express Installation and Configuration Guide</i>
Install Lombardi servers in a runtime environment such as staging, test, or production.	Lombardi runtime environment (includes Process Server and Performance Data Warehouse)	<i>Lombardi Runtime Environment Installation and Configuration Guide</i>
Automate installation of Lombardi servers in a runtime environment such as staging, test, or production.	Lombardi runtime environment using the Automated Installer	<i>Lombardi Automated Runtime Environment Installation and Configuration Guide</i>

Installing Lombardi Process Center

To provide a central repository for all processes and a shared development environment for process authors, you should install Lombardi Process Center, which includes all required components for your shared environment. The Process Center Install includes the following Lombardi product components (see [Lombardi product components](#) for descriptions):

- Process Center Server
- Process Center Console
- Process Admin Console
- Process Portal
- Performance Data Warehouse
- Performance Admin Console



Lombardi Authoring Environment must be installed separately on Windows. For more information, see *Lombardi Authoring Environment Installation and Configuration Guide*.

Steps for installing Lombardi Process Center

The following tables list the steps required to install Lombardi Process Center.



You must have root access to install Lombardi Process Center.



Pre-installation setup

Task	See...
1. Meet the hardware requirements.	Hardware requirements for installing Lombardi Process Center
2. Meet the software requirements.	Supported software
3. Create Lombardi Process Center Server database and Performance Data Warehouse database in your database server.	Creating Lombardi databases
4. Install X-Windows Virtual Frame Buffer.	Installing X-Windows Virtual Frame Buffer

Installation

Task	See...
1. Select the installation method appropriate for your environment.	Process Center installation
2. Install the Process Center using the installation method that you selected.	Installing the Process Center using Lombardi Installer

Post-installation configuration

Task	See...
1. Run the installation scripts to load initial data, including the system data toolkit and process apps.  Required only if you do not select the option to initialize your database during installation of Lombardi product components.	Loading initial data
2. Start Lombardi Process Center Server and Lombardi Performance Data Warehouse.  Required only if you do not select the option to start WebSphere Lombardi Edition during installation.	Starting and stopping Lombardi servers
3. Configure external security providers.	Configuring an LDAP security provider
4. Configure accounts for Lombardi users.	Setting up Lombardi user accounts Changing internal Lombardi passwords
5. Perform optional configuration tasks relevant to your environment.	Optional configuration tasks for Lombardi Process Center

Pre-installation setup

Before installing Lombardi Process Center, ensure that you meet the requirements described in the following sections.

Hardware requirements for installing Lombardi Process Center

The following table describes the hardware requirements for installing Lombardi Process Center:







By default, Lombardi Installer for Unix uses `/tmp` for its temporary directory space. You can change the temporary directory using the `IATEMPDIR` variable.

Lombardi installation	Minimum hardware required
Process Center	Dual processors, each 1.3 GHz, or a single 2.2 GHz processor 3 GB available RAM 4 GB free disk space for Lombardi servers, applications, and databases 2 GB free disk space for additional database growth in development 10 GB free disk space in your default temporary directory

Supported software

The following table describes the supported software for installation of Lombardi servers.

Software	Version
UNIX® operating systems	IBM® AIX® 6.1 (Power6)  For AIX: The system JVM must be version pap6460sr6-20090925_01 or later to run Lombardi product components. If default file size of 1 GB is set, edit /etc/security/limits (as root) by changing fsize to -1 in the default section. This change is required to use Lombardi installer. Red Hat Enterprise Linux® 5 (x86-32) Red Hat Enterprise Linux 5 (x86-64) SUSE Linux Enterprise Server 10 (x86-32) SUSE Linux Enterprise Server 10 (x86-64)  For Linux systems, you must install IBM Java SDK 6.0 prior to installation. Sun Solaris (Sparc) 10 (only 64-bit Sparc hardware is supported)
DB2® database	DB2 Version 9.7 Fix Pack 1
Oracle database	Oracle Enterprise 11g Release 1 Oracle Standard 11g Release 1  XA transactions must be enabled.
Microsoft SQL Server database	Microsoft® SQL Server 2005 SP3 (installed on a separate Windows® server)  Ensure that your SQL Server installation is not case-sensitive (a case-sensitive SQL Server installation is not supported).
Client browsers	Microsoft Internet Explorer 6 and 7 Mozilla Firefox 3



When you install Lombardi Process Center, WebSphere Application Server Version 7.0 is installed. The application server handles basic connections and containers for Lombardi product components, as well as underlying security and permissions.

Creating Lombardi databases

You need to create a Lombardi Process Center Server database and a Lombardi Performance Data Warehouse database in your database server before performing Lombardi installation. The following sections provide guidelines for setting up Lombardi databases in your database server environment.

Creating databases in Microsoft SQL Server

Following are guidelines for configuring a SQL Server instance for Lombardi:

1. Enable the **SQL Server authentication mode** option.
2. Create a **Login user** (in the **Security > Logins > New Login** section for the database server), and be sure to remember the database user and password because you will need to provide them when installing Lombardi. (Lombardi Installer uses `lombardi` as the default database user and password.)



The password policy specifies that the same value cannot be used for both user name and password. For the Login user, clear the **Enforce password policy** option if you want to use the same value for both the database user and password. If you want to apply the password policy for the Login user, enable the Enforce password policy option and specify a password value that is different from the user name value.

