

# **Oracle® Endeca Information Discovery**

Integrator Server Guide

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# Oracle Endeca Supplement to Clover Server

This supplement provides specific information about support and limitations when using the Clover Server as the Oracle Endeca Integrator Server.

## Supported Containers

Oracle Endeca Integrator Server is only supported in the following containers:

- Apache Tomcat
- Oracle WebLogic

While the Clover Server allows installation to other containers, installation into these containers is not supported for Oracle Endeca Integrator Server.

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## Chapter 1. What is CloverETL Server

CloverETL Server (CS) is the integrating member of CloverETL products family. It introduces the powerful Clover tool into the world of corporate applications. CloverETL Server itself is an enterprise class application, thus it is shipped as WAR file (WAR stands for Web Archive). CS is tested and works on a range of application servers: Apache Tomcat, Jetty, IBM Websphere, Sun Glassfish, JBoss or Oracle Weblogic. Basically, CS is a runtime environment for graphs, which brings new possibilities of integrating Clover with your own software. Whereas **Clover Engine** can be integrated only as an embedded library, CS implements several interfaces which can be called by other applications using common protocols like HTTP. In addition, CS implements some thread and memory management optimizations.

Table 1.1. CloverETL Server and CloverETL Engine comparison

	CloverETL Server	CloverEngine as executable tool
possibilities of executing graphs	by calling http (or JMX, etc.) APIs (See details in Chapter 14, <a href="#">Simple HTTP API</a> (p. 76).)	by executing external process or by calling java API
engine initialization	during server startup	init is called for each graph execution
thread and memory optimization	threads recycling, graphs cache, etc.	not implemented
scheduling	scheduling by timetable, onetime trigger, logging included	external tools (i.e. Cron) can be used
statistics	each graph execution has its own log file and result status is stored; each event triggered by the CS is logged	not implemented
monitoring	If graph fails, event listener will be notified. It may send email, execute shell command or execute another graph. See details in Chapter 7, <a href="#">Graph Event Listeners</a> (p. 55) Additionally server implements various APIs (HTTP and JMX) which may be used for monitoring of server/graphs status.	JMX mBean can be used while graph is running
storage of graphs and related files	graphs are stored on server file system in so called sandboxes	
security and authorization support	CS supports users/groups management, so each sandbox may have its own access privileges set. All interfaces require authentication. See details in Chapter 3, <a href="#">Server Side Job files - Sandboxes</a> (p. 25).	passwords entered by user may be encrypted
integration capabilities	CS provides APIs which can be called using common protocols like HTTP. See details in Chapter 14, <a href="#">Simple HTTP API</a> (p. 76).	CloverEngine library can be used as embedded library in client's Java code or it may be executed as separated OS process for each graph.
development of graphs	CS supports team cooperation above one project (sandbox). CloverETL Designer will be integrated with CS in further versions.	
scalability	CS implements horizontal scalability of transformation requests as well as data scalability. See details in Chapter 24, <a href="#">Clustering</a> (p. 115) In addition CloverEngine implements vertical scalability natively.	Clover Engine implements vertical scalability
jobflow	CS implements various jobflow components. See details in the CloverETL manual.	Clover Engine itself has limited support of jobflow.

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## Chapter 2. Installation

Following sections describe two different installation types. the section called “[Evaluation Server](#)”(p. 3)for quick and most simple installation without configuration and the section called “[Enterprise Server](#)”(p. 4)for further testing and production on choosen app-container and database.

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### Evaluation Server

The default installation of **CloverETL Server** does not need any extra **database server**. It uses the embedded Apache Derby DB. What is more, it does not need any subsequent **configuration**. CloverETL Server configures itself during the first startup. Database tables and some necessary records are automatically created on first startup with an empty database. In the **Sandboxes** section of the web GUI, you can then check that sandboxes and a few demo graphs are created there.

If you need to evaluate CloverETL Server features which need any configuration changes, e.g. sending emails, LDAP authentication, clustering, etc., or the CloverETL Server must be evaluated on another application container then Tomcat, please proceed with the common installation: the section called “[Enterprise Server](#)” (p. 4)

---

### Installation of Apache Tomcat

CloverETL Server requires Apache Tomcat version 6.0.x to run.

If you have Apache tomcat already installed, you can skip this section.

