



Orchestra User Guide

This document contains an installation and user guide for Orchestra4.9.0

Orchestra Team

- January 2012 -

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Introduction

This documentation is targeted to Orchestra users. It presents the installation procedure and a quick user guide of Orchestra features.

Chapter 1, *General information* describes the new version Orchestra v4

Chapter 2, *Prerequisites* describes the prerequisites to the installation of Orchestra

Chapter 3, *Installation guide* describes how to install the Orchestra engine

Chapter 4, *Configuration and Services* describes main configuration features and default services

Chapter 5, *User guide* This chapter will guide you through the discovery of the functionalities of Orchestra.

Chapter 6, *Console User Guide* describes how to use the SOA console with Orchestra.

Chapter 8, *Advanced features* describes advanced features provided by Orchestra.

Chapter 9, *Developer's guide* guides you through APIs of Orchestra.

Chapter 1. General information

1.1. Orchestra Overview

The new version of Orchestra is based on the “Process Virtual Machine” conceptual model for processes. The Process Virtual Machine defines a generic process engine enabling support for multiple process languages (such BPEL, XPD...).

On top of that, it leads to a pluggable and embeddable design of process engines that gives modelling freedom to the business analyst. Additionally, it enables the developer to leverage process technology embedded in a Java application.

For more information about the Process Virtual Machine, check Orchestra FAQ's [<http://orchestra.ow2.org/xwiki/bin/view/Main/FAQ>] on the Orchestra web site [<http://orchestra.ow2.org>] .

1.2. Features list

Orchestra is a Web Service Orchestration solution that provides BPEL 2.0 support. Business Process Execution Language (BPEL) is an XML language created by the Oasis Consortium. More information and the specifications can be found on Oasis web site [www.oasis-open.org/committees/wsbpel/]

Orchestra provides full support of the BPEL 2.0 standard.

Orchestra comes out with an innovative architecture based on a generic and extensible engine, called "The Process Virtual Machine" and a powerful injection technology allowing services pluggability.

This version provides Web Service support using Apache CXF 2.4.1.

Orchestra is shipped with a complete test suite and a few examples.

Orchestra is persistable. This means that all the data concerning your processes definition and instances execution is stored in a Database using a persistence framework (hibernate by default). The following database systems have been successfully tested :

- H2 Database (default)
- Postgres (8.3)
- MySQL (5.0)
- Oracle (10g)

Orchestra is shipped with a console designed to administrate SOA platforms. This first version only communicates with Orchestra, but Camel will follow soon.

It is a functional console which gives the possibility to administrate your SOA platform monitoring the different entities from processes to activities. The below Chapter 6, *Console User Guide* section explains in details each feature.

1.3. Restrictions

This version has some restrictions on the following aspects :

- Some restrictions in assign statement :
 - no extensionAssignOperation
 - validate not supported
- Some restrictions in scope statement
 - isolated not supported
 - exitOnStandardFault not supported
- The following BPEL 2.0 statements are not supported :
 - validate
 - import (only wsdl imports are supported)

1.4. Next steps

This version of Orchestra is aimed at showing the power of its very innovative architecture by providing support for all the basic activities defined in the BPEL standard. As stated in previous sections, this version provides the possibility to persist the processes definition and execution. The 4.2 release provides support for the last important BPEL statement named eventHandler. Orchestra now provides full support of BPEL 2.0. The next stage will be to extend Orchestra to provide the first Open Source Business Process Server to power your SOA infrastructure. Stay tuned ! Check the roadmap [<http://wiki.orchestra.objectweb.org/xwiki/bin/view/Main/Roadmap>] for more information.

Chapter 2. Prerequisites

2.1. Hardware

A 1GHz processor is recommended, with a minimum of 512 Mb of RAM. Windows users can avoid swap file adjustments and get improved performance by using 1Gb or more of RAM

2.2. Software

- Orchestra requires Java Development Kit (JDK) 6 but also runs with following releases.

The JDK software can be downloaded from <http://www.oracle.com/technetwork/java/javase/downloads/index.html>

- Orchestra requires Apache Ant 1.7.1 or higher

It can be downloaded from <http://ant.apache.org>

Chapter 3. Installation guide

Orchestra comes in two kinds of distribution:

- Tomcat distribution: Orchestra is embedded in a web application deployed in tomcat container. Note that this distribution embeds in latest versions the SOA console.
- Felix OSGI distribution: Orchestra is embedded in an OSGI bundle deployed in Felix OSGI platform. Note that this distribution doesn't embed the SOA console.

As explained in Chapter 4, *Configuration and Services*, Orchestra can use different Web Service frameworks. Apache CXF is supported by default. For this web service framework, a tomcat package and a Felix package are provided.

The installation and configuration steps are independent of the web service framework.

3.1. Web Service Frameworks

3.1.1. Apache CXF

Orchestra web service implementation based on CXF offers advanced web service capabilities.

CXF implementation adds support for:

- WS-addressing
- WS-RM
- Apache Camel

3.2. Orchestra Tomcat distribution

3.2.1. Installation

Unzip the orchestra-cxf-tomcat distribution package.

```
>unzip orchestra-cxf-tomcat-4.9.0.zip
```

A new directory `orchestra-cxf-tomcat-4.9.0` will be created. It contains an ant file to install and start Orchestra.

3.2.1.1. Basic installation

Remark : Orchestra runs in Apache Tomcat servlet container. Tomcat 6.0.35 is delivered with the Orchestra Package.

To install Orchestra, go to orchestra directory and launch the install by running ant:

```
>cd orchestra-cxf-tomcat-4.9.0
>ant install
```

The install script installs Tomcat and Orchestra. The default installation activates the persistence using the H2 Database.



Important

if your network is based on a proxy, please specify the proxy settings in your JAVA_OPTS environment property. The system properties to specify are described in the Java documentation [<http://download.oracle.com/javase/6/docs/technotes/guides/net/properties.html>].

3.2.1.2. Advanced installation: Using another tomcat distribution.

Orchestra is shipped with a lightweight Apache Tomcat Servlet container. This section explains how to install Orchestra in an existing tomcat distribution.

The `install.properties` file in the `conf` directory contains the information used by Orchestra installation. The default content is:

```
catalina.home=${orchestra.dir}/tomcat
catalina.base=${catalina.home}
```

To use another tomcat installation, just update the `catalina.home` and `catalina.base` properties before calling:

```
>ant install
```

3.2.1.3. Advanced installation: into JOnAS

Orchestra is shipped with a lightweight Apache Tomcat Servlet container. This section explains how to install Orchestra in a JOnAS Application Server.

3.2.1.3.1. JOnAS 5

- Copy Orchestra conf into `$JONAS_BASE/conf` (copy all files from orchestra conf directory to `$JONAS_BASE/conf`).
- Copy jdbc jar driver into `$JONAS_BASE/lib/ext`
- In `orchestra.properties`, change `orchestra.servlet.port` value to your JOnAS's tomcat port configuration (cf `$JONAS_BASE/conf/tomcat6-server.xml`)
- Copy Orchestra war (available in orchestra lib/ directory) to `$JONAS_BASE/deploy` and start JOnAS

3.2.1.3.2. JOnAS 4

- Delete or upgrade `xml-apis.jar`, `xercesImpl.jar` and `xalan-xxx.jar` from `$JONAS_ROOT/lib/endorsed`. These libraries are needed for J2EE compatibility, but JOnAS4 can run fine without them. JOnAS4 has old versions of these libraries, which creates incompatibility issues with Orchestra.
- Copy Orchestra conf into `$JONAS_BASE/conf` (copy all files from orchestra conf directory to `$JONAS_BASE/conf`).
- Copy jdbc jar driver into `$JONAS_BASE/lib/ext`
- In `orchestra.properties`, change `orchestra.servlet.port` value to your JOnAS's tomcat port configuration (cf `$JONAS_BASE/conf/server.xml`)
- Copy Orchestra war (available in orchestra lib/ directory) to `$JONAS_BASE/webapps` and start JOnAS

3.2.2. Database Management

The default configuration of Orchestra uses the Database persistence service and the H2 Database. Orchestra has also been tested with Oracle, MySQL and Postgres database system. To change to MySQL, Postgres or Oracle, you need to put the corresponding JDBC driver in the directory `$CATALINA_BASE/lib` and modify the `hibernate.properties` file (see Section 4.4.4.1, “Database Access Configuration”)

3.2.3. Orchestra directory structure

Hereafter is detailed the structure of Orchestra installation. The installation directory contains the following structure :

```
README
build.xml
install.xml
common.xml
Licence.txt
tomcat/
conf/
doc/
examples/
lib/
resources/
```

Let's present those items :

- README

This file gives the basic information related to Orchestra

- build.xml

This file is an ant file that provides tasks to install and use Orchestra. Just typing `ant` will result giving you the usage.