3. Create a database for Lombardi Process Center Server. For example, name the Process Center Server database `twProcessDB`. (Lombardi Installer uses this as the default database name.)



To support Cyrillic characters, you must create the Process Center Server database with the following collation: `SQL_Latin1_General_CP1251_CI_AS`

4. Create a database for Lombardi Performance Data Warehouse. For example, name the Performance Data Warehouse database `twPerformanceDB`. (Lombardi Installer uses this as the default database name.)



Ensure that the owner of each Lombardi database is the default owner and not the Login user created in step 2. If the new Login user is the database owner, when you try to create a database user with that Login in step 6, you will get an error.

5. For each database, set the **Parameterization** to `Forced` (in the **Properties > Options > Miscellaneous** section for each database).
6. For each database, create a **Database user** (in the **Security > Users** section for each database) whose name and password matches the Login user name. Under **Database role membership**, select `db_owner`.
7. For each database, create a **Schema** named `lombardi` (under **Security > Schemas** for the database). Assign the `lombardi` user as the schema owner and specify the `lombardi` schema as the default schema for each database.

For more information about installing and configuring the Microsoft SQL Server 2005 database server, see the following resources:

- SQL-Server-Performance.com: *Security enhancements in SQL Server 2005: Schema* http://www.sql-server-performance.com/articles/dba/authorization_2005_p1.aspx
- Microsoft TechNet: *Installing SQL Server 2005* <http://technet.microsoft.com/en-us/library/ms143516.aspx>
- Microsoft TechNet: *Forced Parameterization* <http://technet.microsoft.com/en-us/library/ms175037.aspx>

Creating databases in Oracle

You can create a new Oracle instance for use with Lombardi or you can use an existing instance. Following are guidelines for configuring an Oracle instance for Lombardi:

1. In Oracle Enterprise Manager, create a new user for Lombardi Process Center Server.
2. Supply a password for the Process Center Server user. It is important that you remember the database user and password because you will need to provide them when installing Lombardi. (Lombardi Installer uses `lombardi` as the default database user and password.)
3. Add the DBA role to the Process Center Server user.
4. In Oracle Enterprise Manager, create a new user for Lombardi Performance Data Warehouse.
5. Supply a password for the Performance Data Warehouse user. It is important that you remember the database user and password because you need to provide them when installing Lombardi. (Lombardi Installer uses `lombardi` as the default database user and password.)
6. Add the DBA role to the Performance Data Warehouse user.

Creating databases in DB2

The following is required for IBM DB2 databases.



For more information about configuring DB2 databases, see the DB2 documentation at <http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp>.

- When setting up local database users, assign names with eight characters or less. For example, `lombardiusr` as a user name will make the Lombardi database initialization scripts fail while `lombardi` as a user name will not.
- When creating the databases, enable the databases for Unicode (UTF-8 encoding) if you are using a non-ASCII character set such as Russian.
- Create a buffer pool with a page size that is 32 KB.
- Create a regular table space with a buffer pool that is 32 KB.
- Create a system temporary table space with a buffer pool that is 32 KB.

Installing X-Windows Virtual Frame Buffer

The X-Windows Virtual Frame Buffer (Xvfb) is necessary for Lombardi to properly render reports in a UNIX system. The X-Windows Virtual Frame Buffer needs to be running as root on the machine that runs Lombardi Process Center Server.

When you begin the installation process, make sure that you set the following:

- Xvfb needs to be running on display 1. This is a flag that you can set when you start up. See Xvfb documentation for more information.
- Xvfb needs to be running in the background.

Xvfb setup may vary depending on your UNIX platform. For more information about Xvfb, see <http://www.visualmining.com/documentation/xvfb.pdf>.

Process Center installation

After you have met all the requirements for installation, you are ready to install Lombardi Process Center.

The following sections describe how to install Lombardi Process Center on your system using the available installation methods, which are listed in the following table.

Available methods for installing Lombardi Process Center

Installer program	Description	See...
Lombardi Installer	Command-line user interface for installing Lombardi components on UNIX-based operating systems	Installing the Process Center using Lombardi Installer
Automated Installer	Automates the installation of Lombardi components on any supported operating system	<i>Lombardi Automated Process Center Installation and Configuration Guide</i>

Installing the Process Center using Lombardi Installer

Lombardi Installer for Unix operating systems enables you to install and configure Lombardi Process Center using a command-line user interface. Before running Lombardi Installer, review the following steps and make sure you have the information that the Installer requests.

Run Lombardi Installer on the machine where you want to install Lombardi Process Center, supplying the appropriate parameters when prompted.



You must have root access to install Lombardi Process Center.

Steps to follow

1. Copy the WebSphere Lombardi Edition 7.1.0 installer to a temporary directory on your file system.



Several Unix installers are available. Be sure to copy and use the installer that is appropriate for your operating system.

2. From a shell prompt, run `./ [installer_name] .bin` to start the Installer.

If the installer prompts you to select another location, be sure to select a drive that has the required free disk space (10 GB) in the default temporary directory.

3. Read the Introduction, and then press **Enter**. You must supply each parameter requested by Lombardi Installer at the shell prompt, as described in the following steps. Press **Enter** to accept the default selection for the parameter.



If you make a mistake when supplying installation parameters, you can type back at any prompt to return to a previous step in the installation procedure.

