WHITESTEIN
Technologies

Living Systems® Process Suite

Server Installation and Upgrade

Living Systems Process Suite Documentation

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Contents

Chapter 1

Server Installation and Upgrade

Before you perform any of the actions, please, make sure to meet the requirements.

This guide contains information on how to set up a new LSPS environment and how to upgrade an existing environment.

Chapter 2

Requirements

The resources and tools for the setup and deployment of the LSPS Application are available from the `lsps-tools-<VERSION>-lsps.zip` file: The archive contains the command-line tool for management of the server as well as database migration tools.

- *Hardware*: adapt the requirements based on the performance testing of your application. The hardware requirements will depend on the complexity of your application. For example, generally requirements for 50 users, and about 10 concurrent sessions would be as follows:
  - for a **server hosting an application server with the LSPS, your Application User Interface and models**:
    - *Minimum*: i7 x86, 64bit, 8 core CPU. 12 GB RAM
    - *Recommended*: i7 x86, 64bit, 8 core CPU. 24 GB RAM
  - for a **dedicated database server**:
    - *Minimum*: i7 x86, 64bit, 8 core CPU. 16 GB RAM
    - *Recommended*: i7 x86, 64bit, 16 core CPU. 32 GB RAM Before you continue make sure you environment meets the following requirements:
- *Software*
  - databases:
    - MySQL 5.7, MySQL 5.6, MySQL 8.0
    - MS SQL 2014
    - DB2 10.5
    - Oracle 12.2
  - application servers:
    - JBoss EAP 7.0.0
    - JBoss EAP 7.2
    - WildFly 15.0.0
    - WildFly 16.0.0
    - WebSphere 8.5.5.11/12
    - Weblogic 12.1.1
- `Java and Web browsers`

Consider setting up the following environments:

- development environment: environment for deployment of the latest application; This is intended only for development purposes;
- pre-production environment: clone of the production environment for testing;
- production environment: production environment with application that passed testing;

Chapter 3

Installation

Before you start setting up the environment, make sure it meets the requirements, you have selected a compatible combination of java, database, application server, and LSPS Application, and purchased any applicable licenses, such as, license for Oracle JDK.

To set up a new LSPS server with your LSPS Application, do the following:

1. Create and initialize the system database.
2. Set up an application server.

3.1 Setting up the Database

LSPS requires an lsps database with a dedicated user to store its system data. To set up such a database, do the following:

1. Make sure the database is supported by your application server.
2. Create a database with the character encoding to UTF-8.
   Example MySQL database setup with UTF-8

```
 CREATE USER 'lsps' IDENTIFIED BY 'lsps';
CREATE DATABASE lsps DEFAULT CHARACTER SET utf8mb4 DEFAULT COLLATE utf8mb4_unicode_ci;
GRANT ALL PRIVILEGES ON lsps.* TO lsps@'';
GRANT XA_RECOVER_ADMIN ON *.* TO 'lsps'@''; -- not on MySQL 5
SET GLOBAL log_bin_trust_function_creators = 1; -- not on MySQL 5
FLUSH PRIVILEGES;
```

3. Initialize the database with the db-migration tool from the runtime suite:

```
cli-tools$ java -jar lsps-db-migration-lsps-<VERSION>-full.jar --databaseUrl <DATABASE_URL>
```

   (refer to documentation of the lsps-database migration script).

4. Initialize the database for the LSPS or other libraries you are going to use. For example, if you are planning to use the BAM Library, initialize the tables with *bam-migration*:

```
cli-tools$ java -jar lsps-bam-migration-lsps-<VERSION>-full.jar --databaseUrl <DATABASE_URL>
```

5. Configure your database:

- Microsoft SQL server:
  - Enable the XA transaction support. Refer to the relevant Microsoft documentation for information on your version of Microsoft SQL server and JDBC driver; for example, for Windows Server 2003 and sqljdbc4.jar, refer to http://www.microsoft.com/en-us/download/details.aspx?displaylang=en&id=11774 and http://msdn.microsoft.com/en-US/library/aa342335(v=sql.90).
  - It might be necessary to install MSDTC in Windows (Add/remove Windows components -> Application Server -> Details -> Enable network DTC access).
- On MySQL, set the allowed packet size to 512 MBs and the default time zone in the configuration file of your mysql server, typically, the `my.cnf` or `mysqld.conf` files:

```
[mysqld]
 max_allowed_packet=512M
 default_time_zone="+0:00"
```

3.2 Setting up the Application Server

You can deploy LSPS on the following application servers:

- JBoss
- WildFly
- Oracle WebLogic
- IBM WebSphere

Make sure the selected application server supports your database.

3.2.1 JBoss

You can use JBoss Enterprise Application Server 7.2, JBoss Enterprise Application Server 7.0, or JBoss Enterprise Application Server 6.4.

3.2.1.1 Setting up the JBoss Enterprise Application Platform 7.2 with the LSPS Application

Important: It is strongly discouraged to run other applications on the JBoss Enterprise Application Platform (EAP) with LSPS since LSPS is using a customized Hibernate.

To set up JBoss EAP 7.2 with LSPS, do the following:

1. Make sure you have set up, and initialized or migrated the database with `<LSPS-RUNTIME>/cli-tools/lsps-db-migration-lsps-<VERSION>-full.jar`.
2. Install JBoss EAP.
3. Create a JBoss module with the LSPS login module:
   (a) Copy lsps-security-jboss-${lsps.version}.jar to $EAP_HOME/modules/com/whitestein/lsps/security/main.

```
$ cd jboss-eap-7.2
$ mkdir -p modules/com/whitestein/lsps/security/main/
$ cp ~/lsps-runtime/lsps-security-jboss-3.3.jar modules/com/whitestein/lsps/security/main
```

(b) Create the file $EAP_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
  <resources>
    <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
    <module name="org.picketbox" />
  </dependencies>
</module>
```

Take a note of the module name:it is used later in the security realm configuration.

4. Create a JBoss module with your JDBC driver. Type IV JDBC drivers are recommended.

   - For MySQL, you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>-.jar* to $EAP_HOME/modules/com/mysql/main. Then create $EAP_HOME/modules/com/mysql/main/module.xml with following content:

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.mysql">
       <resources>
         <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to `$EAP_HO↩ ME/modules/com/microsoft/sqlserver/main`.
     Also consider adding the `sendStringParametersAsUnicode=false` property.

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
       <resources>
         <resource-root path="sqljdbc4.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Oracle 11g, copy ojdbc6.jar to $EAP_HOME/modules/com/oracle/jdbc/main

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
       <resources>
         <resource-root path="ojdbc6.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   The module name will be used later for creating data source.

5. Configure JMS in the server profile file (typically, $EAP_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to persist messages:

```
        <subsystem xmlns="urn:jboss:domain:messaging-activemq:4.0">
            <!--added persistence-enabled="true": -->
            <server name="default" persistence-enabled="true">
```

(b) Add queue and topic under messaging-activemq -> server:

```
<jms-queue name="LSPS_QUEUE">
  <entry name="java:jboss/jms/LSPS_QUEUE"/>
</jms-queue>
<jms-topic name="LSPS_TOPIC">
  <entry name="java:jboss/jms/LSPS_TOPIC"/>
</jms-topic>
```

LSPS will use the default JMS connection factory.

6. Configure the `lsps` data source.

The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMMITTED and the JNDI name must be *jdbc/LSPS_DS*.

- For MySql, add the following under the data sources subsystem:

```
<datasources>
  <datasource jndi-name="java:jboss/datasources/ExampleDS" pool-name="ExampleDS" enabled=
    <connection-url>jdbc:h2:mem:test;DB_CLOSE_DELAY=-1;DB_CLOSE_ON_EXIT=FALSE</connection
    <driver>h2</driver>
    <security>
      <user-name>sa</user-name>
      <password>sa</password>
    </security>
  </datasource>
  <!--added lsps xa-datasource: -->
  <xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
    <driver>mysqlxa</driver>
    <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&a
    <security>
      <user-name>lsps</user-name>
      <password>lsps</password>
    </security>
    <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
    <xa-pool>
      <min-pool-size>10</min-pool-size>
      <max-pool-size>20</max-pool-size>
      <prefill>true</prefill>
    </xa-pool>
  </xa-datasource>
```

- For Microsoft SQL server, add the following under the data sources subsystem:

```
  <xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
    <driver>mssqlxa</driver>
    <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
    <security>
      <user-name>lsps</user-name>
      <password>lsps</password>
    </security>
    <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
    <xa-pool>
      <min-pool-size>10</min-pool-size>
      <max-pool-size>20</max-pool-size>
      <prefill>true</prefill>
    </xa-pool>
    <new-connection-sql>select 1</new-connection-sql>
    <validation>
      <check-valid-connection-sql>select 1</check-valid-connection-sql>
    </validation>
  </xa-datasource>
```

- For for Oracle 11g XE server, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>oraclexa</driver>
  <xa-datasource-property name="URL">jdbc:oracle:thin:@localhost:1521:XE</xa-datasource
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <validation>
    <valid-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <stale-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <exception-sorter class-name="org.jboss.jca.adapters.jdbc.extensions.oracle.OracleE
  </validation>
</xa-datasource>
```

7. In the <drivers> element, add <driver> used by the data-source definition:

   - for MySql:

```
<driver name="mysqlxa" module="com.mysql">
  <!-- for version 8: -->
  <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
</driver>
```

   - for MSSql:

```
<driver name="mssqlxa" module="com.microsoft.sqlserver">
  <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
</driver>
```

   - for Oracle:

```
<driver name="oraclexa" module="com.oracle.jdbc">
  <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
</driver>
```

   - Delete driver with name="h2".

8. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

```
<subsystem xmlns="urn:jboss:domain:infinispan:7.0">
...
   <local-cache name="passivation">
        <!--set acquired-timeout: -->
        <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
        <transaction mode="BATCH"/>
        <file-store passivation="true" purge="false"/>
   </local-cache>
</cache-container>
```

9. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config under the mail subsystem tag.

```
<mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
  <smtp-server outbound-socket-binding-ref="mail-smtp"/>
</mail-session>
```

   Important: If you are using Microsoft Exchange Server as your mail server, make sure you have enabled the smtp feature.

10. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config referencing the security module from step 2:

```
<security-domain name="lspsRealm" cache-type="default">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

    The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element.

    For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

11. Configure networking (optional).

    By default JBoss binds to the local host. You can change the configuration in $EAP_HO↩ ME/standalone/configuration/standalone-full.xml (or the JBoss config you use). For example, to bind JBoss to any IPv4 address use the following setting:

```
<interface name="management">
  <any-address/>
</interface>
<interface name="public">
  <any-address/>
</interface>
<interface name="unsecure">
  <any-address/>
</interface>
```

12. Consider adding `logging.properties` for better log legibility:

```
# Specify the handlers to create in the root logger
# (all loggers are children of the root logger)
# The following creates two handlers
handlers = java.util.logging.ConsoleHandler, java.util.logging.FileHandler

# Set the default logging level for the root logger
.level = WARN

# Set the default logging level for new ConsoleHandler instances
java.util.logging.ConsoleHandler.level = ALL

# Set the default logging level for new FileHandler instances
java.util.logging.FileHandler.level = ALL

# Set the default formatter for new ConsoleHandler instances
java.util.logging.ConsoleHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

# Set the default formatter for new FileHandler instances
java.util.logging.FileHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

# Set the logging level for the LSPS
com.whitestein.lsps.level = FINER
```

13. Set up the JBoss option file in $EAP_HOME/bin/standalone.conf (or the JBoss config you use).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MetaspaceSize=96M -XX:Max↩ MetaspaceSize=512m"
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MetaspaceSize=96M -XX:↩ MaxMetaspaceSize=512m"

JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

(b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

(c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

i. Configure EMF framework to work properly on JBoss:
```
JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse.e
```

ii. Configure the conversion of empty numeric inputs:
```
JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"
```
LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

14. Copy the LSPS Application EAR to $JB_HOME/standalone/deployments.

3.2.1.2 Setting up the JBoss Enterprise Application Platform 7.0.0 with LSPS Application

Important: It is strongly discouraged to run other applications on the JBoss Enterprise Application Platform (EAP) with LSPS since LSPS is using a customized Hibernate.

To set up JBoss EAP 7.0.0 with LSPS, do the following:

1. Install JBoss EAP.
2. Create a JBoss module with the LSPS login module:
   (a) Copy lsps-security-jboss-${lsps.version}.jar to $EAP_HOME/modules/com/whitestein/lsps/security/main.
   (b) Create the file $EAP_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
  <resources>
    <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
    <module name="org.picketbox" />
  </dependencies>
</module>
```

   Take a note of the module name since it is used later for security realm configuration.

3. Create a JBoss module with your JDBC driver. Type IV JDBC drivers are recommended.
   - For MySQL you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>-.jar* to $EAP_HOME/modules/com/mysql/main. Then create $EAP_HOME/modules/com/mysql/main/module.xml with following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.mysql">
  <resources>
    <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

- For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to `$EAP_HO↩ ME/modules/com/microsoft/sqlserver/main`.
  Also consider adding the `sendStringParametersAsUnicode=false` property.

```
<module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
  <resources>
    <resource-root path="sqljdbc4.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

- For Oracle 11g, copy ojdbc6.jar to $EAP_HOME/modules/com/oracle/jdbc/main

```
<module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
  <resources>
    <resource-root path="ojdbc6.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

The module name will be used later for creating data source.

4. Configure JMS in the server profile file (typically, $EAP_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to persist messages: `<server name="default" persistence-enabled="true">`

   (b) Add queue and topic under messaging-activemq -> server:

```
<jms-queue name="LSPS_QUEUE">
  <entry name="java:jboss/jms/LSPS_QUEUE"/>
</jms-queue>
<jms-topic name="LSPS_TOPIC">
  <entry name="java:jboss/jms/LSPS_TOPIC"/>
</jms-topic>
```

   LSPS will use the default JMS connection factory.