1. Download the ZIP with binary distribution from <http://tomcat.apache.org/download-60.cgi>. Tomcat may be installed as a service on Windows OS as well, however there may be some issues with access to file system, so it's not recommended approach for evaluation.
2. After you download the zip file, unpack it.
3. Run Tomcat by [tomcat\_home]/bin/startup.sh (or [tomcat\_home]/bin/startup.bat on Windows OS).
4. Check whether Tomcat is running on URL: <http://localhost:8080/>. Apache Tomcat info page should appear.
5. Apache Tomcat is installed.

If in need of detailed installation instructions, go to: <http://tomcat.apache.org/tomcat-6.0-doc/setup.html>

---

### Installation of CloverETL Server

1. Check if you meet prerequisites:
  - JDK or JRE v. 1.6.x or higher
  - JAVA\_HOME or JRE\_HOME environment variable has to be set.
  - Apache Tomcat 6.0.x is installed. See [Installation of Apache Tomcat](#) (p. 3) for details.
2. Set memory limits and other switches. See section the section called “[Memory Settings](#)” (p. 23) for details.

Create setenv file:

Unix-like systems: [tomcat]/bin/setenv.sh

```
export CATALINA_OPTS="$CATALINA_OPTS -XX:MaxPermSize=512m -Xms128m -Xmx2048m"
export CATALINA_OPTS="$CATALINA_OPTS -Dderby.system.home=$CATALINA_HOME/temp -server"
echo "Using CATALINA_OPTS: $CATALINA_OPTS"
```

Windows systems: [tomcat]/bin/setenv.bat

```
set CATALINA_OPTS="%CATALINA_OPTS% -XX:MaxPermSize=512m -Xms128m -Xmx2048m"
set CATALINA_OPTS="%CATALINA_OPTS% -Dderby.system.home=%CATALINA_HOME%/temp -server"
echo "Using CATALINA_OPTS: %CATALINA_OPTS%"
```

3. Download the web archive file (clover.war) containing CloverETL Server for Apache Tomcat and clover-license.war containing valid license.
4. Deploy both WAR files: clover.war and clover-license.war to [tomcat\_home]/webapps directory.

To avoid deployment problems, Tomcat should be down during the copying.

5. Run Tomcat by [tomcat\_home]/bin/startup.sh (or [tomcat\_home]/bin/startup.bat on Windows OS).
6. Check whether CloverETL Server is running on URLs:

- Web-app root

`http://[host]:[port]/[contextPath]`

The default Tomcat port for the http connector is 8080 and the default contextPath for CloverETL Server is "clover", thus the default URL is:

<http://localhost:8080/clover/>

- Web GUI

`http://[host]:[port]/[contextPath]/gui` <http://localhost:8080/clover/gui>

Use default administrator credentials to access the web GUI: username - "clover", password - "clover".

7. CloverETL Server is now installed and prepared for basic evaluation. There are couple of sandboxes with various demo transformations installed.

---

## Enterprise Server

This section describes installation of CloverETL Server on various app-containers in detail, also describes the ways how to configure the server. If you need just quickly evaluate CloverETL Server features which don't need any configuration, evaluation installation may be suitable: the section called "[Evaluation Server](#)" (p. 3)

CloverETL Server for enterprise environment is shipped as a *Web application archive* (WAR file). Thus standard methods for deploying a web application on you application server may be used. However each application server has specific behavior and features. Detailed information about their installation and configuration can be found in the chapters below.

List of suitable containers:

- [Apache Tomcat](#) (p. 5)
- [Jetty](#) (p. 8)
- [IBM Websphere](#) (p. 10)

- [Glassfish / Sun Java System Application Server](#) (p. 13)
- [JBoss](#) (p. 15)
- [Oracle WebLogic Server](#) (p. 17)

In case of problems during your installation see [Possible issues during installation](#) (p. 19).

## Apache Tomcat

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### Installation of Apache Tomcat

---

CloverETL Server requires Apache Tomcat version 6.0.x to run.

If you have Apache tomcat already installed, you can skip this section.