If you press **Ctrl+C** to cancel the installation procedure and then attempt to reinstall, you might receive a "files are corrupted" error and the reinstallation fails. This is because the Installer creates temporary files that are not deleted when the installation is interrupted. You can resolve this issue by deleting the temporary files in the `/tmp` directory and then reinstalling.

If you must interrupt an installation procedure, an alternative to pressing **Ctrl+C** is to issue a `QUIT` command at any time during the installation procedure.

4. Read the Lombardi Software License Agreement. If you agree, select **I accept the terms of the license agreement** and then press **Enter**.
5. At the Choose Server Type prompt, select **Process Center for Shared Process Development** and then press **Enter**.

When you choose the Process Center option, the Process Center Server and Performance Data Warehouse are installed on the same host.



If you want to run the Process Center Server without a Performance Data Warehouse, see [Running a Process Center Server without a Performance Data Warehouse](#).

6. At the Process Center Server Options prompt, supply the appropriate information about the Process Center Server. The default values reflect the host names and ports for the machine on which you are installing. Supply the appropriate information and then press **Enter**.

Parameter name	Description
Host Name	The name of the machine on which you want to install Lombardi Process Center. This field defaults to the current host.
HTTP Port	The port to use for Lombardi Process Center on the host machine. The default port is 9086.
SMTP Server	The SMTP server that Lombardi Process Center should use to send e-mail notifications.

7. The Database Options prompt enables you to choose the database that you want to use to store Lombardi data.

After choosing the database that you want, supply the following information:

Parameter name	Description
Database Host	The name of the host machine for Lombardi Process Center Server and Performance Data Warehouse databases.
Port	The port that Lombardi should use to connect to the databases.
Initialize new database?	If you enable this option, the installer fully populates the Lombardi databases (specified in the following fields) with required data. If you do not enable this option, you need to initialize the Lombardi databases after installation as described in Loading initial data .
Process Center Database Name	The name of the database created for the Process Center Server as instructed in Creating Lombardi databases . The default name is <code>twProcessDB</code> .
Process Center Database User	The name of the user who can access the specified database, as described in Creating Lombardi databases . The default user name is <code>lombardi</code> .

Parameter name	Description
Process Center Database Password	The password required for the specified user to access the database as described in Creating Lombardi databases . The default password is <code>lombardi</code> .
Performance Data Warehouse Database Name	The name of the database created for the Performance Data Warehouse as instructed in Creating Lombardi databases . The default name is <code>twPerformanceDB</code> .
Performance Data Warehouse Database User	The name of the user who can access the specified database, as described in Creating Lombardi databases . The default user name is <code>lombardi</code> .
Performance Data Warehouse Database Password	The password required for the specified user to access the database as described in Creating Lombardi databases . The default password is <code>lombardi</code> .

Ensure that the database information is correct, as the values are case-sensitive.

When you are finished configuring the database parameters, press **Enter**.

- At the Choose Install Folder prompt, provide the directory where Lombardi product components should be installed, and then press **Enter**.



If you choose the option to create an Automated Installer Package at the following Pre-Installation Summary prompt, the directory that you specify is the directory where the Automated Installer package is created.

- On the Pre-Installation Summary panel, make sure that the information is correct. If not, go back to alter any incorrect configuration information.

At the **Create Automated Installer Package** prompt:

Type Y and press Enter	If you want to use Lombardi Automated Installer. If you select this option, only the installer package is created in the installation directory; the product components are not installed. When you enable the Create Automated Installer Package option, you should refer to <i>Lombardi Automated Process Center Installation and Configuration Guide</i> .
Type N and press Enter	To install Lombardi product components in the installation directory.

Installation may take several minutes to complete.

- The installer displays an Installation Complete message when it has finished installing Lombardi product components.



When you run Lombardi Installer, an `installvariables.properties` file is created in the `[Lombardi_home]/UninstallerData` directory. This file may contain plain-text password values that are displayed in the Uninstaller during the removal of Lombardi product components. If this causes security concerns for you, delete this file after completing the installation.

- At the Startup Lombardi prompt:

Type Y and press Enter	To start Lombardi product components.
Type N and press Enter	To start Lombardi product components manually as described in Starting and stopping Lombardi servers .

Post-installation configuration

After installing Lombardi Process Center on your system, you need to configure your Lombardi installation to enable the installed components to run, as described in the following sections.



The directory where you installed Lombardi product components is referred to as `[Lombardi_home]`.

Loading initial data

If you do not select the option to initialize your database during installation of Lombardi product components, you need to run an initialization script after installation is complete. When you run the initialization script, it creates the required schema and permissions for the Lombardi databases, imports system data, and (on runtime environments) deploys snapshots of imported toolkits and process applications.

1. From a command line console, navigate to your `[Lombardi_home] \twinit` directory.
2. Run the following command:

```
twinit.sh
```

The console should report a successful build.

If the build fails, for example, due to database server connectivity or user permission issues, inspect the log file in the `twinit\logs` folder for errors. Troubleshoot the indicated issues and then run the script again. The script will resume from the last successful task and will not overwrite any existing data.

3. Start the management tool for your database and then verify that Lombardi database tables exist with data. The tables are named with a `lsw_` prefix (for example, `[schema_name].lsw_usr`).

Starting and stopping Lombardi servers

You can start Lombardi servers simultaneously or one at a time as described in the following procedures.