5. Configure your data source in the server profile file (typically, $EAP_HOME/standalone/configuration/standalone-full.xml).

   The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMM↩ ITTED and the JNDI name must be *jdbc/LSPS_DS*.

   - For MySql, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-java
  <driver>mysqlxa</driver>
  <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&amp
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
</xa-datasource>
```

   - For Microsoft SQL server, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>mssqlxa</driver>
  <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <new-connection-sql>select 1</new-connection-sql>
  <validation>
    <check-valid-connection-sql>select 1</check-valid-connection-sql>
  </validation>
</xa-datasource>
```

- For for Oracle 11g XE server, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>oraclexa</driver>
  <xa-datasource-property name="URL">jdbc:oracle:thin:@localhost:1521:XE</xa-datasource
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <validation>
    <valid-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <stale-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <exception-sorter class-name="org.jboss.jca.adapters.jdbc.extensions.oracle.OracleE
  </validation>
</xa-datasource>
```

6. In the `<drivers>` element, make sure to delete the h2 driver (driver with the `name="h2"` attribute) and add `<driver>` referred to from the data source definition:

   - for MySql:

   ```
   <driver name="mysqlxa" module="com.mysql">
     <!-- for version 8: -->
     <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
   </driver>
   ```

   - for MSSql:

   ```
   <driver name="mssqlxa" module="com.microsoft.sqlserver">
     <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
   </driver>
   ```

   - for Oracle:

   ```
   <driver name="oraclexa" module="com.oracle.jdbc">
     <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
   </driver>
   ```

   - Delete driver with name="h2".

7. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

```
    <local-cache name="passivation">
         <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
         <transaction mode="BATCH"/>
         <file-store passivation="true" purge="false"/>
    </local-cache>
</cache-container>
```

8. Consider adding `logging.properties` for better log legibility:

```
# Specify the handlers to create in the root logger
# (all loggers are children of the root logger)
# The following creates two handlers
handlers = java.util.logging.ConsoleHandler, java.util.logging.FileHandler

# Set the default logging level for the root logger
.level = WARN

# Set the default logging level for new ConsoleHandler instances
java.util.logging.ConsoleHandler.level = ALL

# Set the default logging level for new FileHandler instances
java.util.logging.FileHandler.level = ALL

# Set the default formatter for new ConsoleHandler instances
java.util.logging.ConsoleHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

# Set the default formatter for new FileHandler instances
java.util.logging.FileHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

# Set the logging level for the LSPS
com.whitestein.lsps.level = FINER
```

9. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config under the mail subsystem tag.

```
  <mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
    <smtp-server outbound-socket-binding-ref="mail-smtp"/>
  </mail-session>
```

   Important: If you are using Microsoft Exchange Server as your mail server, make sure you have enabled the smtp feature.

10. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config referencing the security module from step 2:

```
<security-domain name="lspsRealm" cache-type="default">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

    The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element. The security domain definition will look as follows:

```
<security-domain name="lspsRealm">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

    For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

11. Configure networking (optional).

    By default JBoss binds to the local host. You can change the configuration in $EAP_HO↩ ME/standalone/configuration/standalone-full.xml (or the JBoss config you use). For example, to bind JBoss to any IPv4 address use the following setting:

```
<interface name="management">
  <any-address/>
</interface>
<interface name="public">
  <any-address/>
</interface>
<interface name="unsecure">
  <any-address/>
</interface>
```

12. Set up the JBoss option file in $EAP_HOME/bin/standalone.conf (or the JBoss config you use).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MetaspaceSize=96M -XX:Max↩ MetaspaceSize=512m"
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MetaspaceSize=96M -XX:↩ MaxMetaspaceSize=512m"

    JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

    (b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

    (c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

    i. Configure EMF framework to work properly on JBoss:

```
JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse.e
```

    ii. Configure the conversion of empty numeric inputs:

```
JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"
```

    LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.↩ cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

13. Copy the LSPS Application EAR to $JB_HOME/standalone/deployments.

3.2.1.3 Setting up the JBoss Enterprise Application Platform 6.4.0 with LSPS Application

Important: It is strongly discouraged to run other applications on the JBoss Enterprise Application Platform (EAP) with LSPS since LSPS is using a customized Hibernate.

To set up JBoss EAP 6.4.0 with LSPS, do the following:

1. Install JBoss EAP.
2. Create JBoss module with the LSPS login module:

    (a) Copy lsps-security-jboss-${lsps.version}.jar to $EAP_HOME/modules/com/whitestein/lsps/security/main.

    (b) Create the file $EAP_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
  <resources>
    <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
    <module name="org.picketbox" />
  </dependencies>
</module>
```

Take a note of the module name since it is used later for security realm configuration.

3. Create a JBoss module with your JDBC driver. Type IV JDBC drivers are recommended.

   - For MySQL you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>.jar* to $EAP_HOME/modules/com/mysql/main. Then create $EAP_HOME/modules/com/mysql/main/module.xml with following content:

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.mysql">
       <resources>
         <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to `$EAP_HO↩ ME/modules/com/microsoft/sqlserver/main`.
     Also consider adding the `sendStringParametersAsUnicode=false` property.

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
       <resources>
         <resource-root path="sqljdbc4.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Oracle 11g, copy ojdbc6.jar to $EAP_HOME/modules/com/oracle/jdbc/main

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
       <resources>
         <resource-root path="ojdbc6.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   The module name will be used later for creating data source.

4. Configure JMS in the server profile file (typically, $EAP_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to be persistent with `<persistence-enabled>true</persistence-enabled>`.

   ```
   <subsystem xmlns="urn:jboss:domain:messaging:3.0">
      <hornetq-server>
         <persistence-enabled>true</persistence-enabled>
         <journal-file-size>102400</journal-file-size>
   ~
         <connectors>
   ```

```
        <http-connector name="http-connector" socket-binding="http">
           <param key="http-upgrade-endpoint" value="http-acceptor"/>
        </http-connector>
```

(b) Add queue and topic under jms-destinations:

```
<jms-queue name="LSPS_QUEUE">
  <entry name="java:jboss/jms/LSPS_QUEUE"/>
</jms-queue>
<jms-topic name="LSPS_TOPIC">
  <entry name="java:jboss/jms/LSPS_TOPIC"/>
</jms-topic>
```

LSPS will use the default JMS connection factory.

5. Configure your data source in the server profile file (typically, $EAP_HOME/standalone/configuration/standalone-full.xml).

   The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMM↩ ITTED and the JNDI name must be *jdbc/LSPS_DS*.

   - For MySql, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-java
  <driver>mysqlxa</driver>
  <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&amp
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
</xa-datasource>
```

   - For Microsoft SQL server, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>mssqlxa</driver>
  <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <new-connection-sql>select 1</new-connection-sql>
  <validation>
    <check-valid-connection-sql>select 1</check-valid-connection-sql>
  </validation>
</xa-datasource>
```

   - For for Oracle 11g XE server, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>oraclexa</driver>
  <xa-datasource-property name="URL">jdbc:oracle:thin:@localhost:1521:XE</xa-datasource
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
```

```
        <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
        <xa-pool>
          <min-pool-size>10</min-pool-size>
          <max-pool-size>20</max-pool-size>
          <prefill>true</prefill>
        </xa-pool>
        <validation>
          <valid-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
          <stale-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
          <exception-sorter class-name="org.jboss.jca.adapters.jdbc.extensions.oracle.OracleE
        </validation>
      </xa-datasource>
```

6. In the `<drivers>` element, make sure to delete the h2 driver (driver with the `name="h2"` attribute) and add `<driver>` referred to from the datasource definition:

   - for MySql (make sure the driver is 5.5 compatible):

     ```
     <driver name="mysqlxa" module="com.mysql">
       <!-- for version 8: -->
       <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
     </driver>
     ```

   - for MSSql:

     ```
     <driver name="mssqlxa" module="com.microsoft.sqlserver">
       <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
     </driver>
     ```

   - for Oracle:

     ```
     <driver name="oraclexa" module="com.oracle.jdbc">
       <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
     </driver>
     ```

   - Delete driver with name="h2".

7. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

   ```
      <local-cache name="passivation">
           <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
           <transaction mode="BATCH"/>
           <file-store passivation="true" purge="false"/>
      </local-cache>
   </cache-container>
   ```

8. Consider adding `logging.properties` for better log legibility:

   ```
   # Specify the handlers to create in the root logger
   # (all loggers are children of the root logger)
   # The following creates two handlers
   handlers = java.util.logging.ConsoleHandler, java.util.logging.FileHandler

   # Set the default logging level for the root logger
   .level = WARN

   # Set the default logging level for new ConsoleHandler instances
   java.util.logging.ConsoleHandler.level = ALL

   # Set the default logging level for new FileHandler instances
   java.util.logging.FileHandler.level = ALL

   # Set the default formatter for new ConsoleHandler instances
   java.util.logging.ConsoleHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

   # Set the default formatter for new FileHandler instances
   java.util.logging.FileHandler.formatter = com.whitestein.lsps.log.LSPSFormatter

   # Set the logging level for the LSPS
   com.whitestein.lsps.level = FINER
   ```

9. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config under the mail subsystem tag.

```
<mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
  <smtp-server outbound-socket-binding-ref="mail-smtp"/>
</mail-session>
```

Important: If you are using Microsoft Exchange Server as your mail server, make sure you have enabled the smtp feature.

10. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $EAP_HOME/standalone/configuration/standalone-full.xml or the respective JBoss config referencing the security module from step 2:

```
<security-domain name="lspsRealm" cache-type="default">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element. The security domain definition will look as follows:

```
<security-domain name="lspsRealm">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

11. Configure networking (optional).

    By default JBoss binds to the local host. You can change the configuration in $EAP_HO↩ ME/standalone/configuration/standalone-full.xml (or the JBoss config you use). For example, to bind JBoss to any IPv4 address use the following setting:

```
<interface name="management">
  <any-address/>
</interface>
<interface name="public">
  <any-address/>
</interface>
<interface name="unsecure">
  <any-address/>
</interface>
```

12. Set up the JBoss option file in $EAP_HOME/bin/standalone.conf (or the JBoss config you use).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MaxPermSize=128m .....
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MaxPermSize=256m .....

    JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

    (b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

(c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

i. Configure EMF framework to work properly on JBoss:

```
JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse.e
```

ii. Configure the conversion of empty numeric inputs:

```
JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"
```

LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

13. Copy the LSPS Application EAR to $JB_HOME/standalone/deployments.

3.2.2 WildFly

You can deploy the LSPS application to WildFly 11, WildFly 10, or WildFly 9.4.

If you require CAS authentication, follow the instructions in Integration with CAS.

Troubleshooting Data Source

3.2.2.1 Setting up WildFly 11.0.0 with LSPS Application

Important: It is strongly discouraged to run other applications on WildFly (WF) with LSPS since LSPS is using a customized Hibernate.

To set up WildFly 11.0.0 with LSPS, do the following:

1. Install WildFly.
2. Create WildFly module with the LSPS login module:
   (a) Copy lsps-security-jboss-${lsps.version}.jar to $WF_HOME/modules/com/whitestein/lsps/security/main.
   (b) Create the file $WF_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
 <resources>
   <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
 </resources>
 <dependencies>
   <module name="javax.api"/>
   <module name="javax.transaction.api"/>
   <module name="org.picketbox" />
 </dependencies>
</module>
```

   Take a note of the module name since it is used later for security realm configuration.
3. Create a WildFly module with your JDBC driver. Type IV JDBC drivers are recommended.
   - For MySQL you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>-bin.jar* to $WF_HOME/modules/com/mysql/main. Then create $WF_HOME/modules/com/mysql/main/module.xml with following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.mysql">
 <resources>
   <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
 </resources>
 <dependencies>
   <module name="javax.api"/>
   <module name="javax.transaction.api"/>
 </dependencies>
</module>
```

- For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to $WF_HO↩ ME/modules/com/microsoft/sqlserver/main. Then create `$WF_HOME/modules/com/microsoft/sqlserver/ma` with following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
 <resources>
   <resource-root path="sqljdbc4.jar"/>
 </resources>
 <dependencies>
   <module name="javax.api"/>
   <module name="javax.transaction.api"/>
 </dependencies>
</module>
```

  Also consider adding the `sendStringParametersAsUnicode=false` property.

- For Oracle 11g, copy ojdbc6.jar to $WF_HOME/modules/com/oracle/jdbc/main

```
<module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
 <resources>
   <resource-root path="ojdbc6.jar"/>
 </resources>
 <dependencies>
   <module name="javax.api"/>
   <module name="javax.transaction.api"/>
 </dependencies>
</module>
```

- For DB2, copy jcc-11.5.0.0.jar to $WF_HOME/modules/com/ibm/db2/main

```
<module xmlns="urn:jboss:module:1.0" name="com.ibm.db2">
 <resources>
   <resource-root path="jcc-11.5.0.0.jar"/>
 </resources>
 <dependencies>
   <module name="javax.api"/>
   <module name="javax.transaction.api"/>
 </dependencies>
</module>
```

4. Configure JMS in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to be persistent: `<server name="default" persistence-enabled="true">`.

   (b) Add queue and topic under messaging-activemq -> server:

```
<jms-queue name="LSPS_QUEUE" entries="java:jboss/jms/LSPS_QUEUE"/>
<jms-topic name="LSPS_TOPIC" entries="java:jboss/jms/LSPS_TOPIC"/>
```

   LSPS will use the default JMS connection factory.

5. Configure your data source in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml).

   The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMM↩ ITTED and the JNDI name must be *jdbc/LSPS_DS*.