1. Download the binary distribution from <http://tomcat.apache.org/download-60.cgi>.
2. After you download the zip file, unpack it.
3. Run Tomcat by [tomcat\_home]/bin/startup.sh (or [tomcat\_home]/bin/startup.bat on Windows OS).
4. Check whether Tomcat is running on URL: <http://localhost:8080/>. Apache Tomcat info page should appear.
5. Apache Tomcat is installed.

If in need of detailed installation instructions, go to: <http://tomcat.apache.org/tomcat-6.0-doc/setup.html>

### Installation of CloverETL Server

---

1. Download the web archive file (clover.war) containing CloverETL Server for Apache Tomcat.
2. Check if you meet prerequisites:
  - JDK or JRE v. 1.6.x or higher
  - JAVA\_HOME or JRE\_HOME environment variable has to be set.
  - Apache Tomcat 6.0.x is installed. CloverETL Server is developed and tested with the Apache Tomcat 6.0.x container (it may work unpredictably with other versions). See [Installation of Apache Tomcat](#)(p. 5) for details.
  - It is strongly recommended you change default limits for the heap and perm gen memory spaces.

See section the section called “[Memory Settings](#)” (p. 23) for details.

You can set the minimum and maximum memory heap size by adjusting the "Xms" and "Xmx" JVM parameters. You can set JVM parameters for Tomcat by setting the environment variable JAVA\_OPTS in the [TOMCAT\_HOME]/bin/setenv.sh file (if it does not exist, you may create it).

Create setenv file:

Unix-like systems: [tomcat]/bin/setenv.sh

```
export CATALINA_OPTS="$CATALINA_OPTS -XX:MaxPermSize=512m -Xms128m -Xmx1024m"
export CATALINA_OPTS="$CATALINA_OPTS -Dderby.system.home=$CATALINA_HOME/temp -server"
echo "Using CATALINA_OPTS: $CATALINA_OPTS"
```

Windows systems: [tomcat]/bin/setenv.bat

```
set CATALINA_OPTS="%CATALINA_OPTS% -XX:MaxPermSize=512m -Xms128m -Xmx1024m"
set CATALINA_OPTS="%CATALINA_OPTS% -Dderby.system.home=%CATALINA_HOME%/temp -server"
echo "Using CATALINA_OPTS: %CATALINA_OPTS%"
```

As visible in the settings above, there is also switch `-server`. For performance reasons, it is recommended to run the container in the "server" mode.

3. Copy `clover.war` (which is built for Tomcat) to [tomcat\_home]/webapps directory.

Please note, that copying is not an atomic operation. If Tomcat is running, mind duration of the copying process! Too long copying might cause failure during deployment as Tomcat tries to deploy an incomplete file. Instead, manipulate the file when the Tomcat is not running.

4. War file should be detected and deployed automatically without restarting Tomcat.

5. Check whether CloverETL Server is running on URLs:

- Web-app root

`http://[host]:[port]/[contextPath]`

The default Tomcat port for the http connector is 8080 and the default `contextPath` for CloverETL Server is "clover", thus the default URL is:

<http://localhost:8080/clover/>

- Web GUI

`http://[host]:[port]/[contextPath]/gui`

The default Tomcat port for the http connector is 8080 and the default `contextPath` for CloverETL Server is "clover", thus the default URL is:

<http://localhost:8080/clover/gui>

Use default administrator credentials to access the web GUI: user name - "clover", password - "clover".

---

## Configuration of CloverETL Server on Apache Tomcat

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Default installation (without any configuration) is recommended only for evaluation purposes. For production, at least DB data source and SMTP server configuration is recommended.

There are more ways how to set config properties.

### Context Parameters (Available on Apache Tomcat)

Some application servers allow setting context parameters without modifying the WAR file. This way of configuration is recommended for Tomcat.

On Tomcat, it is possible to specify context parameters in the context configuration file - [tomcat\_home]/conf/Catalina/localhost/clover.xml. The file is created automatically just after deploying the CloverETL Server web application.

To specify a property, add this element:

```
<Parameter name="[propertyName]" value="[propertyValue]" override="false" />
```

To modify Tomcat context params, add this to the context config file (modify credentials accordingly):

```
<Parameter name="jdbc.driverClassName" value="..." override="false" />
<Parameter name="jdbc.url" value="..." />
<Parameter name="jdbc.username" value="..." override="false" />
<Parameter name="jdbc.password" value="..." override="false" />
<Parameter name="jdbc.dialect" value="..." override="false" />
```



## Note

Special characters you type in the context file have to be specified as XML entities. For instance, ampersand "&" as "&#38;" etc.