To start both the Process Center Server and Performance Data Warehouse:

1. From a shell prompt, navigate to the `[Lombardi_home] /bin` directory.
2. Run `./startLombardi.sh`

To stop both the Process Center Server and Performance Data Warehouse:

1. From a shell prompt, navigate to the `[Lombardi_home] /bin` directory.
2. Run `./stopLombardi.sh`



If the stop script fails, specify the user and password when running the script. For example:

```
./stopLombardi.sh -user tw_user -password tw_user
```

To start the Process Center Server:

1. From a shell prompt, navigate to the [Lombardi_home]/process-center/bin directory.
2. Run ./startProcessCenter.sh

To stop the Process Center Server:

1. From a shell prompt, navigate to the [Lombardi_home]/process-center/bin directory.
2. Run ./stopProcessCenter.sh

To start the Performance Data Warehouse:

1. From a shell prompt, navigate to the [Lombardi_home]/performance-data-warehouse/bin directory.
2. Run ./startPerformanceDataWarehouse.sh

To stop the Performance Data Warehouse:

1. From a shell prompt, navigate to the [Lombardi_home]/performance-data-warehouse/bin directory.
2. Run ./stopPerformanceDataWarehouse.sh

Configuring an LDAP security provider

By default, WebSphere Lombardi Edition is configured with a single federated repository that contains only the internal Lombardi security provider. To use an additional LDAP security provider, you need to add the provider to the federated repository. The following steps describe how to configure an LDAP security provider (such as Microsoft Active Directory) with WebSphere federated repository.

1. From the WebSphere administrative console, navigate to: **Security > Global security**
2. Under **User account repository**, select **Federated repositories** from the **Available realm definitions** drop-down list.
3. Click the **Configure** button.
4. Under **Related items**, click **Manage repositories**.
5. Click the **Add** button and input parameters for the provider that you want to add. For example, to add Microsoft Active Directory, you would input parameters like the following:

Repository identifier	SALOMLDAP // change to suit
Directory type	Microsoft Windows Active Directory
Primary host name	10.1.5.18
Bind distinguished name	cn=LDAP_USER, CN=Users, DC=COMPANYQA, DC=com
Bind password	pwsaaswp

6. Click the **OK** button and then click Save.

7. Click the **Add Base entry to Realm** button and provide values like the following:

Distinguished name of a base entry that uniquely identifies this set of entries in the realm	DC=COMPANYQA, DC=com
Distinguished name of a base entry in this repository	cn=Users, DC=COMPANYQA, DC=com

8. Click the **OK** button and then click Save.
9. On the Global Security page, click the **Set as current** button and then click the **Apply** button.
10. Shut down all Lombardi servers as instructed in [Starting and stopping Lombardi servers](#).
11. Make sure no duplicate users exist in the Lombardi internal security provider and the security provider that you just added. If duplicate users exist, you will get exceptions when you run WebSphere Lombardi Edition product components.
12. Start all Lombardi servers as instructed in [Starting and stopping Lombardi servers](#).

Setting up Lombardi user accounts

IBM WebSphere Lombardi Edition includes an internal security provider, which you can use to create and maintain Lombardi users and groups. You can use the internal Lombardi security provider in conjunction with an external security provider (such as LDAP) that you have configured with WebSphere application server (see [Configuring an LDAP security provider](#)). Lombardi internal security provider includes several default users and groups. When you use the internal Lombardi security provider in conjunction with an external provider, the users and groups from both providers are available for selection throughout Lombardi.



Do not remove the default Lombardi administrator account, `tw_admin`, or the default administrator group, `tw_admins`. Administration of Lombardi servers and users is not possible without these default accounts. You can change the password for the `tw_admin` account as described in [Changing internal Lombardi passwords](#).


The best way to manage security in Lombardi is by using groups. For example, the best way to grant administrative access to Lombardi is to add preexisting groups of users from your external security provider to `tw_admins`, which is a Lombardi group whose members have administrative access to Lombardi product components by default. Then when changes are required, you can simply add or remove individual users from the groups that exist in your external security provider. This practice ensures that the security maintenance you perform in your external provider does not require additional work in Lombardi.



For more information about managing Lombardi users and groups in the Process Admin Console, see *Lombardi Administration Guide*.

When initially configuring Lombardi servers, you should complete tasks similar to the following to set up your users:

Task	Interface	To learn more..
1. Access the Process Admin Console by opening your Web browser to the following location: <code>http://[host_name]:[port]/ProcessAdmin</code> . Log on using the default administrative account (<code>tw_admin</code>) and the default password (<code>tw_admin</code>).	Process Admin Console	See <i>Accessing the Process Admin Console in Lombardi Administration Guide</i>

Task	Interface	To learn more..
2. (Optional) Create the different types of users and groups that your users will need in Lombardi.	Process Admin Console	See <i>Creating and maintaining users</i> and <i>Creating and maintaining groups</i> in <i>Lombardi Administration Guide</i>
3. Add members to the default Lombardi groups or groups that you have created. You can add users and groups from any configured external provider (such as LDAP) and internal Lombardi users and groups.	Process Admin Console	See <i>Managing group membership</i> in <i>Lombardi Administration Guide</i>
4. Access the Process Center Console by opening your Web browser to the following location: http:// [host_name] : [port] /ProcessCenter . Log on using the default administrative account (tw_admin) and the default password (tw_admin). Add the users and groups who need access to the repository, grant administrative access to the appropriate users, and then establish who can access each process application and toolkit.  The best way to grant access to the repository is to add members to the default Lombardi group, tw_authors.	Process Center Console	See <i>Managing access to the Process Center repository</i> in the <i>Authoring Environment User Guide</i> or online help

Changing internal Lombardi passwords

Once you install Lombardi product components, you can log on to the Process Admin Console and change the default passwords to make your environment more secure. You can change all user passwords if you log on as `tw_admin`.