   - For MySql, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>mysqlxa</driver>
  <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&c
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
</xa-datasource>
```

- For Microsoft SQL Server, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>mssqlxa</driver>
  <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <new-connection-sql>select 1</new-connection-sql>
  <validation>
    <check-valid-connection-sql>select 1</check-valid-connection-sql>
  </validation>
</xa-datasource>
```

- For DB2, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>db2xa</driver>
  <xa-datasource-property name="User">lsps</xa-datasource-property>
  <xa-datasource-property name="Password">lsps</xa-datasource-property>
  <xa-datasource-property name="DatabaseName">lsps</xa-datasource-property>
  <xa-datasource-property name="ServerName">localhost</xa-datasource-property>
  <xa-datasource-property name="PortNumber">5000</xa-datasource-property>
  <xa-datasource-property name="progressiveStreaming">2</xa-datasource-property>
  <xa-datasource-property name="progressiveLocators">2</xa-datasource-property>
  <xa-datasource-property name="fullyMaterializedLobData">true</xa-datasource-property>
  <xa-datasource-property name="fullyMaterializedInputStreams">true</xa-datasource-prop
  <xa-datasource-property name="downgradeHoldCursorsUnderXa">true</xa-datasource-proper
  <xa-datasource-property name="resultSetHoldabilityForCatalogQueries">1</xa-datasource
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
</xa-datasource>
```

6. In the `<drivers>` element, make sure to *delete the h2 driver* (driver with the `name="h2"` attribute) and add `<driver>` for your data source:

- for MySQL:

```
<driver name="mysqlxa" module="com.mysql">
 <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
</driver>
```

- for MSSQL:

```
<driver name="mssqlxa" module="com.microsoft.sqlserver">
 <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
</driver>
```

- for Oracle:

```
<driver name="oraclexa" module="com.oracle.jdbc">
 <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
</driver>
```

- for DB2:

```
<driver name="db2xa" module="com.ibm.db2">
 <xa-datasource-class>com.ibm.db2.jcc.DB2XADataSource</xa-datasource-class>
</driver>
```

- Delete the h2 driver.

7. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

```
  <local-cache name="passivation">
       <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
       <transaction mode="BATCH"/>
       <file-store passivation="true" purge="false"/>
  </local-cache>
</cache-container>
```

8. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config under the mail subsystem tag.

```
  <mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
   <smtp-server outbound-socket-binding-ref="mail-smtp"/>
 </mail-session>
```

9. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config referencing the security module from step 2:

```
<security-domain name="lspsRealm" cache-type="default">
 <authentication>
   <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
   <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
   </login-module>
 </authentication>
</security-domain>
```

The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element. The security domain definition will look as follows:

```
<security-domain name="lspsRealm">
 <authentication>
   <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
   <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
   </login-module>
 </authentication>
</security-domain>
```

For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

10. Configure networking (optional).

    By default WildFly binds to the local host. You can change the configuration in $WF_HOME/standalone/configuration/standalone-full.xml (or the WildFly config you use). For example, to bind WildFly to any IPv4 address use the following setting:

```
<interface name="management">
  <any-address/>
</interface>
<interface name="public">
  <any-address/>
</interface>
<interface name="unsecure">
  <any-address/>
</interface>
```

11. Set up the WildFly option in $WF_HOME/bin/standalone.conf (or the WildFly config you use).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MetaspaceSize=96M -XX:MaxMetaspaceSize=512m"
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MetaspaceSize=96M -XX:MaxMetaspaceSize=512m"

    JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

    (b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

    (c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

    - Configure EMF framework to work properly on WildFly

      ```
      JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse
      ```

      Without this configuration property, the LSPS application will fail to run properly.
    - Configure conversion of empty numeric inputs

      ```
      JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"
      ```

      LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

12. Copy the LSPS Application EAR to $WF_HOME/standalone/deployments.

13. Run WildFly.

3.2.2.2 Setting up WildFly 10.0.0 with LSPS Application

Important: It is strongly discouraged to run other applications on WildFly (WF) along with the LSPS Application since LSPS is using a customized Hibernate.

To set up WildFly 10.0.0 with LSPS, do the following:

1. Install WildFly.
2. Create WildFly module with the LSPS login module:

(a) Copy lsps-security-jboss-${lsps.version}.jar to $WF_HOME/modules/com/whitestein/lsps/security/main.

(b) Create the file $WF_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
  <resources>
    <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
    <module name="org.picketbox" />
  </dependencies>
</module>
```

Take a note of the module name since it is used later for security realm configuration.

3. Create a WildFly module with your JDBC driver. Type IV JDBC drivers are recommended.

   - For MySQL you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>-bin.jar* to $WF_HOME/modules/com/mysql/main. Then create $WF_HOME/modules/com/mysql/main/module.xml with following content:

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.mysql">
       <resources>
         <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to `$WF_HOME/modules/com/microsoft/sqlserver/main`.
     Also consider adding the `sendStringParametersAsUnicode=false` property.

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
       <resources>
         <resource-root path="sqljdbc4.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   - For Oracle 11g, copy ojdbc6.jar to $WF_HOME/modules/com/oracle/jdbc/main

     ```
     <module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
       <resources>
         <resource-root path="ojdbc6.jar"/>
       </resources>
       <dependencies>
         <module name="javax.api"/>
         <module name="javax.transaction.api"/>
       </dependencies>
     </module>
     ```

   The module name will be used later for creating data source.

4. Configure JMS in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to be persistent: `<server name="default" persistence-enabled="true">`.

   (b) Add queue and topic under messaging-activemq -> server:

```
<jms-queue name="LSPS_QUEUE" entries="java:jboss/jms/LSPS_QUEUE"/>
<jms-topic name="LSPS_TOPIC" entries="java:jboss/jms/LSPS_TOPIC"/>
```

LSPS will use the default JMS connection factory.

5. Configure your data source in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml).

   The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMMITTED and the JNDI name must be *jdbc/LSPS_DS*.

   - For MySql, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-java
  <driver>mysqlxa</driver>
  <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&amp
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
</xa-datasource>
```

   - For Microsoft SQL server, add the following under the data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>mssqlxa</driver>
  <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <new-connection-sql>select 1</new-connection-sql>
  <validation>
    <check-valid-connection-sql>select 1</check-valid-connection-sql>
  </validation>
</xa-datasource>
```

   - For forOracle 11g XE server, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>oraclexa</driver>
  <xa-datasource-property name="URL">jdbc:oracle:thin:@localhost:1521:XE</xa-datasource
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <validation>
    <valid-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <stale-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
```

```
        <exception-sorter class-name="org.jboss.jca.adapters.jdbc.extensions.oracle.OracleE
      </validation>
    </xa-datasource>
```

6. In the <drivers> element, make sure to *delete the h2 driver* (driver with the name="h2" attribute) and add <driver> for your datasource:

   - for MySQL:

     ```
     <driver name="mysqlxa" module="com.mysql">
       <!-- for version 8: -->
       <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
     </driver>
     ```

   - for MSSQL:

     ```
     <driver name="mssqlxa" module="com.microsoft.sqlserver">
       <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
     </driver>
     ```

   - for Oracle:

     ```
     <driver name="oraclexa" module="com.oracle.jdbc">
       <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
     </driver>
     ```

7. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

   ```
     <local-cache name="passivation">
          <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
          <transaction mode="BATCH"/>
          <file-store passivation="true" purge="false"/>
     </local-cache>
   </cache-container>
   ```

8. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config under the mail subsystem tag.

   ```
   <mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
     <smtp-server outbound-socket-binding-ref="mail-smtp"/>
   </mail-session>
   ```

   Important: If you are using Microsoft Exchange Server as your mail server, make sure you have enabled the smtp feature.

9. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config referencing the security module from step 2:

   ```
   <security-domain name="lspsRealm" cache-type="default">
     <authentication>
       <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
       <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
       </login-module>
     </authentication>
   </security-domain>
   ```

   The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element. The security domain definition will look as follows:

```
<security-domain name="lspsRealm">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

10. Configure networking (optional).

    By default WildFly binds to the local host. You can change the configuration in $WF_HO↩ ME/standalone/configuration/standalone-full.xml (or the WildFly config you use). For example, to bind WildFly to any IPv4 address use the following setting:

```
<interface name="management">
  <any-address/>
</interface>
<interface name="public">
  <any-address/>
</interface>
<interface name="unsecure">
  <any-address/>
</interface>
```

11. Set up the WildFly option file in $WF_HOME/bin/standalone.conf (or the WildFly config you use).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MetaspaceSize=96M -XX:Max↩ MetaspaceSize=512m"
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MetaspaceSize=96M -XX:↩ MaxMetaspaceSize=512m"

    JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

    (b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

    (c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

    - Configure EMF framework to work properly on WildFly:
      `JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse.e`
    - Configure conversion of empty numeric inputs
      `JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"`

      LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.↩ cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

12. Copy the LSPS Application EAR to $WF_HOME/standalone/deployments.

13. Run WildFly.

3.2.2.3 Setting up WildFly 9.0.2 with LSPS Application

Important: It is strongly discouraged to run other applications on WildFly (WF) with LSPS since LSPS is using a customized Hibernate.

To set up WildFly 9.0.2 with LSPS, do the following:

1. Install WildFly.
2. Create WildFly module with the LSPS login module:
   (a) Copy lsps-security-jboss-${lsps.version}.jar to $WF_HOME/modules/com/whitestein/lsps/security/main.
   (b) Create the file $WF_HOME/modules/com/whitestein/lsps/security/main/module.xml with the following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.whitestein.lsps.security">
  <resources>
    <resource-root path="lsps-security-jboss-${lsps.version}.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
    <module name="org.picketbox" />
  </dependencies>
</module>
```

   Take a note of the module name since it is used later for security realm configuration.
3. Create a WildFly module with your JDBC driver. Type IV JDBC drivers are recommended.
   - For MySQL you need to copy MySQL Connector/J, that is, *mysql-connector-java-<VERSION>-bin.jar* to $WF_HOME/modules/com/mysql/main. Then create $WF_HOME/modules/com/mysql/main/module.xml with following content:

```
<module xmlns="urn:jboss:module:1.0" name="com.mysql">
  <resources>
    <resource-root path="mysql-connector-java-<VERSION>-bin.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

   - For Microsoft SQL server, get the Microsoft SQL driver *sqljdbc4.jar* and copy it to $WF_HOME/modules/com/microsoft/sqlserver/main.
     Also consider adding the `sendStringParametersAsUnicode=false` property.

```
<module xmlns="urn:jboss:module:1.0" name="com.microsoft.sqlserver">
  <resources>
    <resource-root path="sqljdbc4.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

   - For Oracle 11g, copy ojdbc6.jar to $WF_HOME/modules/com/oracle/jdbc/main

```
<module xmlns="urn:jboss:module:1.0" name="com.oracle.jdbc">
  <resources>
    <resource-root path="ojdbc6.jar"/>
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

   The module name will be used later for creating data source.

4. Configure JMS in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml):

   (a) Set JMS to be persistent with `<persistence-enabled>true</persistence-enabled>`.

   ```
   <subsystem xmlns="urn:jboss:domain:messaging:3.0">
      <hornetq-server>
         <persistence-enabled>true</persistence-enabled>
         <journal-file-size>102400</journal-file-size>
   ~
         <connectors>
           <http-connector name="http-connector" socket-binding="http">
              <param key="http-upgrade-endpoint" value="http-acceptor"/>
          </http-connector>
   ```

   (b) Add queue and topic under jms-destinations:

   ```
   <jms-queue name="LSPS_QUEUE">
     <entry name="java:jboss/jms/LSPS_QUEUE"/>
   </jms-queue>
   <jms-topic name="LSPS_TOPIC">
     <entry name="java:jboss/jms/LSPS_TOPIC"/>
   </jms-topic>
   ```

   LSPS will use the default JMS connection factory.

5. Configure your data source in the server profile file (typically, $WF_HOME/standalone/configuration/standalone-full.xml).

   The data source must be an XA-datasource with the transaction isolation TRANSACTION_READ_COMM↩ ITTED and the JNDI name must be *jdbc/LSPS_DS*.