- install.xml and common.xml

These files are ant files that are used by build.xml

- License.txt

The license of Orchestra. All of Orchestra is available under the LGPL license.

- conf/

This directory contains all the configuration files of Orchestra.

- tomcat/

This directory is the default Tomcat installation shipped with Orchestra.

- doc/

This directory contains the documentation of Orchestra. It contains :

- userGuide.pdf

For PDF documentation

- `html/userGuide.html`

For HTML documentation in a single page

- `html/userGuide/userGuide.html`

For HTML documentation in different pages

- `examples/`

This directory contains the examples provided with Orchestra package. See Section 5.3, “Running the examples”

- `lib/`

This directory contains the libraries used in Orchestra.

- `resources/`

This directory contains Orchestra database creation scripts for supported databases and Orchestra environment configuration examples.

3.3. Orchestra OSGI Felix distribution

3.3.1. Installation

Unzip the `orchestra-cxf-felix` distribution package.

```
>unzip orchestra-cxf-felix-4.9.0.zip
```

A new directory `orchestra-cxf-felix-4.9.0` will be created. It contains an ant file to install and start Orchestra.

Remark : Orchestra runs in Apache Felix OSGi platform. Felix 2.0.5 is delivered with the Orchestra Package.

There is no specific installation step for running Orchestra :

```
>cd orchestra-cxf-felix-4.9.0
```

The default configuration activates the persistence using the H2 Database.



Important

if your network is based on a proxy, please specify the proxy settings in your `JAVA_OPTS` environment property. The system properties to specify are described in the Java documentation [<http://download.oracle.com/javase/6/docs/technotes/guides/net/properties.html>].

3.3.2. Database Management

The default configuration of Orchestra uses the Database persistence service and the H2 Database. Orchestra has also been tested with Oracle, MySQL and Postgres database system. To change to MySQL,

Postgres or Oracle, you need to install the corresponding JDBC driver bundle in the OSGI platform and modify the `hibernate.properties` file (see Section 4.4.4.1, “Database Access Configuration”)

3.3.3. Orchestra directory structure

Hereafter is detailed the structure of Orchestra installation. The installation directory contains the following structure :

```
README
build.xml
Licence.txt
bundle/
felix/
conf/
doc/
examples/
lib/
resources/
```

Let's present those items :

- README

This file gives the basic information related to Orchestra

- build.xml

This file is an ant file that provides tasks to use Orchestra. Just typing `ant` will result giving you the usage.

- License.txt

The license of Orchestra. All of Orchestra is available under the LGPL license.

- conf/

This directory contains all the configuration files of Orchestra.

- bundle/

This directory contains Orchestra OSGI bundles and dependencies.

- felix/

This directory contains the Apache Felix bundle.

- doc/

This directory contains the documentation of Orchestra. It contains :

- userGuide.pdf

For PDF documentation

- html/userGuide.html

For HTML documentation in a single page

- html/userGuide/userGuide.html

For HTML documentation in different pages

- `examples/`

This directory contains the examples provided with Orchestra package. See Section 5.3, “Running the examples”

- `lib/`

This directory contains the libraries used for tests.

- `resources/`

This directory contains Orchestra database creation scripts for supported databases and Orchestra environment configuration examples.

3.4. SOA console stand-alone installation

This section is aimed at users who wants to use the SOA Console with an existing Orchestra engine.

To do this, you can download the SOA Console without Orchestra from Orchestra download page on OW2 forge : <http://forge.ow2.org/projects/orchestra>

Then, you need to extract the WAR in the webapps folder of a tomcat or jetty server.

Last step is to modify the JMX information of `orchestra.properties` (in `WEB-INF/classes` directory of the extracted war). You'll need to change the port, service URL and object name with your Orchestra engine ones :

```
# Port of the JMX registry
orchestra.jmx.port=9999
# JMX Service URL to connect to orchestra mbean server.
orchestra.jmx.serviceUrl=service:jmx:rmi:///jndi/rmi://localhost:9999/orchestraServer
# Name of the Orchestra MBean
orchestra.jmx.objectName=Orchestra:type=RemoteAPI
```

Chapter 4. Configuration and Services

This chapter introduces the services configuration infrastructure provided by Orchestra as well as main services included in this version.

4.1. Simple configuration

The `orchestra.properties` file in the `conf/` directory contains properties that can be easily changed. These properties are used by both orchestra client and orchestra server. Here is the default `orchestra.properties` file:

```
orchestra.servlet.host=localhost
orchestra.servlet.port=8080
orchestra.servlet.path=orchestra/services

orchestra.jmx.port=9999
orchestra.jmx.objectName=JMXAgent:name=orchestraRemoteDeployer
orchestra.jmx.serviceUrl=service:jmx:rmi:///jndi/rmi://localhost:9999/orchestraServer
```

- *orchestra.servlet.host* the host where orchestra server is installed.
- *orchestra.servlet.port* the port on which the web services will be exposed.
- *orchestra.servlet.path* the path on the server where the web services will be exposed. Orchestra web services will be available from `http://${orchestra.servlet.host}:${orchestra.servlet.port}/${orchestra.servlet.path}/serviceName`
- *orchestra.jmx.port* the port of the JMX server.
- *orchestra.jmx.serviceUrl* the JMX service URL where the API mbeans will be available.
- *orchestra.jmx.objectName* the name of Orchestra mbean.

4.2. Configuring logger

It is possible to activate the logs. To do so, the file `logging.properties` under the directory `conf/` can be edited. Here is the content of that file :

```
handlers= java.util.logging.ConsoleHandler
.level= SEVERE
java.util.logging.ConsoleHandler.level = FINEST
java.util.logging.ConsoleHandler.formatter = org.ow2.orchestra.util.TraceFormatter

org.ow2.orchestra.util.TraceFormatter.alias=\
org.ow2.orchestra.pvm.internal.wire.descriptor.HibernateConfigurationDescriptor~hibernateConfiguration,
\
org.ow2.orchestra.deployment.Deployer~deployer,\
org.ow2.orchestra.facade.jmx.RemoteDeployerMBean~api,\
org.ow2.orchestra.persistence.log.LoggerRecorder~recorder,\
org.ow2.orchestra.persistence.log.LoggerArchiver~archiver
# For example, set the com.xyz.foo logger to only log SEVERE messages:
# com.xyz.foo.level = SEVERE

org.hibernate.level=SEVERE
org.ow2.orchestra.pvm.internal.wire.descriptor.HibernateConfigurationDescriptor.level=FINE
org.hibernate.event.def.AbstractFlushingEventListener.level=OFF
org.ow2.orchestra.jmx.level=INFO
org.ow2.orchestra.osgi.Engine.level=INFO
org.ow2.orchestra.pvm.internal.svc.DefaultCommandService.level=OFF
org.ow2.orchestra.pvm.internal.tx.StandardTransactionInterceptor.level=OFF
```

```
org.ow2.orchestra.deployment.Deployer.level=FINE
org.ow2.orchestra.test.EnvironmentTestCase.level=FINE
org.ow2.orchestra.test.remote.RemoteTestCase.level=FINE
org.ow2.orchestra.pvm.level=WARNING
org.ow2.orchestra.level=WARNING
org.ow2.orchestra.StartupListener.level=INFO
#org.ow2.orchestra.persistence.log.level=FINE
```

Uncomment the last lines to activate the logs.

4.3. Services Container

The Process Virtual Machine technology includes a services container allowing the injection of services and objects that will be leveraged during the process definition and execution. Objects and services used by the Orchestra engine are defined through a XML file. A dedicated parser and a wiring framework are in charge of creating those objects. Service invoker, publisher, persistence and timers are examples of pluggable services.

This services container (aka IoC container) can be configured through a configuration file. A default configuration file is included in the package under the /conf directory (environment.xml).

This configuration is only used on the server side.