To change passwords:

1. Access the Process Admin Console by opening your Web browser to the following location:
[http:// \[host_name\] : \[port\] /ProcessAdmin](http://[host_name]:[port]/ProcessAdmin). Log on using the default administrative account (tw_admin) and the default password (tw_admin).
2. On the Admin tab in the Process Admin Console, click **User Management**.
3. Click the **User Management** option.
4. In the **User Management > Maintain User Settings** dialog, enter a user name in the **Retrieve Profile** field.
5. Click the **Retrieve** button.
6. Change settings as required and click the **Update** button.

If you want to change the default Lombardi administrative account user name and password, you must also update the relevant Lombardi configuration files to reflect the new values, as described in [Changing the default administrative account password](#). The new values can be encrypted using the EncryptPassword utility provided with Lombardi, as described in [Encrypting passwords](#).

Changing the default administrative account password

Be sure to change the default Lombardi internal security provider's administrative account password if you intend to restrict access to administrative functions. Doing so is prudent because administrative users can halt and delete processes. To change the `tw_admin` password you need to make changes for Lombardi servers and other tools as described in the following sections:

- [Lombardi server changes](#)
- [Lombardi tool changes](#)

Lombardi server changes

1. Log on to the Process Admin Console using the default administrative account (`tw_admin`) and the default password (`tw_admin`), and change the password for the `tw_admin` account in the Process Admin Console as described in [Changing internal Lombardi passwords](#).
2. Log out of the Process Admin Console.
3. Stop Lombardi Process Center Server (see [Starting and stopping Lombardi servers](#)).
4. Generate an encrypted value for the new password as described in [Encrypting passwords](#).
5. Copy the following section of the `[Lombardi_home]/process-center/config/system/99Local.xml` file to the `[Lombardi_home]/process-center/config/100Custom.xml` file and make the following changes.

Add `merge="replace"` to the `<system-lane users>` tag. Also change the value of the `password` attribute to the encrypted value of the new password (make sure the value of the `password-encrypted` attribute is set to `true`):

```
<server merge="mergeChildren">
  <bpd-engine merge="mergeChildren">
    <system-lane-users merge="replace">
      <!-- Use java -cp utility.jar com.lombardisoftware.utility.EncryptPassword <password> -->
      <!-- to generate encrypted password -->
      <user login="tw_admin" password-encrypted="true" password="new-password]"/>
    </system-lane-users>
  </bpd-engine>
</server>
```



To learn more about the `merge` options that you can use in the `100Custom.xml` file, see [Changing Lombardi server properties](#).

Save your changes.

6. Copy the following lines from the `[Lombardi_home]/process-center/config/system/80EventManager.xml` file to the `[Lombardi_home]/process-center/config/100Custom.xml` file.

Add `merge="replace"` to the `<password>` tag and change the value of the `<password>` element to the encrypted value of the new password. Also change the value of the `<password-encrypted>` element to `true`):

```
<event-manager merge="mergeChildren">
  <password merge="replace">[new-password]</password>
  <password-encrypted merge="replace">true</password-encrypted>
</event-manager>
```

Save your changes.

- The contents of your `100Custom.xml` file should look like the following example when you are finished with your edits:

```
<properties>
  <server merge="mergeChildren">
    <bpd-engine merge="mergeChildren">
      <system-lane-users merge="replace">
        <!-- Use java -cp utility.jar com.lombardisoftware.utility.EncryptPassword <password> -->
        <!-- to generate encrypted password -->
        <user login="tw_admin" password-encrypted="true" password="new-password" />
      </system-lane-users>
    </bpd-engine>
  </server>
  <event-manager merge="mergeChildren">
    <password merge="replace">[new-password]</password>
    <password-encrypted merge="replace">true</password-encrypted>
  </event-manager>
</properties>
```

- Start Lombardi Process Center Server (see [Starting and stopping Lombardi servers](#)).

Lombardi tool changes

In addition to making the changes to the `100Custom.xml` file as described in the preceding section, you must also edit the following files to universally change the `tw_admin` password. The following files are located in `[Lombardi_home]`.



The files in the `twinit` directory are created when you initialize Lombardi databases, which is an option that can be enabled during installation or a task that can be completed after installation as described in [Loading initial data](#).

File	Required changes
<code>tools/process-installer/process-installer.properties</code>	Change <code>pcs.encrypted</code> and <code>ps.encrypted</code> to the encrypted value from the preceding procedure.
<code>twinit/tw-init.xml</code>	Change the value of the <code>bootstrap.password</code> property to the encrypted value from the preceding procedure.
<code>twinit/resources/config/system/99Local.xml</code>	Change the <code>system-lane-users</code> password to the encrypted value from the preceding procedure. Make sure the value of the <code><password-encrypted></code> element is <code>true</code> .
<code>twinit/resources/config/system/80EventManager.xml</code>	Change the <code>event-manager</code> password to the encrypted value from the preceding procedure. Make sure the value of the <code><password-encrypted></code> element is <code>true</code> .