   - For MySql, add the following under the data sources subsystem:

   ```
   <xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-java
     <driver>mysqlxa</driver>
     <xa-datasource-property name="URL">jdbc:mysql://localhost:3306/lsps?useUnicode=true&amp
     <security>
       <user-name>lsps</user-name>
       <password>lsps</password>
     </security>
     <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
     <xa-pool>
       <min-pool-size>10</min-pool-size>
       <max-pool-size>20</max-pool-size>
       <prefill>true</prefill>
     </xa-pool>
   </xa-datasource>
   ```

   - For Microsoft SQL server, add the following under the data sources subsystem:

   ```
   <xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
     <driver>mssqlxa</driver>
     <xa-datasource-property name="URL">jdbc:sqlserver://localhost;databaseName=lsps</xa-d
     <security>
       <user-name>lsps</user-name>
       <password>lsps</password>
     </security>
     <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
     <xa-pool>
       <min-pool-size>10</min-pool-size>
       <max-pool-size>20</max-pool-size>
       <prefill>true</prefill>
     </xa-pool>
     <new-connection-sql>select 1</new-connection-sql>
     <validation>
       <check-valid-connection-sql>select 1</check-valid-connection-sql>
     </validation>
   </xa-datasource>
   ```

- For forOracle 11g XE server, add the following under data sources subsystem:

```
<xa-datasource jndi-name="java:/jdbc/LSPS_DS" pool-name="LSPS_DS" enabled="true" use-ja
  <driver>oraclexa</driver>
  <xa-datasource-property name="URL">jdbc:oracle:thin:@localhost:1521:XE</xa-datasource
  <security>
    <user-name>lsps</user-name>
    <password>lsps</password>
  </security>
  <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
  <xa-pool>
    <min-pool-size>10</min-pool-size>
    <max-pool-size>20</max-pool-size>
    <prefill>true</prefill>
  </xa-pool>
  <validation>
    <valid-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <stale-connection-checker class-name="org.jboss.jca.adapters.jdbc.extensions.oracle
    <exception-sorter class-name="org.jboss.jca.adapters.jdbc.extensions.oracle.OracleE
  </validation>
</xa-datasource>
```

6. In the <drivers> element, make sure to *delete the h2 driver* (driver with the name="h2" attribute) and add <driver> for your data source:

   - for MySql (make sure the driver is 5.5 compatible):

```
<driver name="mysqlxa" module="com.mysql">
  <!-- for version 8: -->
  <xa-datasource-class>com.mysql.cj.jdbc.MysqlXADataSource</xa-datasource-class>
</driver>
```

   - for MSSql:

```
<driver name="mssqlxa" module="com.microsoft.sqlserver">
  <xa-datasource-class>com.microsoft.sqlserver.jdbc.SQLServerXADataSource</xa-datasourc
</driver>
```

   - for Oracle:

```
<driver name="oraclexa" module="com.oracle.jdbc">
  <xa-datasource-class>oracle.jdbc.xa.client.OracleXADataSource</xa-datasource-class>
</driver>
```

7. Set Infinispan acquire-timeout setting to at least 5 minutes in your profile XML, such as standalone-full.xml. For details refer to the respective faq entry

```
 <local-cache name="passivation">
      <locking isolation="REPEATABLE_READ" acquire-timeout="600000"/>
      <transaction mode="BATCH"/>
      <file-store passivation="true" purge="false"/>
 </local-cache>
</cache-container>
```

8. Create a mail session with the JNDI name mail/LSPS_MAIL defined in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config under the mail subsystem tag.

```
<mail-session name="lspsmail" jndi-name="java:jboss/mail/LSPS_MAIL">
  <smtp-server outbound-socket-binding-ref="mail-smtp"/>
</mail-session>
```

   Important: If you are using Microsoft Exchange Server as your mail server, make sure you have enabled the smtp feature.

9. Set up the login module for the LSPS realm: add the following to the "security-domains" of the security subsystem tag in $WF_HOME/standalone/configuration/standalone-full.xml or the respective WildFly config referencing the security module from step 2:

```
<security-domain name="lspsRealm" cache-type="default">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
       <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

The attribute cache-type of the security-domain element turns on caching of user login data. As a side effect, changes to user credentials will not be used until after the cache is flushed; for example, if a user changes user's password through the web console but the user is already using PDS, they will be able to connect PDS to the server with the old credentials. You can turn the cache off by omitting the cache-type attribute of the security-domain element. The security domain definition will look as follows:

```
<security-domain name="lspsRealm">
  <authentication>
    <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" module=
    <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
    </login-module>
  </authentication>
</security-domain>
```

For additional module options, refer to the JavaDoc of the implementing class and super classes. You can also plug in your own authentication module.

10. On Wildfly 8 and 9, enable stateless session beans pooling: on WF 10, the feature is enabled by default, see https://developer.jboss.org/message/881747)

```
<session-bean>
  <stateless>
    <bean-instance-pool-ref pool-name="slsb-strict-max-pool"/>
  </stateless>
```

11. Configure networking (optional).

    By default WildFly binds to the local host. You can change the configuration in $WF_HO↩ ME/standalone/configuration/standalone-full.xml (or the WildFly config you use). For example, to bind WildFly to any IPv4 address use the following setting:

```
  <interface name="management">
    <any-ipv4-address/>
  </interface>
  <interface name="public">
    <any-ipv4-address/>
  </interface>
  <interface name="unsecure">
    <any-ipv4-address/>
  </interface>
```

12. Set up the WildFly option file in $WF_HOME/bin/standalone.conf (or the WildFly config you use; on Windows, standalone.conf.bat).

    (a) Set up Java memory options:

    - minimum setting: JAVA_OPTS="-Xms128m -Xmx512m -XX:MaxPermSize=128m"
    - recommended setting: JAVA_OPTS="-Xms256m -Xmx1024m -XX:MaxPermSize=256m"

    JVM might require larger amount of memory depending on the uploaded and used LSPS modules.

    (b) Set up the server startup configuration file to use (pointing to the configuration file you modified), e.g. for standalone-full.xml:

```
JAVA_OPTS="$JAVA_OPTS -Djboss.server.default.config=standalone-full.xml"
```

    (c) Add the following Java system properties to the config file, so it is added to the Java options passed to the JVM:

- Configure EMF framework to work properly on WildFly.
  `JAVA_OPTS="$JAVA_OPTS -Dorg.eclipse.emf.ecore.EPackage.Registry.INSTANCE=org.eclipse.e`
- Configure the conversion of empty numeric inputs.
  `JAVA_OPTS="-Dorg.apache.el.parser.COERCE_TO_ZERO=false $JAVA_OPTS"`
  LSPS needs the system property org.apache.el.parser.COERCE_TO_ZERO to be set to "false" (see https://jsp-spec-public.dev.java.net/issues/show_bug.cgi?id=183). Without the property, empty input in numeric fields in the web application is interpreted as 0. This interpretation causes some functionalities not to work.

13. Copy the LSPS Application EAR to $WF_HOME/standalone/deployments.
14. Run WildFly.

3.2.2.4 Integration with CAS

Integration with CAS allows the user to authenticate against the CAS server and use the authentication to access the LSPS Application User Interface and Management Console.

Before setting up CAS integration, make sure that:

- WildFly is configured correctly.
- LSPS EAR can be deployed to the application server successfully.
- WildFly is configured to support HTTPS on port 8443.

To integrate LSPS applications with CAS, do the following:

1. Download the module with Java CAS Client classes to WildFly. They are available on the apereo webpage.
2. Extract the archive to the WildFly modules directory `<WILDFLY_HOME>/modules/`
   The resulting structure is `<WF_HOME>/modules/org/jasig/cas/main/`
3. Add the org.jasig.cas module as a global module of the *urn:jboss:domain:ee:3.0* subsystem.

```
<subsystem xmlns="urn:jboss:domain:ee:3.0">
   <global-modules>
       <module name="org.jasig.cas" slot="main"/>
   </global-modules>
   ...
</subsystem>
```

4. Configure the *lspsRealm* security domain to use the cas login-module.
   This is the security domain used by the LSPS EAR. By default, LSPS uses the LSPS database for authorization and authentication.

```
<!--ORIGINAL REALM
<security-domain name="lspsRealm" cache-type="default">
    <authentication>
        <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="required" mod
            <module-option name="dsJndiName" value="/jdbc/LSPS_DS"/>
        </login-module>
    </authentication>
</security-domain>-->
<!--REALM USES CAS -->
<security-domain name="lspsRealm">
    <authentication>
```

```
            <login-module code="org.jasig.cas.client.jaas.CasLoginModule" flag="required" module=
                <module-option name="ticketValidatorClass" value="org.jasig.cas.client.validation
                <module-option name="casServerUrlPrefix" value="https://localhost:8181/cas"/>
                <module-option name="tolerance" value="20000"/>
                <!--defaultRole user will be granted to any user that successfully authenticates
                <module-option name="defaultRoles" value="user"/>
                <module-option name="roleAttributeNames" value="memberOf,eduPersonAffiliation,aut
                <module-option name="principalGroupName" value="CallerPrincipal"/>
                <module-option name="roleGroupName" value="Roles"/>
                <module-option name="cacheAssertions" value="true"/>
                <module-option name="cacheTimeout" value="480"/>
            </login-module>
        </authentication>
    </security-domain>
```

5. Configure lsps web applications in individual web.xml files:

   - Add the CAS servlet filter to the *beginning* of the servlet filter chain:

     ```
     <filter>
         <filter-name>Servlet3 Authentication Filter</filter-name>
         <filter-class>org.jasig.cas.client.jaas.Servlet3AuthenticationFilter</filter-class>
         <init-param>
             <param-name>serverName</param-name>
             <param-value> https://localhost:8443</param-value>
         </init-param>
     </filter>
     <filter>
         <filter-name>CAS Authentication Filter</filter-name>
         <filter-class>org.jasig.cas.client.authentication.AuthenticationFilter</filter-class>
         <init-param>
             <param-name>casServerLoginUrl</param-name>
             <param-value> https://localhost:8181/cas/login</param-value>
         </init-param>
         <init-param>
             <param-name>serverName</param-name>
             <param-value> https://localhost:8443</param-value>
         </init-param>
     </filter>
     ```

   - In the *session-config* element, set the COOKIE tracking mode:

     ```
     <session-config>
         <session-timeout>30</session-timeout>
         <tracking-mode>COOKIE</tracking-mode>
     </session-config>
     ```

6. Recompile and redeploy your applications.

3.2.2.5 Troubleshooting Data Source

3.2.2.5.1 XAException on Oracle 10g R2 or 11g

The server returns the following XA exception:

```
WARN  [com.arjuna.ats.jta.logging.loggerI18N] [com.arjuna.ats.internal.jta.recovery.xarecovery1] Local
       XARecoveryModule.xaRecovery got XA exception javax.transaction.xa.XAException, XAException.XAER_RMERR
```

To remedy the situation, do the following:

- For Oracle, make sure the Oracle user has access to the appropriate tables so they can accomplish the recovery:

```
GRANT SELECT ON sys.dba_pending_transactions TO user;
GRANT SELECT ON sys.pending_trans$ TO user;
GRANT SELECT ON sys.dba_2pc_pending TO user;
GRANT EXECUTE ON sys.dbms_xa TO user;
```

The above assumes that the user is the user defined to connect from WildFly to Oracle. It also assumes that either Oracle 10g R2 (patched for bug 5945463) or 11g is used. If an unpatched version, that is, a version older that 11g, is used, change the last GRANT EXECUTE to the following:

```
GRANT EXECUTE ON sys.dbms_system TO user;
```

3.2.2.5.2 Time zone 'CEST' is unrecognized in MySQL

When using MySQL, you might get the following exception when connecting:

```
Caused by: com.mysql.cj.exceptions.InvalidConnectionAttributeException:
The server time zone value 'CEST' is unrecognized or represents more than one time zone.
You must configure either the server or JDBC driver (via the serverTimezone configuration property)
to use a more specific time zone value if you want to utilize time zone support.
```

To remedy the situation, set the time zone in one of the following:

- in the database if one timezone is required, for example, 'SET GLOBAL time_zone = '+0:00';'
- in the data source URL if multiple zones are required, for example,

```
<xa-datasource-property
   name="URL">jdbc:mysql://localhost:3306/lsps?
               useUnicode=true&amp;
               characterEncoding=utf-8
               &amp;useJDBCCompliantTimezoneShift=true
               &amp;useLegacyDatetimeCode=false
               &amp;serverTimezone=UTC
</xa-datasource-property>
```

3.2.3 Oracle WebLogic

To set up LSPS on Oracle WebLogic application server 11gR1 (10.3.2) and newer, do the following:

1. Make sure the JVM runs with the recommended memory settings:
   - Minimum: -Xmx512m -XX:PermSize=128m (Usually satisfied by default application server settings)
   - Optimum: -Xmx1024m -XX:PermSize=256m

   The amount of memory required might increase depending on uploaded and used lsps modules.
2. Ensure JPA2 is supported on app server (see http://wiki.eclipse.org/EclipseLink/↩ Development/JPA_2.0/weblogic#20110115:_JPA_2.0_using_EclipseLink_on_↩ WebLogic_10.3.4.0 for further information).
3. If you are using WebLogic 12.2. and newer, run Java with the following properties:

```
-Dcom.sun.xml.ws.spi.db.BindingContextFactory=com.sun.xml.ws.db.glassfish.JAXBRIContextFactor
```

4. Install WebLogic.
5. If necessary, copy your database JDBC driver libraries to to the `lib` directory of your domain (`$WL_HOME/server/lib` or `$WL_HOME/user_projects/domains/<YOUR_DOMAIN>/lib`).
6. Copy LSPS security module *lsps-security-weblogic-$LSPS_VERSION.jar* to $WL_HOME/server/lib/mbeantypes.
7. Start WebLogic.
8. Create JDBC XA data source named *LSPS_DS* with JNDI name *jdbc/LSPS_DS*.

   Example configuration for an Oracle database installed on localhost

   ```
   JDBC Data Source:
   Name: LSPS_DS
   JNDI Name: jdbc/LSPS_DS
   Database Type: Oracle
   Database Driver: Oracle's Driver (Thin XA)
   Database Name: LSPS
   Host Name: localhost
   Port: 1521
   Database User Name: lsps
   Password: lsps
   ```

9. Create JMS resouces: Create a JMS server, you can also use your own instance.

   Example with a default persistent store

   - JMS Server:
     - Name: LSPS_JMS_SERVER
     - Persistent Store: (none)
     - Target: (your server name)
   - JMS Module:
     - Name: LSPS_JMS
     - Target: (your server name)
   - Resources inside JMS Module LSPS_JMS:
     - Subdeployment:
       - Name: LSPS_DEPL
       - Targets:
         - JMS Servers: LSPS_JMS_SERVER
   - Queue:
     - Name: LSPS_QUEUE
     - JNDI Name: jms/LSPS_QUEUE
     - Subdeployments: LSPS_DEPL
   - Connection Factory:
     - Name: LSPS_CF
     - JNDI Name: jms/LSPS_CF
     - Targets: (your server name)
     - XA Connection Factory Enabled: true (Detail/Configuration/Transactions)
   - Topic:
     - Name: LSPS_TOPIC
     - JNDI Name: jms/LSPS_TOPIC
     - Subdeployments: LSPS_DEPL
     - Targets: (your server name)

10. Optionally, set up LSPS authentication provider. Use your own authentication providers if necessary.

    (a) Open your default security realm and go to Providers.

    (b) Create new authentication provider:

```
Authentication Provider:
  Name: LSPS_AUTHENTICATOR
  Type: LSPSAuthenticator (this should be in the list if you copied the LSPS security module in the step 2
       correctly)
```

11. Set the authentication provider:
    (a) Reorder authentication providers so that LSPS_AUTHENTICATOR is the first provider.
    (b) Set the provider control flag to SUFFICIENT (you can find the control flag in the provider detail page)

    Alternatively, set the control flag on all providers to OPTIONAL.
12. Restart WebLogic.
13. If you are using WLS 12.1.1, add the following line to the *bin/setDomainEnv.cmd* file of your domain to change the default JAXB provider:

```
SET EXT_PRE_CLASSPATH=%WL_HOME%/../modules/databinding.override_1.0.0.0.jar
```

14. Deploy $WL_HOME/common/deployable-libraries/jsf-1.2.war as a library to the WebLogic server.
15. Deploy the LSPS application EAR.

Now you can upload your modules to the server, for example, with the cli console.

3.2.4 IBM WebSphere

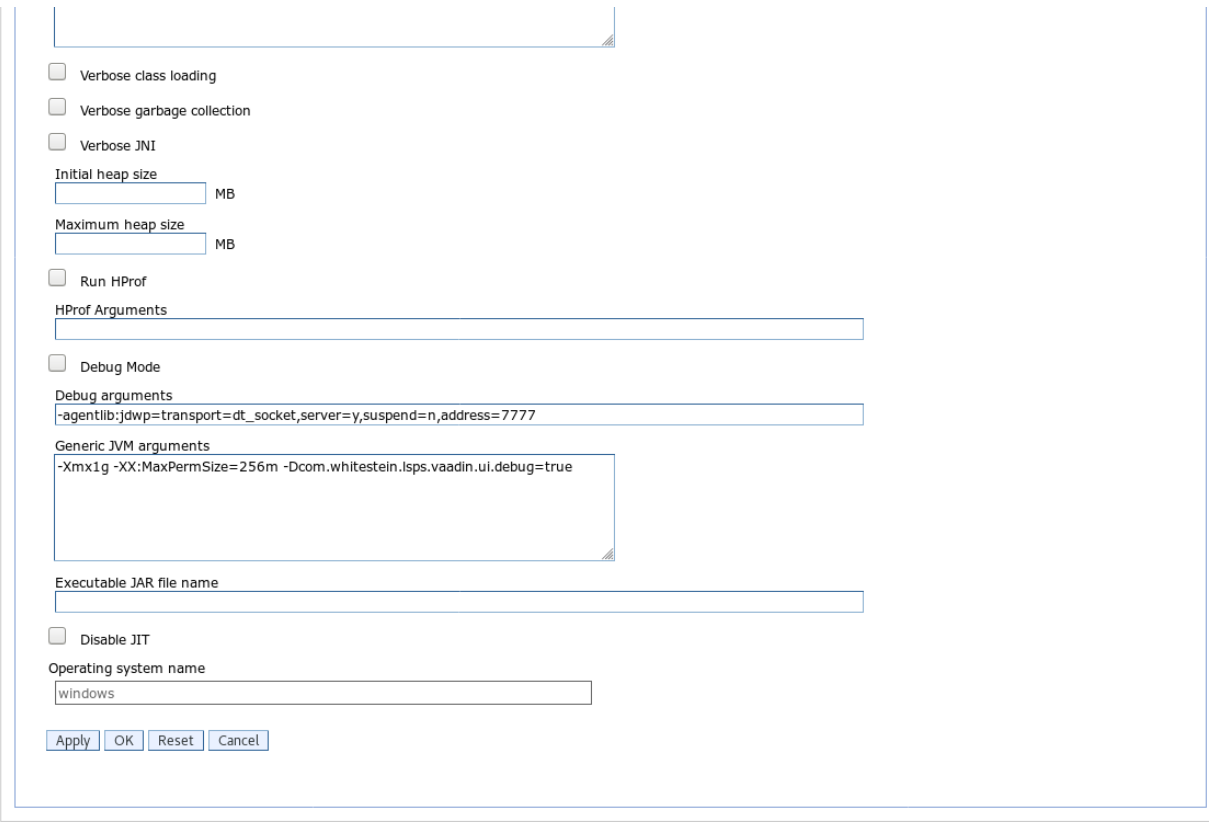
This guide describes how to configure WebSphere with Oracle and DB2 for LSPS.

Prerequisites:

- Oracle or DB2 database initialized with the lsps-db-migration tool.

To set up IBM WebSphere Application Server with LSPS, do the following:

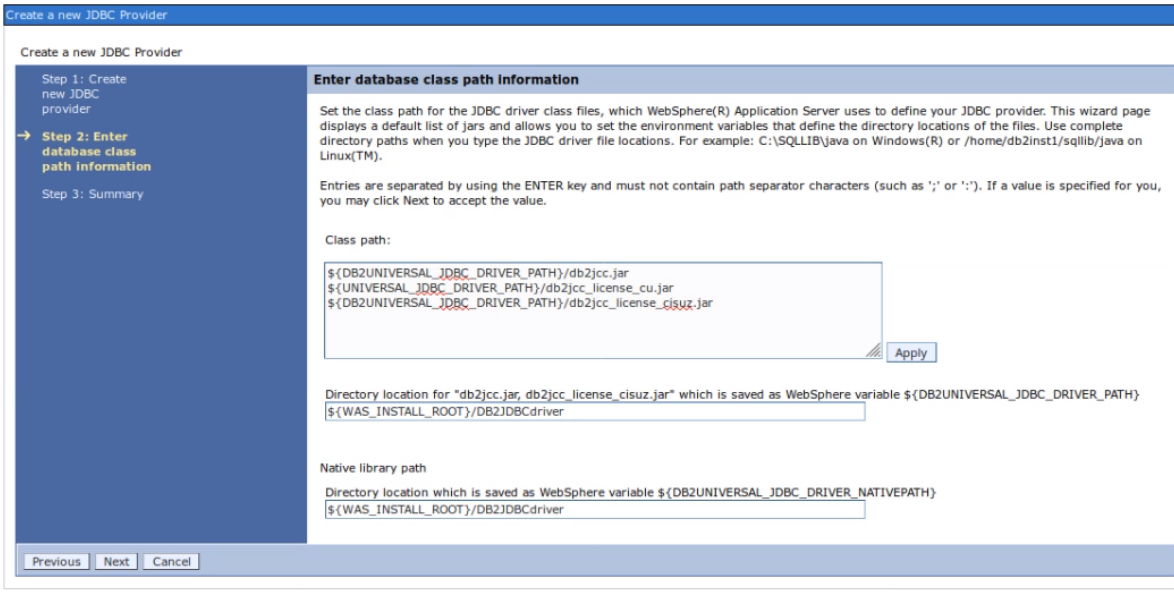
1. Install WebSphere:
2. Open the *WebSphere Application Server Administrative Console*.
3. Configure the JVM arguments:
    (a) In the *Administration Console*, expand *Servers* > *Server Type* and click *WebSphere application servers*.
    (b) On the right, click the name of your server.
    (c) On the *Configuration* tab of the server detail page, expand *Java and Process Management* and click *Process Definition*.
    (d) Under the *Additional Properties* section on the right, click *Java Virtual Machine*.
    (e) Scroll down.
    (f) Under *Generic JVM arguments*, enter the memory arguments, for example, `-Xmx1g -XX:MaxPermSize=256m`.
    (g) Optionally, in the *Generic JVM arguments*, allow testing and profiling by adding the arguments:
        - To enable running of automated Testbench and Selenium tests, add the `-Dcom.whitestein.lsps.vaadin.ui.debug=true` parameter.
        - To enable analysis of performance issues with the LSPS Profiler, add the `-DlspsProfile=true` parameter.



4. Enter the database credentials:
   (a) On the left, expand *Security* and click *Global Security*.
   (b) On the right, expand *Java Authentication and Authorization Service* and click *J2C authentication data*.
   (c) Click **New** to create an authentication user:
      - *Alias*: `LSPS_DS_AUTH`
      - *User ID*: `lsps`
      - *Password*: `<PASSWORD>`
   (d) Click **Apply**.
5. Create the JDBC provider for your database:
   (a) On the left, expand *Resources* > *JDBC* and click *JDBC providers*.
   (b) On the right, select the node visibility in the *Scope* dropdown box.
   (c) Setup the JDBC provider for your database:
      - If you are using **Oracle**:
        i. Copy the Oracle JDBC driver to `$WAS_INSTALL_ROOT/OracleJDBCdriver/ojdbc6.jar`, for example, `c:\sw\IBM\WebSphere\AppServer\OracleJDBCdriver\ojdbc6.jar`
        ii. Click **New** and set the properties:
          – Database type: Oracle
          – Provider type: Oracle JDBC Driver
          – Implementation type: XA data source
          – Name: Oracle JDBC Driver (XA)
        iii. Click **Next**.
        iv. Enter the database-class-path information:
          – Class path: `${ORACLE_JDBC_DRIVER_PATH}/ojdbc6.jar`
          – Directory location for *ojdbc6.jar*: `$WAS_INSTALL_ROOT/OracleJDBCdriver`

v. Click **Next** and **Finish**.

- If you are using **DB2**
  i. Copy the Oracle JDBC driver to `$WAS_INSTALL_ROOT/DB2JDBCdriver/db2jcc4.jar`, for example, `c:\sw\IBM\WebSphere\AppServer\DB2JDBCdriver\db2jcc4.jar`
  ii. Click **New** and set the properties:
  – Database type: DB2
  – Provider type: DB2 Universal JDBC driver provider
  – Implementation type: XA Datasource
  – Name: DB2 Universal JDBC Driver Provider (XA)
  iii. Set the DB2UNIVERSAL_JDBC_DRIVER_PATH variable to point to the location with the jar files.



6. Create JDBC XA data source:

- To set up an **Oracle data source**, do the following:
  (a) On the left, expand *Resources* > *JDBC* and click *Data sources*:
  (b) Select the visibility of the data source in the *Scope* dropdown; for cluster environments, set Scope to `Cluster`.
  (c) Click **New**.
  (d) Enter the data source name `LSPS_DS` and the JNDI name `jdbc/LSPS_DS`, and click **Next**.
    i. Select *Select an existing JDBC provider* with `Oracle JDBC driver (XA)` and click **Next**.
    ii. Set *URL* to `jdbc:oracle:thin:@127.0.0.1:1521:LSPS`and select *Use this data source in container managed persistence (CMP)*. Click **Next**.
    iii. Set *Authentication alias for XA recovery* to `LSPS_DS_AUTH`, *Component-managed authentication alias* to `LSPS_DS_AUTH`.
  (e) Click **Next** and **Finish**.
- To set up a **DB2 data source**, do the following:
  (a) On the left, expand *Resources* > *JDBC* and click *Data sources*:
  (b) Select the visibility of the data source in the *Scope* dropdown; for cluster environments, set Scope to `Cluster`.
  (c) Click **New**.
  (d) Enter the data source name `LSPS_DS` and the JNDI name `jdbc/LSPS_DS`, and click **Next**.
    i. Select *Select an existing JDBC provider* with `DB2 Universal JDBC Driver Provider (XA)`

ii. Set *Driver type* to `4`.
iii. Set *Database name* to `lsps`.
iv. Set *Server name* to `localhost`.
v. Set *Port number* to `50000`
vi. Select *Use this data source in container managed persistence (CMP)*.
vii. Set *Authentication alias for XA recovery* to `LSPS_DS_AUTH`.
viii. Set *Component-managed authentication alias* to `LSPS_DS_AUTH`.
ix. Define additional properties of the data source:
A. Open the data source detail
B. Click *Custom properties* on the right.
C. Click **New** to create the properties:
– `webSphereDefaultIsolationLevel` with value `2` (this means transaction isolation the level read-commited);
– `progressiveStreaming` with value `2` (see https://issues.jboss.org/browse/JBPAPP-2613, also https://www.ibm.com/developerworks/community and properties `fullyMaterializeLobData=true`, `fullyMaterializeInputStreams=true`, `progresssiveLocators=2`
– `downgradeHoldCursorsUnderXa=true`
– `resultSetHoldabilityForCatalogQueries=1`

7. Create a JMS queue, JMS queue connection factory, and the corresponding JMS activation specifications Use the default messaging provider and store messages in the LSPS database:

(a) Expand *Service Integration* and click *Buses*.
(b) Click **New** and follow the wizard to create a new bus:
- Set the name to `LSPS_BUS`.
- Unselect *Bus security*.

(c) On the *Buses* page, click **LSPS_BUS**
(d) On the detail page, click the *Bus members* link in the *Topology* section.
(e) Click **Add** and create a bus member with the following details:
- Server: default value
- Message store: Data store
- Use existing data source
- Data source JNDI name: jdbc/LSPS_DS
- Schema name: empty
- Authentication alias: LSPS_DS_AUTH
- Create tables: true
- Restrict long running locks: true (for cluster with High Availability)

(f) On the LSPS_BUS detail page, click *Destinations* in the *Destination resources* section:
i. Click **New** and create a new queue:
- Destination type: *Queue*
- Identifier: `LSPS_DEST`
- Bus member: your local server node

ii. Click **New** and create a new topic:
- Destination type: *Topic space*
- Identifier: `LSPS_TOPIC`

(g) Expand *Resources* > *JMS* > *Connection factories* and create a connection factory:
i. Set Scope to your local server node.
ii. Set provider to *Default messaging provider*.
iii. Set Name to `LSPS_CF`.
iv. Set *JNDI Name* to `jms/LSPS_CF`.

v. Set *BUS Name* to `LSPS_BUS`.

(h) Expand *Resources* > *JMS* > *Queue* and create a queue:

i. Set Scope to your local server node.
ii. Set provider to *Default messaging provider*.
iii. Set Name to `LSPS_QUEUE`.
iv. Set *JNDI Name* to `jms/LSPS_QUEUE`.
v. Set *BUS Name* to `LSPS_BUS`.
vi. Set *Queue Name* to `LSPS_DEST`.

(i) Expand *Resources* > *JMS* > *Topic* and create a topic:

- Scope: *local server node*
- Provider: `Default messaging provider`
- Name: `LSPS_TOPIC`
- JNDI Name: `jms/LSPS_TOPIC`
- Bus name: `LSPS_BUS`
- Topic space: `LSPS_TOPIC`

(j) Go to Resources/JMS/Activation specifications and create activation specification:

i. Expand *Resources* > *JMS* > *Activation specification* and create an activation specification:
   - Scope: *local server node*
   - Provider: `Default messaging provider`
   - Name: `LSPS_AS`
   - JNDI Name: `jms/LSPS_AS`
   - Destination type: `Queue`
   - Destination JNDI name: `jms/LSPS_QUEUE`
   - Bus name: `LSPS_BUS`

ii. Create another activation specification:
   - Provider: `Default messaging provider`
   - Name: `LSPS_WS_AS`
   - JNDI Name: `jms/LSPS_WS_AS`
   - Destination type: `Topic`
   - Destination JNDI name: `jms/LSPS_TOPIC`
   - Bus name: `LSPS_BUS`

8. Set up the LSPS security:

(a) Copy `lsps-security-websphere-\<LSPS_VERSION>.jar` to `$WAS_HOME/lib/ext`, typically, `C:\sw\IBM\WebSphere\AppServer\lib\ext`.

(b) Save your changes.

(c) Restart WebSphere.

(d) Go to Security/Global Security:

i. Enable administrative security: `true`
ii. Enable application security: `true`
iii. Go to *Security/Global Security* and configure the *User account repository*:
   A. Choose *Standalone* custom registry and click **Set as current**
   B. Click **Configure**:
      - Primary administrative user name: `admin`
      - Custom registry class name: `com.whitestein.lsps.security.LSPSUser↩Registry`

iv. Go to *Global Security* -> *LTPA* -> *LTPA timeout* and set the LTPA timeout to the maximum period of time the user is expected to be active in a session, for example, 10 hours (600 minutes). After the period elapses, the user is logged out.

v. Set the *Session timeout*: When the user is active, the session time is extended. When the user is inactive, they are logged out when the *Session timeout* has elapsed, at the latest after the *LTPA timeout*.

A. Navigate to *Servers* > *Server Types* > *WebSphere Application Servers*

B. Select your application server instance.

C. On the *Configuration* tab select the *Session Management* link.

D. Adjust the value in the *Session timeout* setting.

Note: You can use your own authentication, such as, LDAP; However make sure that every authenticated person exists in the LSPS table LSPS_PERSONS apart from your authentication source.

9. Create a mail session: Expand *Resources* > *Mail* > *Mail Sessions* and create mail session:

   (a) Set *Scope* to your local server node and click **New**.

   (b) Under *General Properties*, set:

   - *Name* to `LSPS_MAIL`
   - *JNDI Name* to `mail/LSPS_MAIL`.

   (c) Under *Outgoing Mail Properties*, set:

   - Server: `<your mail server hostname/IP>`
   - Protocol: *smtp/smtps*
   - User: `\<username\>`
   - Password: `\<password\>`
   - Verify Password: '<password>'
   - Return e-mail address: '<return e-mail address>'