4.3.1. Environment.xml file

The default environment.xml file created during the installation of Orchestra is set to use the database implementation of the persistence service. This file also sets the configuration of hibernate. Here is the environment.xml file generated :

```
<environment-definition>
  <environment-factory>
    <properties name="orchestra-properties" resource="orchestra.properties"/>
    <hibernate-configuration name="hibernate-configuration:core">
      <properties resource="hibernate.properties"/>
      <mappings resource="hibernate/bpel.core.mappings.xml"/>
      <mappings resource="hibernate/bpel.monitoring.mappings.xml"/>
      <cache-configuration resource="hibernate/bpel.cache.definition.xml" usage="nonstrict-read-
write"/>
    </hibernate-configuration>
    <hibernate-session-factory configuration="hibernate-configuration:core" init="eager"
name="hibernate-session-factory:core"/>
    <command-service>
      <orchestra-retry-interceptor delay-factor="2" retries="10"/>
      <environment-interceptor/>
      <standard-transaction-interceptor/>
    </command-service>
    <invoke-executor threads="10"/>
    <job-executor auto-start="false" lock="180000" threads="10"/>
    <hibernate-configuration name="hibernate-configuration:history">
      <properties resource="hibernate-history.properties"/>
      <mappings resource="hibernate/bpel.monitoring.mappings.xml"/>
      <mapping resource="hibernate/bpel.util.hbm.xml"/>
    </hibernate-configuration>
    <hibernate-session-factory configuration="hibernate-configuration:history" init="eager"
name="hibernate-session-factory:history"/>
    <repository class="org.ow2.orchestra.services.impl.DbRepository"/>
    <publisher class="org.ow2.orchestra.cxf.CxfPublisher">
      <property name="timeout">
        <long value="180000"/>
      </property>
    </publisher>
    <invoker class="org.ow2.orchestra.cxf.CxfInvoker" name="serviceInvoker"/>
  </environment-factory>
</environment-definition>
<environment>
  <hibernate-session factory="hibernate-session-factory:core" name="hibernate-session:core"/>
  <runtime-db-session name="runtime-session:core" session="hibernate-session:core"/>
```



```

<transaction/>
<timer-session retries="10"/>
<message-session retries="10" use-fair-scheduling="false"/>
<job-db-session session="hibernate-session:core"/>
<journal class="org.ow2.orchestra.persistence.db.DbJournal" name="journal">
  <arg>
    <ref object="querier-session:core"/>
  </arg>
</journal>
<querier-db-session name="querier-session:core" session="hibernate-session:core"/>
<history class="org.ow2.orchestra.persistence.db.DbHistory" name="history">
  <arg>
    <ref object="querier-session:history"/>
  </arg>
</history>
<hibernate-session factory="hibernate-session-factory:history" name="hibernate-session:history"/>
>
<querier-db-session name="querier-session:history" session="hibernate-session:history"/>
<chainer name="recorder">
  <recorder class="org.ow2.orchestra.persistence.log.LoggerRecorder"/>
  <ref object="journal"/>
</chainer>
<chainer name="archiver">
  <archiver class="org.ow2.orchestra.persistence.log.LoggerArchiver"/>
  <ref object="history"/>
</chainer>
<queryApi name="queryList">
  <ref object="journal"/>
  <ref object="history"/>
</queryApi>
<chainer name="finished-instance-handler">
  <finished-instance-handler
class="org.ow2.orchestra.services.handlers.impl.DeleteFinishedInstanceHandler"/>
  <finished-instance-handler
class="org.ow2.orchestra.services.handlers.impl.ArchiveFinishedInstanceHandler"/>
  </chainer>
  <chainer name="undeployed-process-handler">
    <undeployed-process-handler
class="org.ow2.orchestra.services.handlers.impl.ArchiveUndeployedProcessHandler"/>
  </chainer>
</environment>
</environment-definition>

```

Currently, following objects implementations can be injected in the environment:

- **publisher:** object intended for publishing services of the given BPEL process. For web services based on CXF framework, the default class is `org.ow2.orchestra.cxf.CxfPublisher`.
- **invoker:** object intended for external web services invocations. Default implementation is based on SAAJ through the default implementation (class `org.ow2.orchestra.services.impl.SOAPInvoker`). For web services based on CXF framework, the default class is `org.ow2.orchestra.cxf.CxfInvoker`
- **repository:** data repository storing processes and instances... Database persistence (class `org.ow2.orchestra.execution.services.db.DbRepository`) implementation is included in this release.
- **recorder:** object responsible of process execution logs. Default implementation handles process logs in the command line console (`org.ow2.orchestra.persistence.log.LoggerRecorder`). Recorder and Journal (see next) objects can be chained (new ones can be added as well on top of the recorder chainer). This give you a powerful mechanism to handle process execution data.
- **journal:** object responsible for storing or retrieving process execution data. Database persistence (class `org.ow2.orchestra.persistence.db.DbJournal`) implementation is provided by default.
- **archiver:** object intended for process logs archiving. Default implementation handles logs on process data archiving through the default implementation (class `org.ow2.orchestra.persistence.log.LoggerArchiver`). Archiver and History (see next) objects can be chained (new ones can be added as well on top of the archiver chainer). This give you a powerful mechanism to handle process archived data

- **history:** object intended for storing or retrieving process archived data. Default implementation is provided and available in the following class: `org.ow2.orchestra.persistence.db.DbHistory`.
- **queryList:** object intended to configure how the `QueryRuntimeAPI` will retrieve the process execution data. This retrieval could be configured to chain with the expected order into the journal and the history.
- **finished-instance-handler:** action to perform when a process instance is finished. This object could chain two or more distinct actions: for a given process instance, deleting the runtime object including its activities from the repository and then store data in the archive and remove data from journal. Default implementations are proposed for both chained actions.
- **undeployed-process-handler:** action to perform when a process is un-deployed. This object could chain distinct actions. Default implementation stores data in the archive and removes data from journal.
- **dead-job-handler:** action to perform when a asynchronous execution has failed all the retries. This object could chain distinct actions. Default implementation exits the process instance that failed to execute asynchronously.

* Note 1: As explained before persistence objects are provided as default implementations in the environment. Notice that in a persistence configuration additional resources are required, i.e for hibernate persistence you can specify mappings, cache configuration...

* Note 2: The environment is divided in two different contexts: `environment-factory` and `environment`. Objects declared inside the `environment-factory` context are created once and reused while objects declared inside the `environment` context are created for each operation.

4.4. Services

Services in Orchestra is all about pluggability. To allow that, each service has been thought in terms of an interface with different possible implementations. In the following lines you will find a description of main services supported in Orchestra.

The PVM includes a framework to allow the injection of services and objects that will be leveraged during the process definition and execution. Objects and services required in Orchestra are defined through an XML file. A dedicated parser and wiring framework in the PVM is in charge of creating those objects.

A default environment file (`environment.xml`) is provided in the installed package.

Currently, following objects are required for the execution environment :

- publisher
- invoker
- repository
- persistence
- timer
- journal and history
- querier

Example of implementation classes for these objects are embedded into the Orchestra jar and defined into the `environment.xml` file.

4.4.1. Publisher

The publisher service sets the way the services proposed by the BPEL processes will be published. The default implementation of this service uses the CXF Web Service Container.

4.4.2. Invoker

The invoker service sets the way the BPEL processes will call external services. The default implementation of this service uses the SAAJ implementation.

4.4.3. Repository

The repository service sets the way the data will be handled by the engine. Orchestra proposes one implementation managing data in the database.

4.4.4. Persistence

Persistence is one of key technical services injected into the services container. This service, as well as other major services in Orchestra, is based on a service interface. That means that multiple persistence implementations can be plugged on top.

The Persistence service interface is responsible to save and load objects from a relational database. By default, a persistence implementation based on the Hibernate ORM framework is provided (JPA and JCR to come).

The Process Virtual Machine core definition and execution elements (processes, nodes, transitions, events, actions, variables and executions) as well as the BPEL extension ones (activities, conditions, variables...) are persisted through this service. Process Virtual Machine core elements are also cached by leveraging the default persistence service implementation (Hibernate based). Processes and instances are stored through this persistence service. Repository is the term used in Orchestra to store those entities.

This service is only used if the repository service is set to database.