Encrypting passwords

When you install Lombardi product components, passwords in the installed files are generally encrypted by default. If you ever need to change these passwords, you can easily encrypt the new passwords using the Lombardi `EncryptPassword` utility:

1. From a shell prompt, navigate to the `[Lombardi_home]/twinit/lib` directory and then run the following command:

```
java -cp utility.jar com.lombardisoftware.utility.EncryptPassword <password>
```

where `<password>` is the password you want to encrypt.

Example:

```
java -cp utility.jar com.lombardisoftware.utility.EncryptPassword JohnDoe
```

prints

```
taVCmTLTWWgkTvfavvu/7g==:sROM4ZbvqRDFYMobWXqvvg==
```

If you are running the utility from a directory other than the above, you must replace `utility.jar` with the exact path to the `utility.jar` file.

If the utility fails with a `ClassNotFoundException` exception, set your java home to the following directory before running the utility: `[Lombardi_home]/AppServer/java/bin/java`

Example:

```
java -cp /opt/[Lombardi_home]/twinit/lib/utility.jar
com.lombardisoftware.utility.EncryptPassword JohnDoe
```



The `EncryptPassword` utility only works in one direction; you cannot use it to decrypt passwords that are already encrypted.

2. Replace the existing encrypted password in your Lombardi configuration files (such as `[Lombardi_home]/process-center/config/100Custom.xml`).



When you need to change encrypted passwords in Lombardi configuration files such as `98Database.xml`, `80EventManager.xml`, and `99Local.xml`, you should copy the necessary sections from those files to the `100Custom.xml` file and make changes there as described in [Changing the default administrative account password](#).

Configuring single sign-on

WebSphere Lombardi Edition supports Kerberos-based automatic login (often referred to as Single Sign-On, or SSO). This functionality reduces configuration overhead and simplifies the authentication process by using the credentials of the current Windows user to authenticate with Lombardi. The Kerberos protocol enables Lombardi users to automatically log on to Lombardi interfaces, including Process Center Console, Process Portal, Process Admin Console, and Performance Admin Console.

When configuring single sign-on for Lombardi product components, ensure that you meet the following requirements:

- For detailed and comprehensive information, refer to the redbook entitled *Implementing Kerberos in a WebSphere Application Server Environment*, which you can find here: <http://www.redbooks.ibm.com/abstracts/sg247771.html?Open>

- Synchronize the date and time between the Key Distribution Center (KDC) and the machines running Lombardi servers.
- Lombardi servers must be run under the domain account for which the Kerberos keytab is generated.
- You must have only one service account and only the service account should be mapped to the Kerberos endpoint.

To configure single sign-on for Lombardi product components, you need to complete the tasks outlined in the following sections:

Configuring the Key Distribution Center (KDC)	Describes the steps required to configure a KDC.
Configuring Lombardi server hosts	Describes the steps required to configure a Windows host for a Lombardi server.
Using WebSphere Admin Console to enable SPNEGO	Describes the steps required to enable SPNEGO.
Configuring your browser	Describes the browser configuration required for each user who wants to take advantage of SSO.

Configuring the Key Distribution Center (KDC)

The following example describes the steps required to configure a Key Distribution Center (KDC).

1. Create a Microsoft Active Directory user account that maps to the Kerberos service principal name (SPN) for WebSphere Application Server as follows:
 - a) On the Windows Server system that serves as the Microsoft domain controller, log on as administrator.
 - b) Go to: **Control Panel > Administrative Tools > Active Directory Users and Computers**
 - c) Create a user account. For the following sample procedure, the account is called waskerb. Make sure that **Use DES encryption types for this account** is not enabled/checked.
2. Use ktpass.exe to create the Kerberos keytab file as shown in the following example:

```
ktpass -out c:\waskerb.keytab -princ HTTP/tw7.sso.com@SSO.COM -mapUser
waskerb -mapOp set -pass * -crypto RC4-HMAC-NT
```

```
Targeting domain controller: tw7.sso.com
Using legacy password setting method
Successfully mapped HTTP/tw7.sso.com to waskerb.
Type the password for HTTP/tw7.sso.com:
Type the password again to confirm:
WARNING: pType and account type do not match. This might cause
problems.
Key created.
Output keytab to c:\waskerb.keytab:
Keytab version: 0x502
keysize 72 HTTP/tw7.sso.com@SSO.COM ptype 0
(KRB5_NT_UNKNOWN) vno 5
etype 0x17 (RC4-HMAC) keylength 16
(0x25cf2dc91be14a3509cbada1743bef84)
```

3. Verify the SPN list as shown in the following example:

```
C:\>setspn.exe -l waskerb

Registered ServicePrincipalNames for
CN=waskerb,CN=Users,DC=sso,DC=com:
HTTP/tw7.sso.com
```

4. Run setspn:

```
Setspn -A HTTP/tw7.sso.com@SSO.COM tw7
```

Configuring Lombardi server hosts

The following example describes the steps required to configure a Windows host for a Lombardi server.