10. Set *org.apache.el.parser.COERCE_TO_ZERO* property to false:

    (a) Expand *Servers* > *Server types* > *WebSphere application servers*

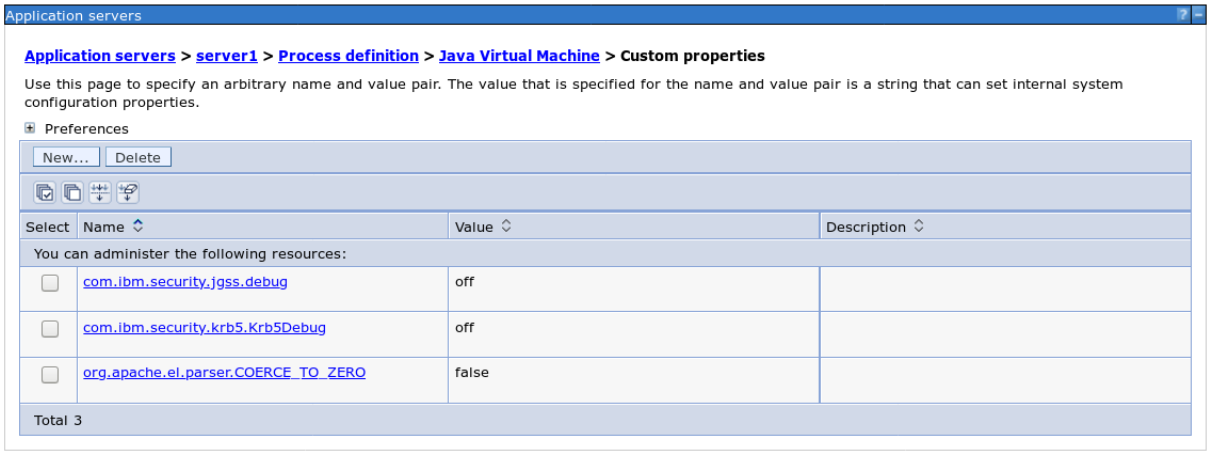
    (b) Click your server name.

    (c) Under *Server Infrastructure*, expand *Java and Process Management* and click *Process definition*.

    (d) Under *Additional Properties*, click *Java Virtual Machine*.

    (e) Under *Additional Properties*, click *Custom properties*.

    (f) Define the property org.apache.el.parser.COERCE_TO_ZERO with the value `false`.



11. Save your changes.

12. Restart the server and deploy your customized LSPS application EAR.

Now you are ready to upload your modules to the server `from PDS or with the command-line tool`.

Chapter 4

Updating

When upgrading the LSPS application, your modules, or modules of a library, make sure that the version of the LSPS system database corresponds to the LSPS version used by *your updated application and modules*.

If you migrate the LSPS system database to a newer version of LSPS and use the new PDS to adapt shared Records and their relationships in your modules, you need to migrate your database tables as well, typically with a flyway script.

Consider distributing resources for your database-table migration with the updated application EAR and modules. For information on the resources, refer to `developer documentation`.

> **Important:** Before performing any updates, back up your database.

4.1 Updating Modules

Once you have created and tested a new version of your module, you need to plan how to update it:

- If your new model is changing its shared records or their relationships, you need to prepare scripts that will migrate the existing database data to the new database schema.
- If you changed the workflow, update will depend on whether your model are restartable or not:
  - When updating restartable models, the restartability of models is the result of the model design. To re-design existing models to be restartable might require significant effort depending on the model complexity. Consider reading about the `basic idea behind the restartability pattern` and to the `agile processes` for its more advanced version.
  - For other models, prepare the `model update` configuration and follow the instructions for updating with module update configurations.

Required artifacts:

- zip files with modules and models
- optionally, model update definition files or the model restart orchestration model
- optionally, database schema script

4.2 Updating Modules with Restartable Processes

If you are using the restartable processes pattern in your modules do the following: To update modules on your LSPS Server:

1. Terminate or suspend running model instances.
2. If applicable, run your scripts that migrate your business database tables.
3. Upload new models with the database update strategy of the upload configuration set to *Do not change*, *Update by model*, or *Validate*. If you have migrated the database in the previous step, set the strategy to *Do not change*.

   In production environments, the *Do not change* stategy is recommended.
4. Run the orchestration process to start the relevant model instances.
5. Inspect the status of model-instances starting in the Application Restart view in the Management perspective or in Management Console.

4.3 Updating Modules with Model Update

If you are using the model update feature to recover the status of your model instances, do the following: To update modules on your LSPS Server:

1. Terminate or suspend running model instances.
2. If applicable, run your scripts that migrate your business database tables.
3. Upload new models with the database update strategy of the upload configuration set to *Do not change*, *Update by model*, or *Validate*. If you have migrated the database in the previous step, set the strategy to *Do not change*.

   In production environments, the *Do not change* stategy is recommended.
4. If applicable, update the suspended model instances.

   Important: Model update can be very complex: make sure to prepare the model update resources beforehand and test the entire update process properly.
5. Continue the suspended model instances.

4.4 Updating the LSPS Application

Required artifacts:

- LSPS Application EAR

Provided the new LSPS Application has been created in the same minor version of PDS, for example 3.3, it is enough to deploy the new LSPS Application EAR to the application server. Otherwise, refer to Upgrading LSPS.

4.5 Upgrading LSPS

Required artifacts:

- LSPS Application EAR
- zip files with modules and models exported with GO-BPMN export
- optionally, model update definition files
- optionally, database schema script for business data when applicable

When upgrading your LSPS, you will need to upgrade the entire stack:

- LSPS system database: Mind that the database holds the LSPS system data *and possibly* your business data based on the LSPS data type models.
- LSPS Application: apart from updating the EAR, you might need to upgrade also the version of your database and application server.
- Models and modules: even if you have not introduced changes to your models, you need to at least upgrade the standard library modules they use and make sure you models work with them correctly.

> **Important:** Make sure to test the upgrade in a testing environment that is **identical to the production environment** and **back up your database** before you perform any changes on production.

To upgrade to a newer LSPS version, do the following:

1. Make sure the environment meets the requirements of LSPS.
2. `Suspend any running model instances`.
3. Stop the application server.
4. Migrate the LSPS system database.
5. Deploy the EAR file to your LSPS server (refer to instructions on `how to set up a server for LSPS`.
6. Upload updated modules and update their instances.
7. Migrate business data.
8. Start the server.

4.5.1 Migrating LSPS System Database Tables

When upgrading your LSPS application, you need to upgrade the LSPS system database. Make sure to **back up the database** and **test the migration process in a testing environment that is identical to the production environment** before you perform any changes on production.

To upgrade the LSPS system database to correspond to a newer LSPS version, do the following:

1. Migrate the LSPS system tables:
   - If **your LSPS database contains the `LSPS_SCHEMA_VERSION` table**, run the migration script with the databaseUrl and databaseType parameter: the script migrates your current database to the database version of the Runtime Suite.

     ```
     ~/lsps-runtime/cli-tools$ java -jar lsps-db-migration-lsps-<VER>-full.jar \
     --databaseUrl jdbc:h2:tcp://localhost/./h2/h2 --user lsps --password lsps
     ```

   - Otherwise, find the schema version in the migration tool:
     (a) Get the current database version: open <YOUR_OLD_LSPS_TOOLS_PACKAGE>/cli-tools/lsps-db-mi
     ERSION>.jar> db > migration:
        i. Check the most recent java migration class in the location, for example, *V3_1_0_010__↩ Upgrade.class*
        ii. Open the directory of your database, for example *mysql* and check the latest SQL script, for example, *MYSQL_V3_1_0_003__Upgrade.sql*

     Your current version is the higher version (in the example case, it is *3.1.0.010*).
     (b) Run the migration script with the *initialVersion* parameter set to the current version of the LSPS database:

     ```
     ~/lsps-runtime/cli-tools$ java -jar \
     lsps-db-migration-lsps-<VERSION>-full.jar --databaseUrl \
     jdbc:h2:tcp://localhost/./h2/h2 --user lsps --password lsps \
     --initialVersion 3.1.0.010
     ~/lsps-runtime/cli-tools$ java -jar \
     lsps-db-migration-lsps-<VERSION>-full.jar --databaseUrl \
     "jdbc:sqlserver://localhost:1433;databaseName=lsps;sendStringParametersAsUnicode=false
     --user lsps --password lsps
     ~/lsps-runtime/cli-tools$ java -jar \
     lsps-db-migration-lsps-<VERSION>-full.jar --databaseUrl \
     jdbc:oracle:thin:@localhost:1521:lsps --user lsps --password lsps
     ~/lsps-runtime/cli-tools$ java -jar \
     lsps-db-migration-lsps-<VERSION>-full.jar --databaseUrl \
     jdbc:db2://localhost:50000/lsps --user admin --password admin
     ```

2. If you are using the LSPS BAM library, migrate the BAM tables:

   ```
   ~/lsps-runtime/cli-tools$ java -jar \
   lsps-db-migration-bam-<VERSION>-full.jar --databaseUrl \
   jdbc:h2:tcp://localhost/./h2/h2 --user lsps --password lsps
   ```

When running the DB migration from the command line, make sure to escape any special characters in parameter values as required by your operating system or shell. For example, if using Bash and a parameter contains characters like $ ‘ ' " and so on then these characters must be escaped: Read the manual to your command line to learn how to escape special characters.

Important: The migration of LSPS tables will fail while executing `V3_3_2_004_Delete_user_↩ guest.sql` with an error similar to the following:

```
SQL State  : 23000Error Code : 547Message    : The DELETE statement conflicted with the REFE
```

This happens if you have assigned a security role or a model role to the *guest* user: This user has been removed due to security reasons. Please, remove such roles from the user prior to migration. If you require the user, re-create it after the migration.

4.5.1.1 Parameters of the Database Migration Tool

The database migration script accepts the following parameters with the respective value entered after a colon:

databaseUrl∗ URI of the database with LSPS runtime data

> **Note:** For SQL databases, the instance property is supported: add the instance to the url as `instance=<name>`, for example,
>
> ```
> ~/lsps-runtime/cli-tools$ java -jar lsps-db-migration-lsps-<VERSION>-full.jar \
> --databaseUrl "jdbc:sqlserver://localhost/lsps;instance=wt" \
> --user lsps --password lsps
> ```

databaseType type of the database (The migration tool attempts to identify the database type automatically from the databaseUrl parameter. However, if necessary, you can define the database type explicitly. The possible values are `H2`, `DB2`, `ORACLE`, `SQLSERVER`, `MYSQL`.

initialVersion The current version of LSPS database: it corresponds to the LSPS that created the database. The parameter is required if the database is being migrated for the first time: On the first migration, the underlying tooling creates a database table with information on the previous and current schema version. Next migrations use this data to identify the initial database version so that the parameter is no longer required.

targetVersion The parameter is optional. If undefined, the database is migrated to the Runtime Suite database version.

flyway The flyway command to execute over the database, such as, `info`, `clean` (cleans the entire LS↩ PS database including any business or library tables, such as BAM tables), `validate`, `migrate`, and `repair` (repairs hash codes of migration scripts in case these were modified).