4.4.4.1. Database Access Configuration

The default configuration of Orchestra uses the Database persistence service and the H2 Database. Orchestra has also been tested with Oracle, MySQL and Postgres database system. To change to MySQL, Postgres or Oracle, you need to install the corresponding JDBC driver (see Chapter 3, *Installation guide*) and modify the `hibernate.properties` file : uncomment the corresponding lines :

```
# Hibernate configuration

# For using Orchestra with H2
# hibernate.dialect                org.hibernate.dialect.H2Dialect
# hibernate.connection.driver_class org.h2.Driver
# hibernate.connection.url         jdbc:h2:file:db_orchestra
# hibernate.connection.username   sa
# hibernate.connection.password

# For using Orchestra with postgresQL
# hibernate.dialect                org.hibernate.dialect.PostgreSQLDialect
# hibernate.connection.driver_class org.postgresql.Driver
# hibernate.connection.url         jdbc:postgresql://server:port/db
# hibernate.connection.username   user
# hibernate.connection.password   pass

# For using Orchestra with MySQL
```

```
# hibernate.dialect org.hibernate.dialect.MySQL5InnoDBDialect
# hibernate.connection.driver_class com.mysql.jdbc.Driver
# hibernate.connection.url jdbc:mysql://server:port/db
# hibernate.connection.username user
# hibernate.connection.password pass

hibernate.dialect org.hibernate.dialect.H2Dialect
hibernate.connection.driver_class org.h2.Driver
hibernate.connection.url jdbc:h2:file:db_orchestra
hibernate.connection.username sa
hibernate.connection.password

hibernate.hbm2ddl.auto update
hibernate.cache.use_second_level_cache true
hibernate.cache.provider_class org.hibernate.cache.HashtableCacheProvider
hibernate.show_sql false
hibernate.format_sql false
hibernate.use_sql_comments false
hibernate.bytecode.use_reflection_optimizer true
```

4.4.5. Journal and History

This module concerns the way in which the process data is stored during the process execution and archived when the execution is completed. This is indeed a crucial module in a process solution.

Orchestra unifies journal data et history data as the underlying essence of both is to handle process data. For that to be done, we created the concept of process record. A record is a minimal set of attributes describing a process entity execution. That means that each process entity related to the execution has its own associated record.

Those records are recorded during the process execution and stored depending on the persistence service implementation (DB, XML...). The Orchestra API will retrieve record data from the records storage and sent them back to the users (meaning that records also acts as value objects in Orchestra APIs).

As soon as a process instance is finished, a typical scenario would be (by default) to move instance related process data from the production environment to a history one. While the physical device and the data structure could changed from one process engine deployment to another (XML, BI database...), the internal format could remain the same (records). This is exactly what is happening in Orchestra, when archiving data the engine just move execution records from the production to the history environment without data transformation in between.

Journal and history data are persisted in different database. Change hibernate.properties [hibernate-history.properties] file in conf directory to modify the journal [history] database

4.4.6. Querier

The querier is an API tool for getting process records corresponding to different criteria. It can get records from journal, from history or both. This possibility is defined in the environment. Several parameters will allow us to obtain this information by various criteria: their state (running or after delivery) or ID. Depending on the circumstances this request will return a record, a set of records or an empty table.

4.4.7. Command service

The command service manages the environments and the transactions in Orchestra. Each process or API method is executed by the command service.

Its definition in the environment is the following :

```
<command-service>
```

```
<orchestra-retry-interceptor delay-factor="2" delay="100" max-delay="10000" retries="10"/>
<environment-interceptor/>
<standard-transaction-interceptor/>
</command-service>
```

The *retries* (optional) attribute can be used to define how many times commands will be tried before propagating the exception. This attribute is ignored for jobs (see Section 4.4.8, “Asynchronous Executions (Jobs)”).

The *delay*, *max-delay*, *delay-factor* (optional) attributes can be used to define the sleep time between each retry. The sleep time for the n^{th} attempt is given by

```
sleep = min($max-delay, $delay * $delay-factor * random(1, $delay-factor)n)
```

delay and *max-delay* values are in milliseconds.

4.4.8. Asynchronous Executions (Jobs)

To optimize the execution, Orchestra splits the execution in small steps. A job represents a step of an execution. It can be executed in parallel with other jobs. Jobs are grouped in two sets: messages, which can be executed immediately, and timers, whose executions are scheduled at a precise date.

Timers are used for the BPEL statements "wait" and "onAlarm".

Messages are used for the BPEL statements "receive", "onEvent", "onMessage" and "invoke".

Orchestra uses the PVM Job executor service to handle jobs. Jobs are created using either the timer session service or the message session service. The job executor then fetches the job from the database and perform the instructions contained in the job.

4.4.8.1. Timer session

A timer session service is required to schedule timers in the PVM. Its definition in the environment is the following :

```
<timer-session retries="5"/>
```

The timer session *retries* (optional) attribute can be used to define how many times the job will be retried before it becomes dead (see Section 4.4.8.4, “Dead jobs”).

4.4.8.2. Message session

A message session service is required to schedule messages in the PVM. Its definition in the environment is the following :

```
<message-session retries="5" use-fair-scheduling="false"/>
```

The message session *retries* (optional) attribute can be used to define how many times the job will be retried before it becomes dead (see Section 4.4.8.4, “Dead jobs”).

The message session *use-fair-scheduling* (optional) attribute can be used to define if the jobs should be executed with the same priority or if the jobs of older instances should be executed first.

4.4.8.3. Job Executor

The job executor fetches the jobs to execute from the database, and then executes the job.

Default implementations of the job executor uses a thread pool to execute jobs in parallel.

There are two default implementations of the job executor:

- an implementation using a thread pool with a fixed size. This service is defined in the environment file with the following line :

```
<job-executor threads='10' auto-start='false' />
```

The number of thread is defined by the *threads* attribute. This implementation is the default implementation.

- an implementation using a thread pool with a variable size (based on `java.util.concurrent.ExecutorService`). This service is defined in the environment file with the following line :

```
<job-executor type='jdk' auto-start='false' />
```

Optional attributes can be defined in the environment to configure the job executor service:

- *command-service*: name of the command service to use to execute jobs. Only necessary if more than one command service exists.
- *dead-job-handler*: name of the command service to use to handle dead jobs. Only necessary if more than one dead job handler exists.
- *idle*: polling interval of the job database (in milliseconds). Note that the job executor is notified of job added by message and timer session services. Polling is just to check no notification has been missed.
- *lock*: before a job is executed by a job executor thread, the thread locks the job to be sure no other threads executes the same job. The *lock* attribute specifies the duration of the lock (in milliseconds). When the lock expires, a new thread can execute the job again (can happen if a job executor thread dies unexpectedly).
- *limit-job-per-instance*: specifies if jobs of a process instance should be executed sequentially. If this attribute is set to *false*, jobs of the same instance can be executed in parallel.
- *queueSize*: specifies the maximum number of jobs locked by the job executor, but waiting for a job executor thread to execute them.
- *acquireSize*: specifies the number of jobs fetched from the database and locked at the same time. Increasing this number can reduce the number of database transactions, but can reduce parallelism in clustered environments.
- *addQueueSize*: specifies the maximum number of jobs that can be directly locked by this job executor. If a new job is created during the execution of a job by this job executor, the job will directly be locked by this job executor and added to the waiting queue. Increasing the add queue size reduces the number of database transactions, but setting a too important value can cause jobs locks expirations.

4.4.8.4. Dead jobs

If an exception occurs during a job execution, the job executor will decrement the retry counter of the job. While the retry counter is positive, the job executor will pick the job and try to execute it again.

When the job retry counter is zero, the job executor will not execute the job again. The job becomes a dead job.

If a dead job handler exists in the environment, it will be executed.

The default retry counter value for a job can be set in the message session configuration.

4.4.8.4.1. Dead Job Handler (DJH)

DJH are executed after a job retry counter has reached zero. Orchestra provides following implementations in the package *org.ow2.orchestra.services.handlers.impl*:

- *ExitInstanceDeadJobHandler* : exits the BPEL instance which has faulted.
- *ThrowBpelFaultDeadJobHandler* : throw a BPEL fault {http://orchestra.ow2.org}jobExecutionFault to the BPEL instance which has faulted. The fault can be handled by a catch activity.

By default, the Dead Job Handler is disabled (no dead job handler is used).

4.4.8.4.2. Interacting with dead jobs

The management API provides methods to find dead jobs and to reset the retry counter of a job to a specified value.

If you want to manage the dead jobs manually, you need to disable the Dead Job Handler.

Refer to Section 9.1, “Orchestra APIs” for more information on how to use the APIs.