1. Copy the keytab file to c:\windows.
2. Run wsadmin as shown in the following example:

```
wsadmin>$AdminTask createKrbConfigFile {-krbPath c:/WINDOWS/krb5.ini -realm
SSO.COM -kdcHost sso.com -dns sso.com -keytabPath c:/WINDOWS/waskerb.keytab}

c:/WINDOWS/krb5.ini has been created.
```

3. Make sure your newly created krb5.ini file resembles the following example. Pay attention to the encryption method.

```
[libdefaults]
    default_realm = SSO.COM
    default_keytab_name = FILE:///c:/WINDOWS/waskerb.keytab
    default_tkt_enctypes = rc4-hmac
    default_tgs_enctypes = rc4-hmac
    forwardable = false
    renewable = false
    clocks skew = 300
[realms]
    SSO.COM = {
        kdc = sso.com:88
        default_domain = sso.com
    }
[domain_realm]
    .sso.com = SSO.COM
```

Using WebSphere Admin Console to enable SPNEGO

The following sample procedure assumes that you have already configured an LDAP security provider.

1. From the WebSphere administrative console, navigate to: **Security > Global security**
2. Under authentication, click **Kerberos configuration** and then select **SPNEGO Web authentication** under Related Configuration.

- You need to define a filter for each application that will participate in SSO. To do so, under SPNEGO Filters click the **New** button and provide the following information:

Host name	For this sample the host name is: <code>tw7.sso.com</code>
Kerberos realm name	For this sample the realm name is: <code>SSO.COM</code>

- Enable the **Trim Kerberos realm from principal name** option.
- Click the **Apply** button.
- Click the **Enable SPNEGO** option, select the Kerberos configuration and keytab file, and then click **Apply**.
- On the Global security panel, in the Authentication section, click **Kerberos configuration**.
- Change the Kerberos service name to `HTTP`.
- Enter `SSO.COM` as the Kerberos realm name.
- Ensure the **Trim Kerberos realm from principal name** option is enabled.
- Clear the checkbox for the **Enable delegation of Kerberos credentials** option.
- Save the configuration changes.
- Stop and start all Lombardi servers.

Configuring your browser

When the preceding tasks are completed, each user who wants to take advantage of SSO must appropriately configure their browser settings. The following example describes how to configure Internet Explorer for the configuration established using the preceding tasks.

- In Internet Explorer, go to **Tools > Internet Options > Security > Local Intranet > Sites** and click the **Advanced** option.
- Add the WebSphere fully qualified name to the sites list. (For the preceding sample: `http://tw7.sso.com`)
- Go to the **Advanced** tab and ensure that the **Enable Integrated Windows Authentication** option is selected.

Troubleshooting

If you have issues configuring SSO, refer to the following resources:

- http://publib.boulder.ibm.com/infocenter/wasinfo/v6r1/index.jsp?topic=/com.ibm.websphere.express.doc/info/epae/sec_SPNEGO_trouble_shoot.html
- <http://www.redbooks.ibm.com/abstracts/sg247771.html?Open>

Optional configuration tasks for Lombardi Process Center

The following topics provide instructions for optional post-installation configuration tasks for your Lombardi installation and environment.

Changing Lombardi server properties

When changing a Lombardi configuration, you should not change the setting in the original configuration file. For example, you should not change properties in `[Lombardi_home]/process-center/config/system/00Static.xml` directly. You should instead add the configuration you want to change to the `[Lombardi_home]/process-center/config/100Custom.xml` file. Lombardi merges the changes you make in the `100Custom.xml` file with the original configuration, as described in the following table.



You should always use the `100Custom.xml` file to change configuration settings so that all customizations are captured in a single file and are readily available when you upgrade to a newer version of Lombardi. When you do upgrade, remember to review the settings in the `100Custom.xml` file to ensure they are appropriate for the new version.

When using `100Custom.xml` to change Lombardi configuration settings, you can use the `merge` attribute for each element. The `merge` attribute supports the following options:

Option	Description
"append"	Appends the new tag regardless.
"mergeChildren"	Merges the new tag with the first of the existing tags. (This is the default behavior.)
"replace"	Replaces all old tags with the new one.

The following example describes how to use `100Custom.xml` to change the environment name in the `99Local.xml` file.

1. Stop Lombardi Process Center Server (see [Starting and stopping Lombardi servers](#)).
2. Open the `[Lombardi_home]/process-center/config/system/99Local.xml` file in a text editor and you see content like the following:

```
<properties>
...
  <common merge="mergeChildren">
    ...
    <environment-name>[existing_name]</environment-name>
    ...
  </common>
...
</properties>
```

3. To change the environment name, you can specify the following in the `100Custom.xml` file:

```
<properties>
  <common merge="mergeChildren">
    <environment-name merge="replace">[new_name]</environment-name>
  </common>
</properties>
```

4. Start Lombardi Process Center Server (see [Starting and stopping Lombardi servers](#)).



Make a backup copy of the configuration files you are changing and when backing them up, be sure to change the file extension to something like .bak. Changing the extension is necessary to ensure that Lombardi does not attempt to load the backup files instead of the originals during start up.

Running a Process Center Server without a Performance Data Warehouse

You might find a situation when you want to run Lombardi Process Center Server without connecting to a Performance Data Warehouse. You can disconnect the Performance Data Warehouse communication by changing a setting in the Lombardi properties files. Disconnecting the Performance Data Warehouse communication enables you to work in the Process Center Server without seeing connection errors.



If you disconnect, you will not be able to track data required for reports and optimization.

1. Open the [Lombardi_home]/process-center/config/100Custom.xml file in a text editor.
2. Add the following elements to merge with the other properties files:

```
<common> <performance-data-warehouse-communication> <enabled
merge="replace">>false</enabled> </performance-data-warehouse-communication>
</common>
```

3. Restart Lombardi Process Center Server. Communication between the Performance Data Warehouse and the Process Center Server is now disabled. Any tracking you have set up will not occur during the time that the communication is down.