```
~/lsps-runtime/cli-tools$ java -jar lsps-db-migration-lsps-<VERSION>-full.jar \
--databaseUrl "jdbc:sqlserver://localhost:1433/lsps;instance=wt" \
--user lsps --password lsps --flyway info
```

Chapter 5

Configuration and Monitoring

You can configure and monitor the LSPS Server via JMX or in the LSPS_SETTINGS database table and can be changed via JMX:

- Monitoring (HealthCheck) provides statistics on LSPS Server
- Settings exposes server and database related setting

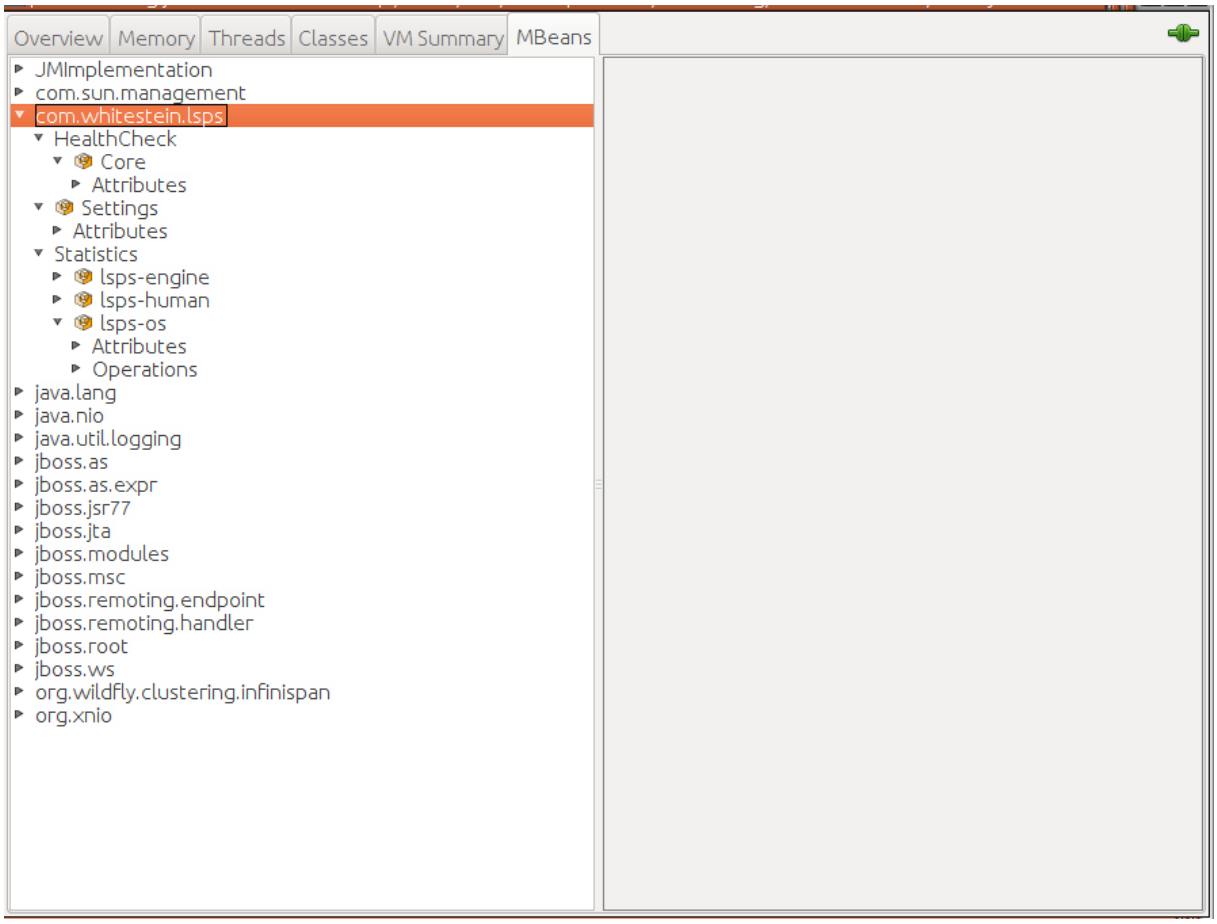


Figure 5.1 LSPS Server settings in jconsole

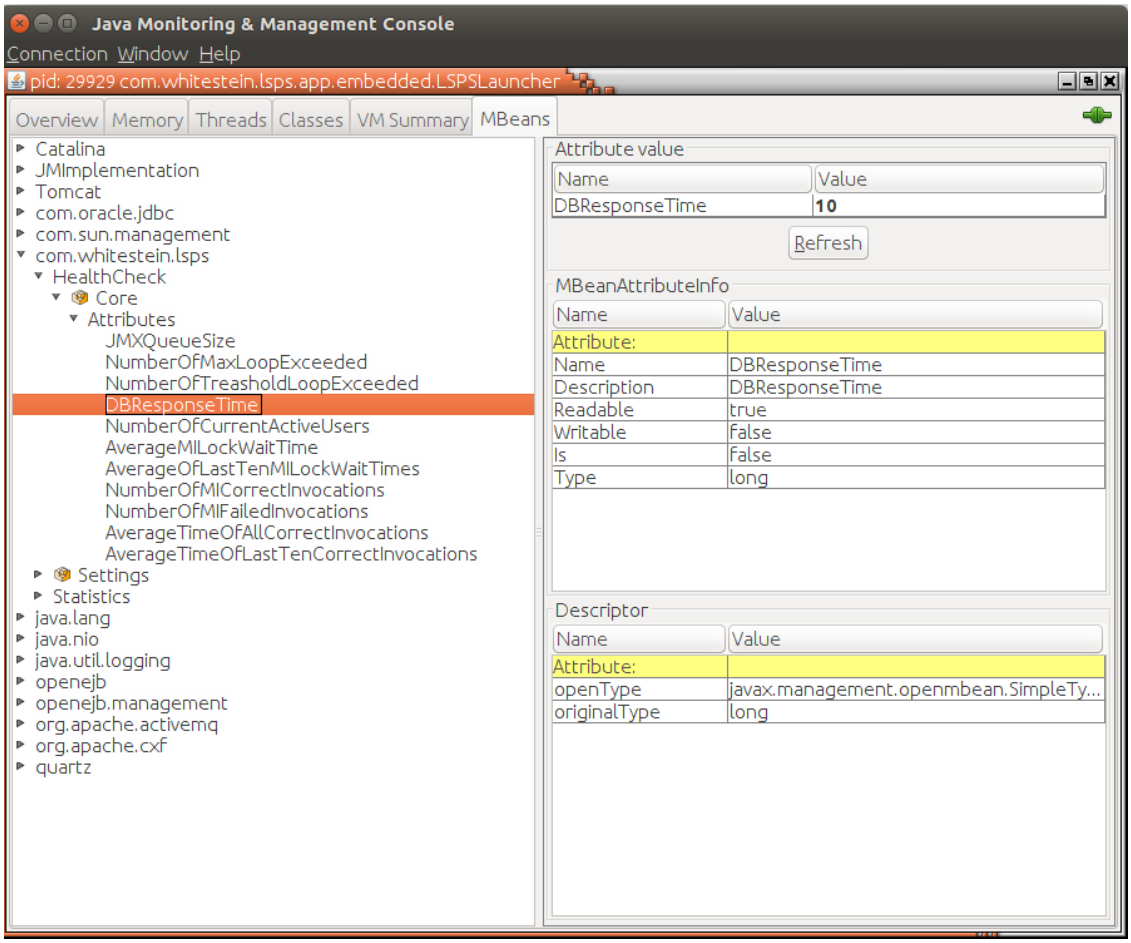
5.1 Monitoring the LSPS Application

To check the health of the LSPS Application, open a JMX-compliant monitoring tool, such as JConsole, and check the attributes under **com.whitestein.lsps.HealtCheck**:

- JMXQueueSize: current amount of JMX messages queued for processing
- NumberOfMICorrectInvocations: the number of successful invocations on all model instances since server start
- NumberOfMIFailedInvocations: the number of failed invocation on all model instances since server start
- AverageTimeOfAllCorrectInvocations: the average execution time of all successful invocations in milliseconds
- AverageTimeOfLastTenCorrectInvocations: the average execution time of the last 10 invocations in milliseconds
- AverageMILockWaitTime and AverageOfLastTenMILockWaitTimes: total average and average of the last 10 waiting times when accessing model instances

  Model instances run in a single thread and can be hence accessed by one entity at a time. While accessed, the instance is locked and other entities wait for the lock to be released: this time is used to calculate the average model-instance-lock wait time. when synchronizing model instances
- NumberOfMaxLoopExceeded: the number of times that a loop exceeded the maximum allowed number of loop runs

  The maximum number of loops is set by the MaxNumberOfEngineLoops setting.
- NumberOfThresholdLoopExceeded: the number of times that a loop exceeded the threshold number of loop runs
- DBResponseTime: time to receive database response
- NumberOfCurrentActiveUsers: number of active users (only relevant if `user tracking` is enabled.)



5.2 Server and Database Settings

LSPS configuration is generally stored in the LSPS_SETTINGS database table and can be changed directly in the database or via JMX. For some setting changes, the server needs to be restarted: the applicable information is provided with individual settings.

Note that some settings, such as debugging settings, are passed as system properties to the server, that is, in the format `-Dkey=value`.

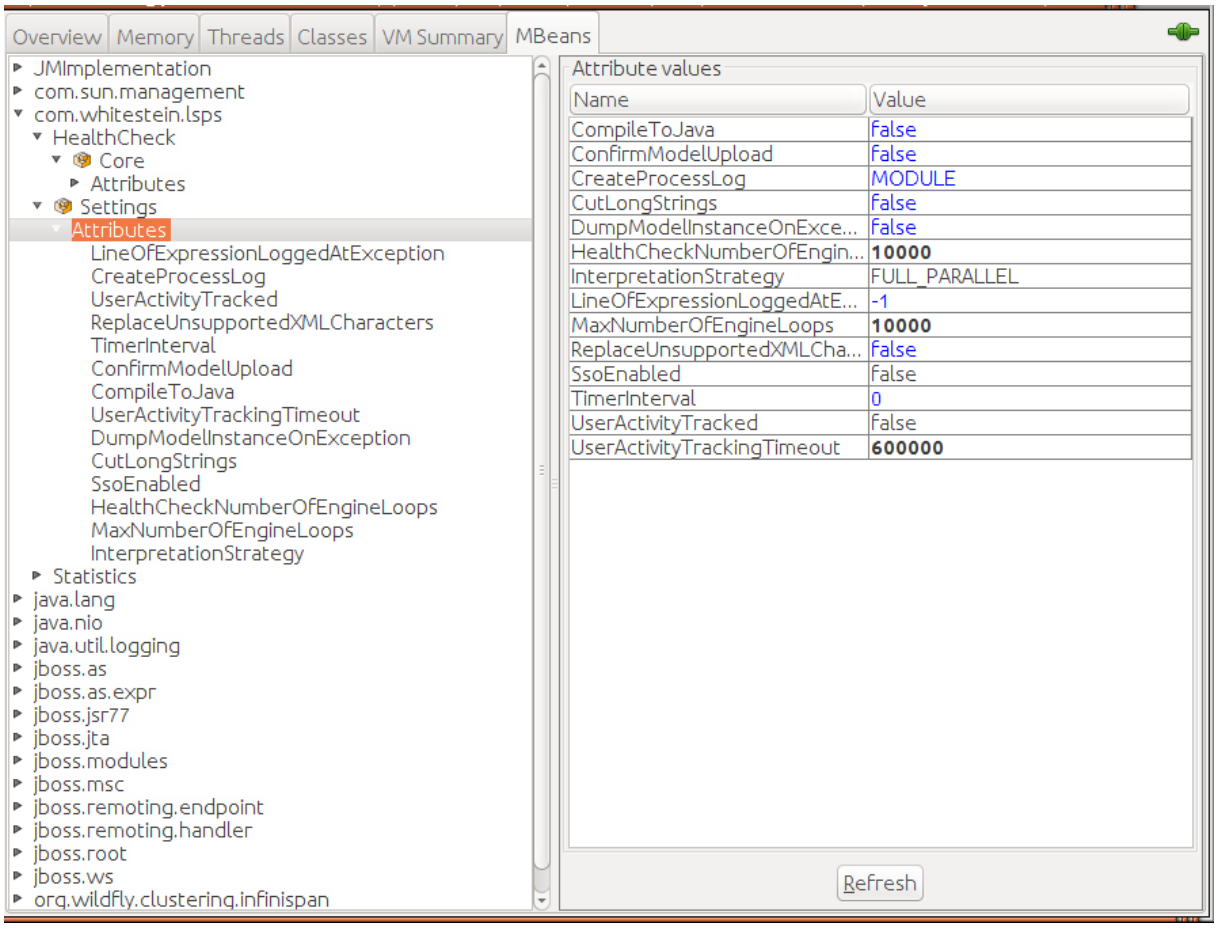


Figure 5.2 LSPS settings in MBeans

5.2.1 General Settings

5.2.1.1 SSO_ENABLED (SsoEnabled): Enabling SSO in UI

When **true** and the application server is configured to use SSO, the application checks if the current user exists in the application and is active when creating a new Vaadin UI.

5.2.1.2 CUT_LONG_STRINGS (CutLongString): Cutting a String in Database

- When **true**, strings longer that the length defined in database are cut.
- When **false**, write of such strings results in an error.

Default setting: *false*

The setting is loaded on server startup and can be changed in the LSPS_SETTINGS table or via JMX. When changed via JMX, the database value remains unchanged.

5.2.1.3 REPLACE_UNSUPPORTED_XML_CHARACTERS (ReplaceUnsupportedXMLCharacters): Replacing Unsupported XML Characters

- When **true**, unsupported XML characters are replaced with the replacement character \uFFFD on model-instance marshalling.
- When **false**, unsupported XML characters cause an exception on model-instance marshalling.

Default setting: *false*

The setting is loaded on server startup and can be changed in the LSPS_SETTINGS table or via JMX. When changed via JMX, the database value remains unchanged.

5.2.2 Model Related Settings

5.2.2.1 ENABLE_DROP_CREATE: Enabling Drop-Create Database-Schema Update

- When **true**, models with the drop-create strategy can be uploaded.
- When **false** and the user attempts to upload a model with the drop-create strategy, the upload fails with an exception.

Default setting: *true*

When changed in the LSPS_SETTINGS table, the change is reflected in runtime immediately.

5.2.2.2 INITIAL_MODELS_SQL: SQL with Model IDS loaded on Launch

SQL that returns IDs of model that should be loaded on server launch.

The setting is loaded only on server launch.

5.2.2.3 CONFIRM_MODEL_UPLOAD (ConfirmModelUpload): Requiring Confirmation on Model Update

- When **true**, the user is prompted to confirm model upload on each upload.

The setting is loaded on server launch and can be changed in runtime via JMX (When changed via JMX, the database value remains unchanged).

Default setting: *false*

5.2.2.4 SERIALIZE_MODEL_UPLOAD: Serializing Models on Upload

- When **serialize**, models are serialized on upload.

Default setting: *serialize*

When changed in the LSPS_SETTINGS table, the change is reflected in runtime immediately.

5.2.2.5 MaxNumberOfEngineLoops and ThresholdNumberOfEngineLoops: Preventing Infinite Looping

A single execution step in a model instance is referred to as a *loop*: A loop moves tokens and checks repeatedly the status of various elements and data to make sure that the data, such as goal statuses, is correct when the loop finishes.

If the loop ends up in an infinite loop, for example, if one condition is switched from true to false within the loop continuously, the server terminates the looping based on the MaxNumberOfEngineLoops and ThresholdNumber↩ OfEngineLoops setting:

- When a loop is repeated for more times than the number defined by ThresholdNumberOfEngineLoops, the NumberOfThresholdLoopExceeded attribute is bumped.
- When a loop is repeated for more time than the number defined by MaxNumberOfEngineLoops, the execution fails with a runtime exception, the transaction is rolled back and the NumberOfThresholdLoopExceeded attribute is bumped.

5.2.3 User Tracking

5.2.3.1 USER_ACTIVITY_TRACKING (UserActivityTracked): Enabling User-Activity Tracking

- When **true**, periods when the user is active are logged in the LSPS_USER_ACTIVITY_TRACK table.

Default setting: *false*

On change, restart the server to apply the change.

5.2.3.2 USER_ACTIVITY_TRACKING_TIMEOUT (UserActivityTrackingTimeout): Setting Timeout for User Activity

- Time period in milliseconds: if a user is idle for the specified time period, logged period of activity is finished (the user is considered inactive).

Default setting: *600000* (10 minutes)

> **Note:** You can access the user-activity data through the `UserTrack` shared record.

5.2.4 Performance

5.2.4.1 INTERPRETATION_STRATEGY (InterpretationStrategy): Setting Interpretation Strategy of a Goal Process

Interpretation strategy of the LSPS Execution Engine

- When set to **FULL_PARALLEL**, Goal conditions are checked whenever any of the Goals changes its status or a token is moved.
- When set to **BPMN_FIRST**, the engine first pushes all the tokens *in Plans* as far as possible and only then checks Goals and their conditions.

Default setting: FULL_PARALLEL

The setting is loaded on server startup and can be changed in runtime via JMX (When changed via JMX, the database value remains unchanged).

5.2.4.2 TIMER_INTERVAL (TimerInterval): Setting Interval for Timed Trigger

The smallest interval for sending a timed trigger in milliseconds. If there are multiple time notifications scheduled for a Model instance (for example, by multiple Timer Intermediate Events), and the time difference between the notifications is smaller that the TIMER_INTERVAL value, the notifications are merged into one (multiple Timer Intermediate Events are notified by a single timer notification)

If set to *0*, timer notifications are not merged.

Default setting: 0

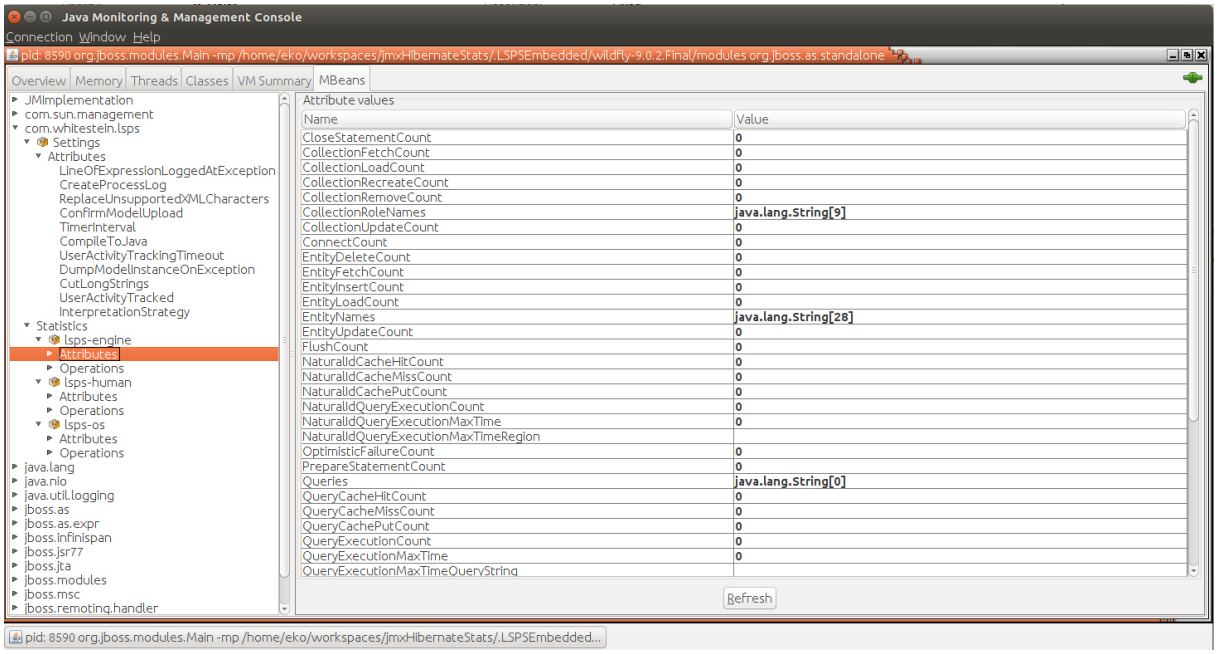
The setting is loaded on server startup and can be changed in runtime via JMX (When changed via JMX, the database value remains unchanged).

5.2.4.3 STATISTICS_ENABLED: Enabling Hibernate Statistics

Availability of Hibernate statistics (equivalent of `hibernate.generate_statistics`)

The option is by default disabled. You can enable it from JConsole: you can enable the setting for individual modules from the *MBeans* tab under *com.whitestein.lsps* > *Statistics* > *MODULE* > *Attributes* > *Statistics↩ Enabled*. To enable the setting for the entire application, modify the *server.properties* file in the application EAR (`lsps-app-ear/lsps-app-ejb.jar/server.properties`)

Do not enable the setting in production environments since it can cause performance issues.



5.2.5 Logging and Exceptions

5.2.5.1 DUMP_MODEL_INSTANCE_ON_EXCEPTION (DumpModelInstanceOnException): Dumping A Module Instance on Exception

If set to true, model instance state is dumped when an exception occurs. The setting is loaded on server startup and can be changed in runtime via JMX (When changed via JMX, the database value remains unchanged).

Default setting: *false*

5.2.5.2 CREATE_PROCESS_LOGS(CreateProcessLog): Creating Process Logs

The setting defines whether events that occur during model-instance execution are logged. The events include such information as when the model and process started, when a process elements was executed, etc.

They are stored in the LSPS_PROCESS_LOGS system-database table. The data is used, for example, by views in the Management Perspective and Management Console.

> **Note:** If you are looking for information on other logging mechanisms, please, refer to FAQ

Possible values:

- MODULE: the setting of the module is respected.
- YES: process logs are created for all modules regardless of the *Create process log* module setting.
- NO: process logs are not created for any modules regardless of the *Create process log* module setting.

Default setting: *MODULE*

To clean old entries from the process log, use the delete-old-process-logs.<DB_NAME>.sql script available in <LSPS-RUNTIME>/scripts/lsps/<YOUR_DB>/

> **Important:** If you set the property to NO, *information about model-instance status and execution history*, such as, when a model instance started, a to-do was submitted, timer event triggered, etc. will not be available. As a result:
>
> - Model Instance details in the Management Perspective and Management Console will not be available.
> - BAM reports might not contain correct data.

5.2.5.3 LINES_OF_EXPRESSION_LOGGED_IN_EXCEPTION (LineOfExpressionLoggedAtException): Numbers of Expression Lines in Exception

Number of lines before and after the statement with the problem included in the stack trace (0 means all: the entire expression is returned). The setting is loaded on server startup and can be changed in runtime via JMX (When changed via JMX, the database value remains unchanged).

Default setting: *-1*

> **Note:** You can display SQL statements issued by PDS to the server in the console to troubleshoot the statements. Refer to information on performance tuning.

5.3 Debugging

Important: In production, the debugging parameters must not be active.

The debugging parameters are passed as JVM properties `-Dkey=value`.

- *com.whitestein.lsps.vaadin.ui.debug*

If true, the modeling ID set on form components is used as Vaadin debug ID on all Vaadin components.

- *lspsDebug*

If true, the Execution Engine runs in debug mode (usually activated in combination with remote socket debugging).

- *lspsProfile*

If set to `true`, `profiler` is enabled.

5.4 Authentication

LSPS uses the authentication mechanism of the underlying application server. The users are authenticated against the LSPSRealm.

If you want to authenticate users against other directory services, modify the configuration of your application server.

For example, to authenticate against LDAP in WildFly, add another login module to the security domain.

Note that you need to make sure that all persons from your directory service have their counterpart in the LSPS: For example, insert a new person to the LSPS using the web service API. Similarly, remove any removed persons.

Example WildFly login module configuration