4.4.8.5. Invoke Executor

The invoke executor executes external web services calls. Invoke are executed by a separate thread pool. The thread is hold until the web service response is received.

Default implementation of the invoke executor uses a thread pool to execute invoke in parallel.

The default implementation of the invoke executor use a thread pool with a fixed size. This service is defined in the environment file with the following line :

```
<invoke-executor threads='10' />
```

The number of thread is defined by the *threads* attribute. This parameter defines the maximum number of invoke that can be executed simultaneously.

4.4.9. Finished instance handler (FIH)

FIH are executed after the instance finished. Orchestra provides following implementations in the package *org.ow2.orchestra.services.handlers.impl*:

- *NoOpFinishedInstanceHandler* : do nothing
- *CleanJournalFinishedInstanceHandler* : remove instance data from journal
- *ArchiveFinishedInstanceHandler* : remove instance data from journal and put it in history (used by default)
- *DeleteFinishedInstanceHandler* : delete instance data from orchestra repository (used by default)

4.4.10. Undeployed process handler (UPH)

UPH are executed after the process is undeployed. Orchestra provides following implementations in the package *org.ow2.orchestra.services.handlers.impl* :

- *NoOpUndeployedProcessHandler* : do nothing

- *CleanJournalUndeployedProcessHandler* : remove process data from journal
- *ArchiveUndeployedProcessHandler* : remove process data from journal and put it in history (used by default)

Chapter 5. User guide

5.1. Start and Stop Orchestra

Orchestra is a webapp that can be deployed on Tomcat. So starting Orchestra in fact starts Tomcat with the correct environment. This can be performed from the installation directory with the following command line :

```
>cd orchestra-cxf-tomcat-4.9.0
>ant start
```

Starting Orchestra will not be done in background. This means that the console starting Orchestra will be dedicated to the traces from Orchestra. To perform further actions, new consoles need to be opened.

To stop Orchestra, type the following command line :

```
>cd orchestra-cxf-tomcat-4.9.0
>ant stop
```

5.2. Other commands

Orchestra provides a set of other commands that can be useful

- A command to check the status of Orchestra. This command tells if the engine is started and if so, gives the names of processes deployed on the engine :

```
>ant status
```

- A command to simulate a Web Service call. This command will simulate a WS call to interact with a deployed process :

```
>ant call -Dendpoint=<service_url> -Daction=<SOAP_action> -Dmessage=<message>
```

For example :

```
>ant call -Dendpoint=http://localhost:8080/orchestra
-Daction=http://orchestra.ow2.org/weatherArtifacts/process/weatherPT
-Dmessage="<weatherRequest xmlns='http://orchestra.ow2.org/weather'>
  <input>Grenoble,France</input>
</weatherRequest>"
```

5.3. Running the examples

The Orchestra package contains examples of BPEL processes:

- loanApproval: invokes two local web services. This example is taken from the BPEL 2.0 standard.

This is an example from the BPEL 2.0 standards

- weather: invokes a remote Web Service and returns the current weather.

This example shows how to call a real world Web Service.

- echo

This example shows a basic synchronous BPEL process.

- orderingService

This example shows how to use pick instruction and correlations.

- producerConsumer

This example shows how executions can be saved and restarted after a crash.

A build.xml file is provided for each of those samples. Those ant scripts provide the same targets to deploy, launch and undeploy the sample. Go to the desired example and use the command lines :

```
>ant deploy
>ant launch
>ant undeploy
```

5.4. Process designers

For the new version, Orchestra does not ship a graphical designer. Orchestra engine has been tested with processes created using the Netbeans BPEL designer [<http://soa.netbeans.org/>]. It is also possible to use the Eclipse BPEL designer [www.eclipse.org/bpel/]. Download and installation instruction are available on the project web site. However we have encountered a few bugs in the eclipse designer. So we advise the use of NetBeans.

There is a work in progress to provide a Web 2.0 designer, using BPMN 2.0, that will be accessible directly from the console. A preview is already available.

5.5. Deploying / undeploying a process

Once Orchestra is started, it is then possible to deploy a new process on the engine :

```
>ant deploy -Dbpel=<process>.bpel -Dwsdl=<process>.wsdl -Dextwsdl=<wsdl1,wsdl2>
```

Orchestra also provides the possibility to use an archive to deploy a process. This archive should be a zip file with the extension .bar. Here is the command line to deploy such an archive :

```
>ant deploy -Dbar=<process>.bar
```

Warning : The archive should be a zip file structured as described bellow :

```
/<process>.bpel
/<process>.wsdl
/<files>.wsdl
```

To undeploy a process, use the following command line :

```
>ant undeploy -Dprocess=<process_name>
```

Warning : the process name should be fully qualified. This means that it needs to contain to namespace. For instance :

```
{http://orchestra.ow2.org/weather}weather
```

Details of deployment errors are logged into the "error.txt" file.

Alternatively you can use Section 6.3, "Process View" to deploy a .bar file.

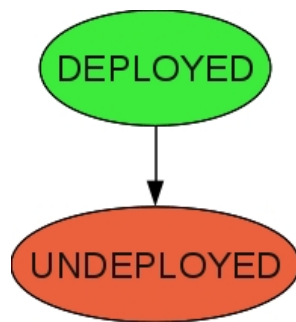
5.6. Process lifecycle

A process has three states:

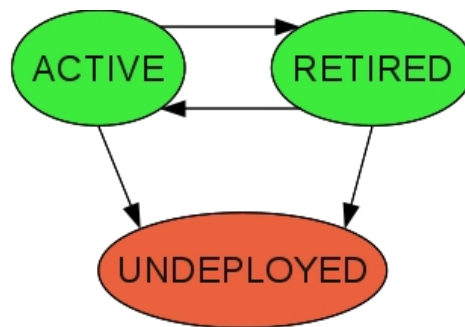
- *active*: this is the default state when a process is deployed. The process can create new instances, and running instances can finish their execution. Process web services are deployed and active.
- *retired*: The process cannot create new instances, but running instances can finish their execution. Process web services are deployed and active.
- *undeployed*: The process cannot create new instances. There are no more running instances. Process web services are not deployed (and disabled).

A process can change state from:

- *active to retired*
- *retired to active*
- *active to undeployed*
- *retired to undeployed*



Orchestra 4.5



Orchestra 4.6

Process lifecycle.

Chapter 6. Console User Guide

In this chapter we present the possibilities of the SOA Console.

6.1. Quick start guide

In this chapter we present a quick start documentation for SOA Console. In the next chapters we will explain in more details the functionalities available in this release.

The first step to begin with SOA Console is to log on the server. To do this, you have to :

- Open a command line and execute the following under the orchestra-cxf-tomcat-4.9.0 directory :

ant start

- In your web browser connect to the following URL : <http://localhost:8080/console/> It's the default URL, otherwise the correct syntax is : <http://hostname:portnumber/console>

You'll have to connect with :

1. User Name : orchestra
2. Password : orchestra



6.2. Default Users

By default, the SOA Console has one user registered. It's important to change this users' list as soon as possible to control the access on your engine. To do this, you'll find a "tomcat-users.xml" file in repository tomcat/conf/ and you'll have to modify these following lines to modify the access list :

```
<tomcat-users>
<!--
  NOTE: By default, no user is included in the "manager" role required
  to operate the "/manager" web application. If you wish to use this app,
  you must define such a user - the username and password are arbitrary.
-->
<!--
  NOTE: The sample user and role entries below are wrapped in a comment
  and thus are ignored when reading this file. Do not forget to remove
  <!-- ... --> that surrounds them.
-->
<!--
  <role rolename="tomcat"/>
  <role rolename="role1"/>
```

```

<user username="tomcat" password="tomcat" roles="tomcat"/>
<user username="both" password="tomcat" roles="tomcat,role1"/>
<user username="role1" password="tomcat" roles="role1"/>
-->
<user username="orchestra" password="orchestra" roles="user"/>
</tomcat-users>

```

The roles are defined in web.xml file. By default, you can log with user and admin as role but this version doesn't implement the role mechanism.

This is the standard authentication mechanism for servlet container, you can find more details on this URL : <http://tomcat.apache.org/tomcat-6.0-doc/realms-howto.html>

6.3. Process View

This is the first view you'll see when connecting to the console. Its purpose is to display the processes on Orchestra but you can switch to the instances tab to display the instances on Orchestra. This is the global mechanism to change view for the entire application.