Preventing XSS vulnerability

Cross-site scripting (XSS) is a type of computer security vulnerability typically found in Web applications that allow a malicious Web user to inject code, such as HTML and client-side scripts, into Web pages viewed by other users. Attackers can exploit cross-site scripting vulnerability to avoid security access controls.

The <escape-user-input> property in the [Lombardi_home]/process-center/config/system/00Static.xml configuration file prevents a user who is working in Lombardi Process Portal or Lombardi Process Admin Console from executing Java™ script that is embedded in the URLs and might cause a security risk.

The <escape-user-input> property can have one of two values:

Value	Function
false	Disables escaping of user input in Lombardi Process Portal and Process Admin Console URLs. When escaping is disabled, Java script that is inserted into the URLs can be executed.
true	Enables escaping of user input in Lombardi Process Portal and Process Admin Console URLs. When escaping is enabled, Java script that is inserted into the URLs cannot be executed.

Allocating Async and Sync threads

Separate pools of threads are available for running Undercover Agents (UCAs) and processes (BPDs) in designated Asynchronous and Synchronous queues. To control the number of threads assigned to executing BPDs, and asynchronous and synchronous UCAs, override the default values set in the [Lombardi_home]/process-center/config/system/80EventManager.xml system configuration file using the [Lombardi_home]/process-center/config/100Custom.xml file.



Increasing the number of threads increases the required system resources needed for processing.

See [Changing Lombardi server properties](#) for more information about overriding default values in Lombardi configuration files.

Specifying the run-time sender of tasks

When a task is generated at run time and sent to the assigned participant, the task sender is the `tw_admin` user. For example, the **Sent From** field in Lombardi Process Portal displays this user name.

The default task sender is set in the [Lombardi_home]/process-center/config/system/99Local.xml file.

To specify another sender for run-time tasks:

1. Open the [Lombardi_home]/process-center/config/100Custom.xml file in a text editor, and then add the following code block inside the `<common>` element of the file:

```
<common merge="mergeChildren">
  <user-to-create-task
merge="replace"> [custom_task_sender_name] </user-to-create-task>
</common>
```

2. For the custom task sender name, specify the appropriate user name and then save your changes.
3. Restart the Lombardi server (if you are running a clustered environment, restart all servers in the cluster).

Removing Lombardi components

If you need to remove Lombardi from your system, the Uninstaller program removes installation files and folders for Lombardi and the embedded application server.

Before you begin:

- Back up any files that you want to preserve.
1. Run the Uninstaller program, `[Lombardi_home]/uninstall/uninstall.sh`.
 2. When the Uninstaller program completes, you might need to remove some installation files manually. For example, if you have a shell open to a directory in the Lombardi installation directory, the Uninstaller program cannot remove that directory.

Notices and Trademarks

Notices

This information was developed for products and services offered in the U.S.A. IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this documentation does not grant you any license to these patents. You can send license inquiries, in writing, to:

*IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY 10504-1785
U.S.A.*

For license inquiries regarding double-byte character set (DBCS) information, contact the IBM Intellectual Property Department in your country or send inquiries, in writing, to:

*IBM World Trade Asia Corporation
Licensing
2-31 Roppongi 3-chome, Minato-ku
Tokyo 106-0032, Japan*

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law:

INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Licensees of this program who wish to have information about it for the purpose of enabling: (i) the exchange of information between independently created programs and other programs (including this one) and (ii) the mutual use of the information which has been exchanged, should contact:

*Intellectual Property Dept. for WebSphere Software
IBM Corporation
3600 Steeles Ave. East
Markham, Ontario
Canada L3R 9Z7*

Such information may be available, subject to appropriate terms and conditions, including in some cases, payment of a fee.

The licensed program described in this document and all licensed material available for it are provided by IBM under terms of the IBM Customer Agreement, IBM International Program License Agreement or any equivalent agreement between us.

Any performance data contained herein was determined in a controlled environment. Therefore, the results obtained in other operating environments may vary significantly. Some measurements may have been made on development-level systems and there is no guarantee that these measurements will be the same on generally available systems. Furthermore, some measurements may have been estimated through extrapolation. Actual results may vary. Users of this document should verify the applicable data for their specific environment.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

All statements regarding IBM's future direction or intent are subject to change or withdrawal without notice, and represent goals and objectives only.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Each copy or any portion of these sample programs or any derivative work, must include a copyright notice as follows:

© (your company name) (year). Portions of this code are derived from IBM Corp. Sample Programs.

© Copyright IBM Corp. enter the year or years. All rights reserved.

If you are viewing this information softcopy, the photographs and color illustrations may not appear.

Trademarks and service marks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. If these and other IBM trademarked terms are marked on their first occurrence in this information with a trademark symbol (® or ™), these symbols indicate U.S. registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at “Copyright and trademark information” at <http://www.ibm.com/legal/copytrade.shtml>.

Linux is a registered trademark of Linus Torvalds in the United States, other countries, or both.

Microsoft and Windows are trademarks of Microsoft Corporation in the United States, other countries, or both.

UNIX is a registered trademark of The Open Group in the United States and other countries.

Java and all Java-based trademarks and logos are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.