```
<subsystem xmlns="urn:jboss:domain:security:1.1">
    <security-domains>
        <security-domain name="lspsRealm" cache-type="default">
            <authentication>
                <login-module code="com.whitestein.lsps.security.jboss.LSPSRealm" flag="optional"
                    <module-option name="password-stacking" value="useFirstPass" />
                    <module-option name="dsJndiName" value="/jdbc/LSPS_DS" />
                </login-module>
                <login-module code="org.jboss.security.auth.spi.LdapExtLoginModule" flag="optional
                    <module-option name="password-stacking" value="useFirstPass" />
                    <module-option name="java.naming.factory.initial" value="com.sun.jndi.ldap.Lda
                    <module-option name="java.naming.provider.url" value="ldap://myurl:111" />
                    <module-option name="bindDN" value="cn=SA_LDAPReadOnly,ou=Service Accounts,dc=
                    <module-option name="bindCredential" value="passwd" />
                    <module-option name="baseCtxDN" value="ou=INCOMM,dc=uss,dc=net" />
                    <module-option name="baseFilter" value="(sAMAccountName={0})" />
                    <module-option name="rolesCtxDN" value="ou=INCOMM,dc=uss,dc=net" />
                    <module-option name="roleFilter" value="(sAMAccountName={0})" />
                    <module-option name="roleAttributeID" value="memberOf" />
                    <module-option name="roleAttributeIsDN" value="true" />
```

```
                <module-option name="roleNameAttributeID" value="cn" />
                <module-option name="parseRoleNameFromDN" value="false" />
                <module-option name="allowEmptyPasswords" value="false" />
                <module-option name="searchScope" value="SUBTREE_SCOPE" />
                <module-option name="allowEmptyPasswords" value="false" />
                <module-option name="throwValidateError" value="false" />
            </login-module>
            <login-module code="org.jboss.security.auth.spi.RoleMappingLoginModule" flag="opti
                <module-option name="rolesProperties" value="../standalone/configuration/roles
                <module-option name="replaceRole" value="false" />
            </login-module>
        </authentication>
    </security-domain>
```

Chapter 6

Maintenance

6.1 Cleaning Database Logs

To delete logs from the LSPS system database, run the SQL scripts in the `scripts/lsps/<YOUR_DB>` directory of the LSPS Runtime package.