You have the possibility on each view to sort the tables as you want clicking on the title labels except Actions one.

UUID	Name	Namespace	Version	Deployment Date	Undeployment Date	State	Actions
1	echo	http://enterprise.netbeans.org/bpel/echo/echo_1	1	10/21/2010 at 09:37:31	10/21/2010 at 11:33:41	undeployed	[Icons]
2	orderingServ...	http://orchestra.ow2.org/demos/orderingService	1	10/21/2010 at 11:32:50	N/A	retired	[Icons]
3	producerCons...	http://orchestra.ow2.org/demos/producerConsumer	1	10/21/2010 at 11:33:00	N/A	active	[Icons]
4	weather	http://orchestra.ow2.org/weather	1	10/21/2010 at 11:33:21	N/A	active	[Icons]
5	orderingServ...	http://orchestra.ow2.org/demos/orderingService	2	10/21/2010 at 11:33:34	N/A	active	[Icons]
6	echo	http://enterprise.netbeans.org/bpel/echo/echo_1	1	10/21/2010 at 11:33:52	N/A	active	[Icons]

Deploy a process:

6.3.1. Deploy a process

In the processes view tab, you have the possibility to deploy a process :

UUID	Name	Namespace	Version	Deployment Date	Undeployment Date	State	Actions
------	------	-----------	---------	-----------------	-------------------	-------	---------

Deploy a process:

Once you have clicked the browse button, you'll have to choose a process to deploy through your file system. On Orchestra, processes are .bar files containing at least one WSDL file and one BPEL file.

Choose your process to deploy and click the upload button :



Once Orchestra has finished to deploy the process, the Processes tab will automatically refresh with the new process and a pop up information will be displayed :



To test the console, you can use the Orchestra examples delivered within the package running the command : `ant deploy`. You can use the file upload widget too but make sure that the port in soap:address in the WSDL file is the same as the tomcat port.

You can also run instances with the command : `ant launch`

6.3.2. Information about a process

For each process deployed on Orchestra, the following fields will be displayed :

1. UUID

It's the ID of the process on Orchestra. This ID is unique, it can correspond to only one process.

2. Name

It's the name of the process deployed

3. Namespace

It's the namespace of the process. The concatenation of name and namespace identifies a unique deployed process too.

4. Version

It's the version number of the process. (see for Section 8.4, "Process versioning with Orchestra" more details)

5. Deployment Date

It's the date when the process has been deployed on Orchestra.

6. Undeployment Date

It's the date when a process has been undeployed. For a process not undeployed yet, this field will be "N/A" for Not Applicable.

7. State

It's the state of the process, the different values are "active", "retired" or "undeployed" (see for Section 5.6, "Process lifecycle" more details)

8. Actions






It's the different actions possible on each process.


6.3.3. Actions on a deployed process

In the last column of the grid, you'll find the actions possible on a process :



Icon Description :

1.  a new tab is added with instances of the corresponding process.
2.  a new tab is added with details and definition activities of the corresponding process.
3.  Set the corresponding process version as retired. (see for Section 5.6, "Process lifecycle" more details)
4.  Set the corresponding process version as active. (see for Section 5.6, "Process lifecycle" more details)
5.  the process will be undeployed. It will always be on the process list but its state will be undeployed and so, it will not be possible to instantiate it.

6.  the process will be totally removed from engine, contrary to the undeployment.

Note that these icons are disabled when the actions are not possible.

6.4. Instance View

The second tab will always be a list of all instances of all processes on Orchestra but you can, with actions bar, open a new view with instances for a specific process.



UUID	Process UUID	Process Name	State	Start Date	Last Update Date	Actions
69\$2018	69	echo	finished	05/26/2010 at 15:23:40	05/26/2010 at 15:23:40	  
69\$2024	69	echo	finished	05/26/2010 at 15:23:43	05/26/2010 at 15:23:43	  
72\$2007	72	weather	finished	05/26/2010 at 15:23:34	05/26/2010 at 15:23:36	  
72\$2030	72	weather	finished	05/26/2010 at 15:23:47	05/26/2010 at 15:23:48	  
73\$2001	73	producerCons...	running	05/26/2010 at 15:23:20	05/26/2010 at 15:23:20	  
73\$2041	73	producerCons...	running	05/26/2010 at 15:23:55	05/26/2010 at 15:23:55	  

6.4.1. Information about an instance

For each instance executed on Orchestra, the following fields will be displayed :

1. UUID

It's the ID of the instance on Orchestra. This ID is unique, it can correspond to only one instance.

2. Process UUID

It's the unique ID of the process corresponding to the instances displayed.

3. Process Name

It's the name of the process corresponding to the instances displayed.

4. State

It's the state of an instance. The different values are "running", "suspended", "finished" or "exited".

5. Start Date

It's the date when the instance has begun.

6. Last Update Date

It's the date of last update of the instance and the end date for an instance terminated.

7. Actions

It's the different actions possible on each instance.

6.4.2. Actions on an instance

In the last column of the grid, you'll find the actions possible on an instance :



Icon Description :

1. a new tab is added with details and activities corresponding to the selected instance.
2. the instance will be suspended until you click on the next icon.
3. the instance previously suspended will be resumed.
4. the instance will be terminated and its state will be "exited".
5. the instance will be totally removed from the history base.

Note that these icons are disabled when the actions are not possible.

6.5. Activities View

UID	Name	Namespace	Deployment Date	Undeployment Date	State	Actions
69	echo	http://enterprise.netbeans...	05/26/2010 at 15:21:25	N/A	deployed	

Activity UID	Type	Name
69	PROCESS	echo
69\$10-C...	COMPENSATE	autoGenerated_DefaultCH_process echo_compensate
69\$2-SE...	SEQUENCE	unnamed
69\$3-RE...	RECEIVE	start
69\$4-AS...	ASSIGN	Assign1
69\$5-RE...	REPLY	end
69\$7-TE...	TERMINATION_HANDLER	autoGenerated_DefaultTH_process echo
69\$8-CO...	COMPENSATE	autoGenerated_DefaultTH_process echo_compensate
69\$9-CO...	COMPENSATION_HAND...	autoGenerated_DefaultCH_process echo

This view is displayed on its own tab when you click on the activities icon as explained in the previous section. You can open an activities tab for a process, these activities will be the definition activities of the process. You can open an activities tab for an instance, these activities will be the runtime activities of the specific instance, so you'll see what activities are already done by the instance and which one is running. Definition activities and execution activities contain 2 separate views :

1. Details view : This first grid gives information about the process/instance.
2. Activity view : This second grid gives the whole list of activities executed by a process for a process and the list of activities already executed for an instance.

Note that in the details view, you have the possibility to interact with the process/instance selected thanks to the Actions column as explained in previous section.

6.6. Other Features

Some other features are available when any tab is selected. You can :

1. Sort your grids depending on every field except Actions.
2. Check your connection to Orchestra at any time on the info labels just below the banner. The refresh label allows you to check if the connection to Orchestra is always unavailable.
3. Check your login information on the same info banner.
4. Logout from the console at any time clicking the Logout label.

Connected to Orchestra [Refresh](#) user connected since 26/05/2010 at 15:50:52 [Logout](#)

Chapter 7. Designer User Guide

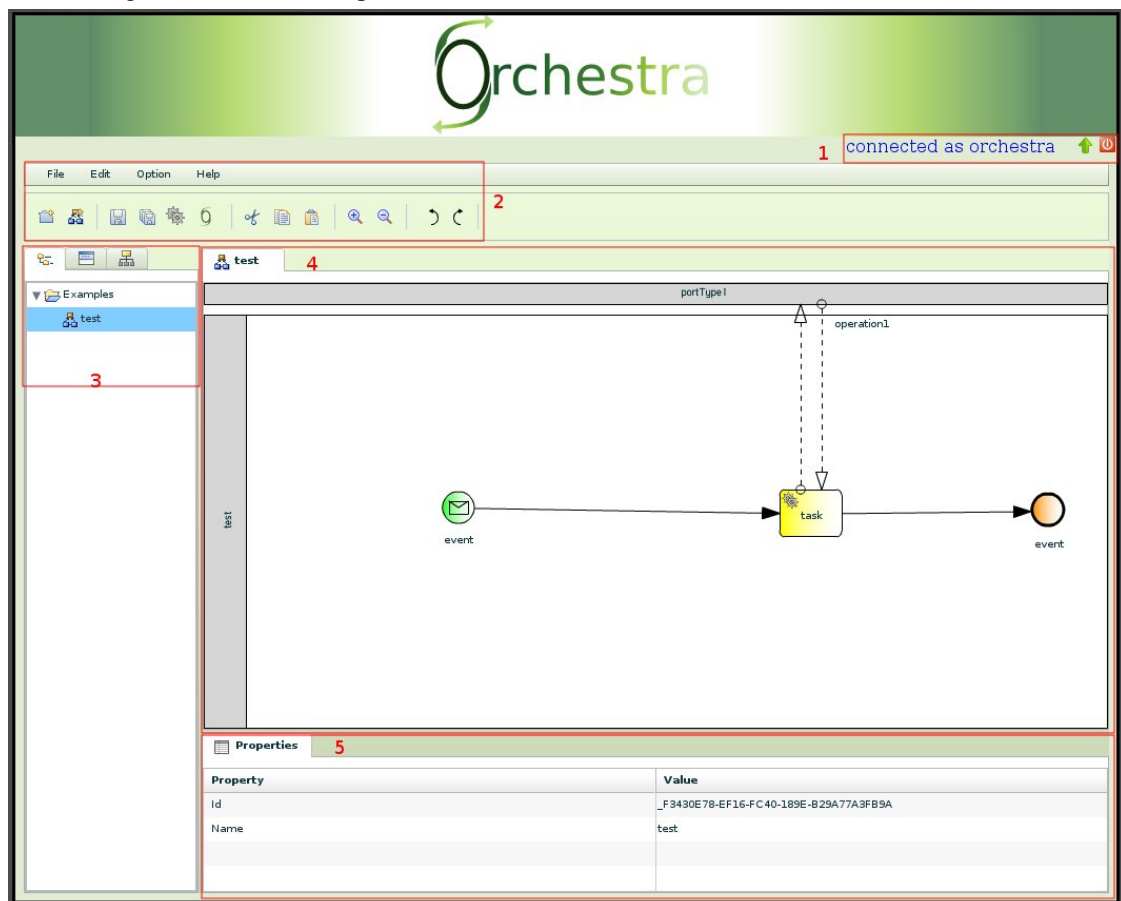
7.1. Quick start guide

7.2. Default Users

Same users defined for the Console are used for the Designer. See Console user guide.

7.3. Editor

In the Designer there are 5 main parts detailed below :



1/ Connecting zone

This zone is composed by :

The login name is displayed before "connected as"

Full screen button : to reduce the green zone Orchestra on the top of the screen

Logout button : to return to the login window and change the current user

2/ Menu and toolbar

- Menu

File/Edit : options to save/select/undo/redo

Option

- Orchestra connection : change the JMX URL and ObjectName used to connect with Orchestra server (not mandatory to design a process but mandatory to deploy a process)
- Show view : Customize the Designer to show/hide window properties or micro-image.

Help : Version of the Orchestra Designer and Copyrights

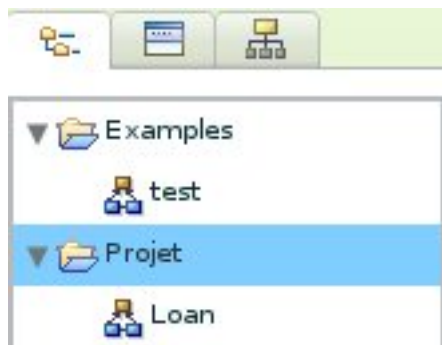
- Toolbar



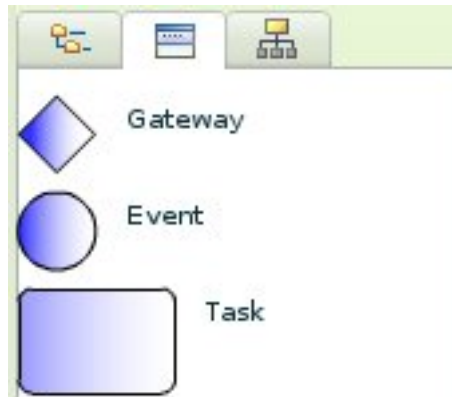
- Create a Folder (just one level of folder)
- Create a process into a folder (this name must be unique by folder)
- Save current edited process into the server
- Save all opened process
- Export the current edited process to bpm and wsdl (generate a BAR archive)
- Deploy the generated BAR of the current edited process
- Cut / Copy / Paste : Not implemented in this version
- Zoom in / Zoom out : Not implemented in this version
- Undo / redo

3/ Explorer

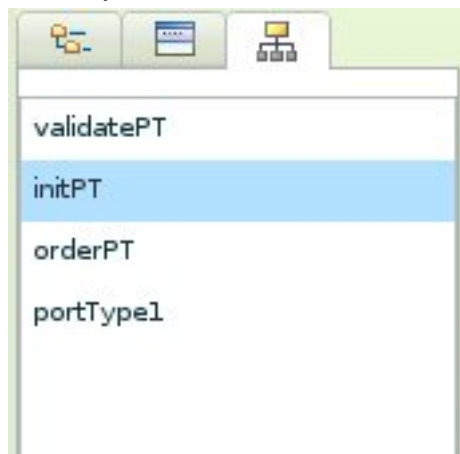
- File explorer (Folder and processes)



- BPMN Palette with 3 BPMN elements (to be completed soon)



- External Services explorer : with the Add button you can choose from your local files a wsdl file which describe your external service. You can drag&drop this service into process Editor to add a BPMN Pool.



4/Process designer tab

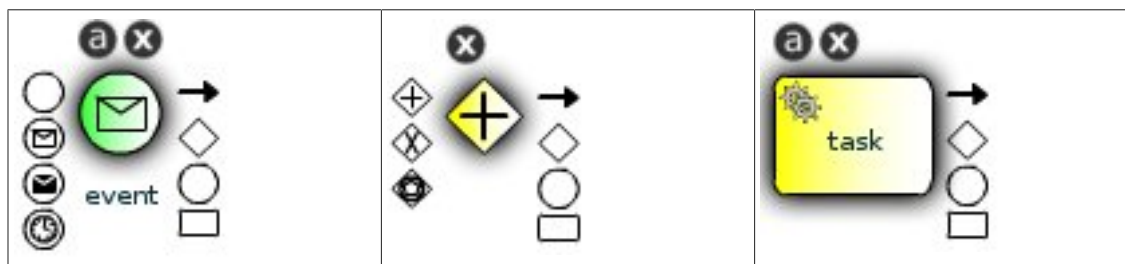
For each BPMN 2.0 process, a diagram editor opens a new tab.

In each diagram editor you can drag and drop BPMN elements from the BPMN palette.

Each BPMN element can be selected. When selected, a contextual menu appears around the element :

- On the top, the element can be renamed or removed.
- On the left, the type of the BPMN element can be changed.
- On the right, the element can be connected with another element.

Table 7.1.



5/Properties

This editor shows the properties of the current selected element.

You can edit value of a writable property.

Properties	
Property	Value
Id	_CCE9CF8D-EE48-2E7A-022C-B29A9BDA8528
Name	task
Type	service
Operation (Interface)	operation1 (portType1)
Output Variable	eventVar
Input XPath Expression	getDataObject("eventVar")

Chapter 8. Advanced features

8.1. Monitoring and administration with JMX

Orchestra registers several MBeans which provide some monitoring information.

- Orchestra API is exposed as a JMX MBean (default objectName: *Orchestra:type=RemoteAPI*). Orchestra API is detailed in Section 9.1, “Orchestra APIs”.
- Orchestra job and invoke executor thread pools can be managed with JMX (default objectName: *Orchestra:type=threadPool,name=JobExecutor* and *Orchestra:type=threadPool,name=InvokeExecutor*). Orchestra thread pool mbean is detailed in Section 8.1.1, “Orchestra MBean for thread pools”.
- Hibernate MBeans (default objectName: *Orchestra:type=Hibernate,name=hibernate-session-factory_core* and *Orchestra:type=Hibernate,name=hibernate-session-factory_history*). These MBeans provide statistics about the Hibernate sessions. Refer to Hibernate documentation [<http://docs.jboss.org/hibernate/stable/core/reference/en/html/>] for more information about the statistics.
- C3P0 MBeans (default objectName: *com.mchange.v2.c3p0:type=PooledDataSource**). These MBeans provide statistics about the Hibernate JDBC connection pool. Refer to C3P0 documentation [http://www.mchange.com/projects/c3p0/index.html#jmx_configuration_and_management] for more information.
- Tomcat MBeans (default objectName: *Catalina:**). These MBeans provide informations about Tomcat. Refer to Tomcat documentation [<http://tomcat.apache.org/tomcat-6.0-doc/funcspecs/fs-admin-objects.html>] for more information.

8.1.1. Orchestra MBean for thread pools

Available attributes:

- *ActiveCount* : Number of threads currently executing a task.
- *CompletedTaskCount* : Number of tasks completed.
- *CorePoolSize* : Maximum number of threads of this pool. This attribute can be modified.
- *PoolSize* : Current number of threads of this pool.
- *TaskCount* : Number of tasks submitted to the thread pool. This includes tasks already completed, tasks currently being executed and tasks waiting for execution.
- *WaitingTaskCount* : Number of tasks currently waiting for execution.

8.2. Clustering configuration

Orchestra can run in a clustered environment.

In a clustered environment, all Orchestra nodes share the same database.

When a process is deployed in Orchestra, the process web services are deployed on each node of the cluster. An instance of the process can execute on any node of the cluster.



Important

In a clustered environment, reply activities are not supported. The web services exported by Orchestra are only one-way web services.

In this version, Orchestra cluster configuration is done by declaring the cluster nodes in the `environment.xml` file.

To declare a cluster, add these lines to the *environment-factory* part of the configuration file:

```
<static-cluster>
  <jmx-server serviceUrl="..." objectName="..." />
  <jmx-server serviceUrl="..." objectName="..." />
</static-cluster>
```

Each *jmx-server* element describes an Orchestra node. The *serviceUrl* and *objectName* attributes are the parameters to use to connect to the JMX interface of the node. These values are configured for each node in the *orchestra.properties* file.

8.3. Using Apache Camel with Orchestra

When using Orchestra with CXF Web Service framework, Orchestra can use Apache Camel as transport for web services interactions.

Orchestra-Camel integration allows processes to produce/consume messages on the Camel context. It allows a process to use for example JMS, mail, file connectors to connect to remote services.

For more information about Apache Camel features, please read Camel documentation [<http://camel.apache.org/user-guide.html>]

8.3.1. How to create a Camel context for a process ?

Orchestra uses Camel Spring [<http://camel.apache.org/spring.html>] language to describe routes. To define the Camel routes deployed with a process, add a `camel-context.xml` file in your BAR archive. Orchestra will deploy and start the routes with the process. If your `camel-context.xml` uses external Java classes, you can add them too to the BAR archive.

Example of `camel-context.xml` file:

```
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans-2.5.xsd
    http://camel.apache.org/schema/spring
    http://camel.apache.org/schema/spring/camel-spring.xsd">
  <camelContext xmlns="http://camel.apache.org/schema/spring" autoStartup="false">
    <route>
      <from uri="file:///inputDir" />
      <to uri="direct:hello"/>
    </route>
  </camelContext>
</beans>
```

8.3.2. How to use camel context instead of HTTP for Web Service interactions ?

In the WSDL file of the service you want to invoke or expose in the camel context,

- change to transport defined in the SOAP binding element to *<http://cxf.apache.org/transports/camel>*

- change the location of the service defined in the SOAP address element to *camel://camel_endpoint* (where *camel_endpoint* is the endpoint you want to expose/invoke in the camel context)

Example of WSDL Service configured to use Camel:

```
<wsdl:binding name="helloworldPTSOAPBinding" type="tns:helloworldPT">
  <soap:binding style="document" transport="http://cxf.apache.org/transports/camel"/>
  <wsdl:operation name="submit">
    <soap:operation soapAction="http://orchestra.ow2.org/helloworld/submit"/>
    <wsdl:input>
      <soap:body use="literal" />
    </wsdl:input>
    <wsdl:output>
      <soap:body use="literal"/>
    </wsdl:output>
  </wsdl:operation>
</wsdl:binding>

<wsdl:service name="helloworldService">
  <wsdl:port name="helloworldPort" binding="tns:helloworldPTSOAPBinding">
    <soap:address location="camel://direct:hello"/>
  </wsdl:port>
</wsdl:service>
```

8.4. Process versioning with Orchestra

Since Orchestra 4.6, versioning of process is supported.


This feature eases deployment of new versions of a process in an environment with long-running instances.

8.4.1. Process versions


To deploy a new version of a process, just deploy a new process with the same name and namespace as an already deployed process. The version is automatically incremented.

Only one version of a process can be *active*. If multiple versions are deployed:

- when a version becomes *active*, the previously *active* version becomes *retired*.

In the SOA console you can set a process version as *active* by clicking on the  button in the process view

- when the *active* version is *undeployed*, the highest *retired* version becomes *active*.

In the SOA console you can set a process version as *retired* by clicking on the  button in the process view

- when a new version is deployed, it becomes automatically *active*.

8.4.2. Restrictions on versioning

There are some restrictions when changing the process web services between process versions.

If a web service is shared by two versions of a process (same endpoint address), it must have the same WSDL definition (same portType, same binding...) in the two versions.

A new version of a process can add/remove web services (if receive activities are added, removed), as long as they use a separate portType.

A web service cannot be shared by two different processes (processes with different names).

Chapter 9. Developer's guide

This chapter describes how to start playing with Orchestra:

- How to develop a simple application by leveraging Orchestra APIs

9.1. Orchestra APIs

9.1.1. Getting started with Orchestra APIs



Important

Starting with Orchestra 5.0 `org.ow2.orchestra.facade.QuerierRuntimeAPI` and `org.ow2.orchestra.facade.QuerierDefinitionAPI` were renamed into respectively `org.ow2.orchestra.facade.QueryRuntimeAPI` and `org.ow2.orchestra.facade.QueryDefinitionAPI`.

Actually, four different APIs are available in Orchestra :

- `QueryRuntimeAPI` that gives runtime information about instances of process and activities.
- `QueryDefinitionAPI` that gives information of process definition.
- `ManagementAPI` that gives the possibility to manage Orchestra (deploy / undeploy processes, etc...)
- `InstanceManagementAPI` that gives the possibility to manage instances of process (suspend / resume / exit process instance)

You can find detailed information about APIs in the javadocs. APIs are included in a Maven module. To include this module you have to add following Maven dependency :

```
<dependency>
  <groupId>org.ow2.orchestra</groupId>
  <artifactId>orchestra-api</artifactId>
  <version>4.9.0</version>
</dependency>
```

If you do not want / can't use Maven within your project, you can create a Maven module which depends only on this dependency and create an assembly. Then copy created jar to your project.

- **QueryRuntimeAPI**: to get recorded/runtime informations for instances and activities. It allows also to get activities per state. Then operations in this API applies to process instances and activity instances.

Hereafter you will find an example on how to access to the `QueryRuntimeAPI` from your client application:

```
org.ow2.orchestra.facade.QueryRuntimeAPI queryRuntimeAPI =
    org.ow2.orchestra.facade.AccessorUtil.getQueryRuntimeAPI(String, String);
```

The method `getQueryRuntimeAPI` takes two arguments of type `String`. The first argument is the URL of the JMX service. The second is the name of the object JMX. In case we use the default configuration, two constants can be used which are: `AccessorUtil.SERVICE_URL` and `AccessorUtil.OBJECT_NAME`.

For a detailed insight on Orchestra APIs, please take a look to the Orchestra javadoc APIs (available under / javadoc directory)

Similar methods exist to access to the `QueryDefinitionAPI`, `ManagementAPI` and `InstanceManagementAPI`.

9.2. Orchestra Client jar

If you want to call Orchestra APIs from a remote application you can use the Orchestra client jar. It contains all the needed classes for you to build your application. Just download the jar and include it in your classpath.

9.3. Adding new Orchestra services implementations

Orchestra uses OSGi services to find extensions. To find services implementations, Orchestra uses `org.ow2.orchestra.osgi.OrchestraExtensionService` services. These services simply return the classes to use in orchestra.

To use your own implementation of a service, you need to package it in an OSGi bundle. The bundle should export a `org.ow2.orchestra.osgi.OrchestraExtensionService` service. The implementation of the method `getExtension(className)` should return the extension class when the `className` is the name of the extension, `null` otherwise.

`org.ow2.orchestra.osgi.ExtensionActivator` class provides a base for registering extensions. See javadoc for more details on how to use this class.