## Properties File on Specified Location

Example of such a file:

```
jdbc.driverClassName=...
jdbc.url=...
jdbc.username=...
jdbc.password=...
jdbc.dialect=...
```

Which location the common properties file is loaded from is specified by the system property or environment variable `clover_config_file` (`clover.config.file`). This is a recommended way of configuring if context parameters cannot be set in application server.

On Apache Tomcat, you can set the system property in the `[TOMCAT_HOME]/bin/setenv.sh` file (if it does not exist, you may create it). Just add: `JAVA_OPTS="$JAVA_OPTS -Dclover_config_file=/path/to/cloverServer.properties"`.

## Installation of CloverETL Server License

---

To be able to execute graphs, CloverETL Server requires a valid license. You can install CloverETL Server without any license, but no graph will be executed.

There are two ways of installing license on Tomcat. A simpler way is a separate web application `clover-license.war`. However, in cluster environment, configuring the plain license file has to be done (common for all application containers).

### a) Separate License WAR

1. Download the web archive file `clover-license.war`.
2. Copy `clover-license.war` to the `[tomcat_home]/webapps` directory.
3. The war file should be detected and deployed automatically without restarting Tomcat.
4. Check whether the license web-app is running on:

`http://[host]:[port]/clover-license/` (Note: `contextPath` `clover-license` is mandatory and cannot be changed)

## b) License.file Property

Alternatively, configure the server's "license.file" property. Set its value to full path to the `license.dat` file.



### Note

CloverETL license can be **changed** any time by re-deploying `clover-license.war`. Afterwards, you have to let CloverETL Server know the license has changed.

- Go to **server web GUI** → **Monitoring** → **License**
- Click **Reload license**.
- Alternatively, you can restart the CloverETL Server application.

*Warning:* Keep in mind that during the WAR file redeployment, directory `[tomcat_home]/webapps/[contextPath]` has to be deleted. If Tomcat is running, it should do it automatically. Still, we suggest you check it manually, otherwise changes will not take any effect.

## Apache Tomcat on IBM AS/400 (iSeries)

---

To run CloverETL Server on the iSeries platform, there are some additional settings:

1. Declare you are using Java 6.0 32-bit
2. Run java with parameter `-Djava.awt.headless=true`

To configure this you can modify/create a file `[tomcat_home]/bin/setenv.sh` which contains:

```
JAVA_HOME=/QOpenSys/QIBM/ProdData/JavaVM/jdk50/32bit
```

```
JAVA_OPTS="$JAVA_OPTS -Djava.awt.headless=true"
```

## Jetty

---

### Installation of CloverETL Server

---

1. Download the web archive file (`clover.war`) containing the CloverETL Server application which is built for Jetty.
2. Check if prerequisites are met:
  - JDK or JRE version 1.6.x or higher
  - Jetty 6.1.x - only this particular version is supported

All jetty-6 releases are available from <http://jetty.codehaus.org/jetty/>. Jetty 7 is not supported (as of Jetty 7, there have been huge differences in distribution packages as it is hosted by the Eclipse Foundation).

- Memory allocation settings

It involves JVM parameters: `-Xms` `-Xmx` (heap memory) and `-XX:MaxPermSize` (classloaders memory limit). See section the section called “[Memory Settings](#)” (p. 23) for details.

You can set the parameters by adding

```
JAVA_OPTIONS='$JAVA_OPTIONS -Xms128m -Xmx1024m -XX:MaxPermSize=256m'
```

to `[JETTY_HOME]/bin/jetty.sh`

3. Copy `clover.war` to `[JETTY_HOME]/webapps`.

4. Create a context file `clover.xml` in `[JETTY_HOME]/contexts` and fill it with the following lines:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!DOCTYPE Configure PUBLIC "-//Jetty//Configure//EN" "http://www.eclipse.org/jetty/configure.dtd">
<Configure class="org.mortbay.jetty.webapp.WebAppContext">
  <Set name="contextPath">/clover</Set>
  <Set name="war"><SystemProperty name="jetty.home" default="."/>/webapps/clover.war</Set>
</Configure>
```

`clover.xml` will be detected by Jetty and the application will be loaded automatically.

5. Run `[JETTY_HOME]/bin/jetty.sh start` (or `[JETTY_HOME]/bin/Jetty-Service.exe` on Windows OS).

Finally, you can check if the server is running e.g. on <http://localhost:8080/test/>.

## Configuration of CloverETL Server on Jetty

---

Default installation (without any configuration) is recommended only for evaluation purposes. For production, at least DB data source and SMTP server configuration is recommended.

There are more ways how to set config properties, yet the most common one is properties file in a specified location.

### Properties file in Specified Location

Example of such a file:

```
jdbc.driverClassName=...
jdbc.url=...
jdbc.username=...
jdbc.password=...
jdbc.dialect=...
license.file=/path/to/license.dat
```

The common properties file is loaded from a location which is specified by the environment/system property `clover_config_file` or `clover.config.file`. This is a recommended way of configuring Jetty.

On Jetty, you can set system property in the `[JETTY_HOME]/bin/jetty.sh` file. Add:

```
JAVA_OPTIONS="$JAVA_OPTIONS -Dclover_config_file=/path/to/cloverServer.properties"
```

---

## Installation of CloverETL Server license

In order to execute graphs, CloverETL Server requires a valid license file. Despite that, you can install CloverETL Server without a license, but no graph will be executed.

1. Get the `license.dat` file.
2. Set the CloverETL Server `license.file` parameter to the path to `license.dat`.
  - Add "license.file" property to the config properties file (as described in [Configuration of CloverETL Server on Jetty](#) (p. 9). Set its value to full path to the `license.dat` file.
  - Restart Jetty.

There are more ways how to configure the license. See Chapter 18, [Configuration](#) (p. 96) for a description of all possibilities.



### Note

CloverETL license can be **changed** any time by replacing the `license.dat` file. Afterwards, you have to let CloverETL Server know the license has changed.

- Go to **server web GUI** → **Monitoring** → **License**
- Click **Reload license**.
- Alternatively, you can restart the CloverETL Server application.

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## IBM Websphere

---

### Installation of CloverETL Server

1. Get the web archive file (`clover.war`) with CloverETL Server application which is built for Websphere.
2. Check if you meet prerequisites:
  - JDK or JRE version 1.6.x or higher
  - IBM Websphere 7.0 (see <http://www.ibm.com/developerworks/downloads/ws/was/>)
  - Memory allocation settings

It involves JVM parameters: `-Xms` `-Xmx` and `-XX:MaxPermSize`. See section the section called "[Memory Settings](#)" (p. 23) for details.

You can set heap size and perm space in IBM Websphere's **Integrated Solutions Console** (by default accessible at: `http://[host]:10003/ibm/console/`)

- Go to **Servers** → **Application servers** → **[server1]** (or another name of your server) → **Process Management** → **Java Virtual Machine**
- There is the **Maximum heap size** field. Default value is only 256 MB, which is not enough for ETL transformations.

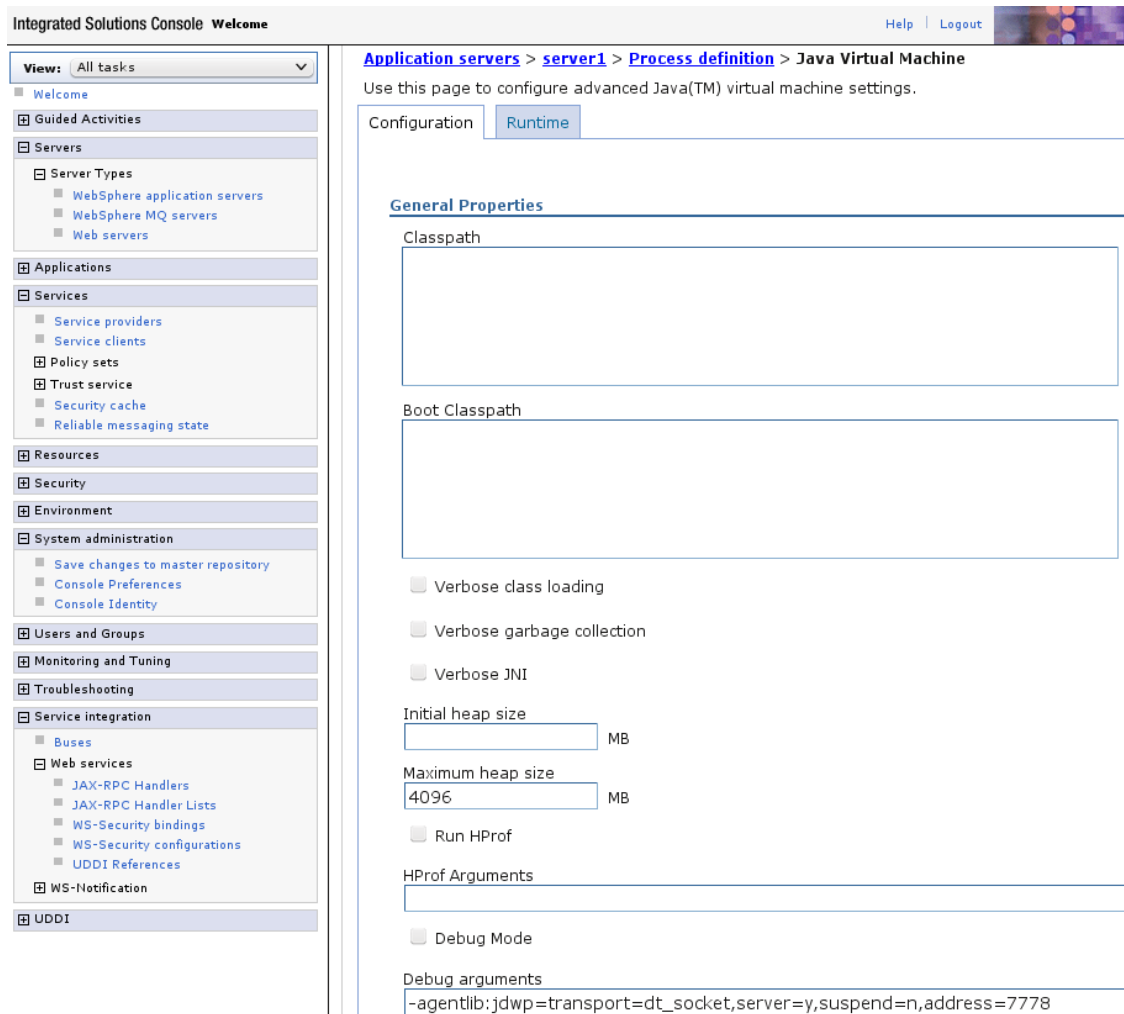


Figure 2.1. Adjusting Maximum heap size limit

- On the same page, there is **Generic JVM arguments**. Add the perm space limit there, e.g. like this:

```
-XX:MaxPermSize=512M
```

- Restart the server to confirm these changes.

### 3. Deploy WAR file

- Go to **Integrated Solutions Console**  
( <http://localhost:9060/ibm/console/>)
- Go to **Applications** → **New Application** → **New Enterprise Application**

### 4. Configure logging

Websphere loggers do not use log4j by default. This may cause CloverETL Server logging to be ill-configured. As a result, some CloverETL Engine messages are missing in graph execution logs. Thus it is recommended to configure Websphere properly to use log4j.

- Add a config file to the Websphere directory: `AppServer/profiles/AppSrv01/properties/commons-logging.properties`
- Insert these lines into the file:

```
priority=1
org.apache.commons.logging.LogFactory=org.apache.commons.logging.impl.LogFactoryImpl
org.apache.commons.logging.Log=org.apache.commons.logging.impl.Log4JLogger
```

- Copy jar files from the `clover.war/WEB-INF/lib` archive to the `AppServer/lib` directory. Copy all files like `commons-logging-*.jar` and `log4j-*.jar`.

#### 5. Try if the server is running

Provided you set `clover.war` as the application running with "clover" context path. Notice the port number has changed:

<http://localhost:9080/clover>

## Configuration of CloverETL Server on IBM Websphere

Default installation (without any configuration) is recommended only for evaluation purposes. For production, configuring at least the DB data source and SMTP server is recommended.

There are more ways how to set config properties. The most common one is properties file in a specified location.

### Properties File in Specified Location

Example of such a file:

```
jdbc.driverClassName=...
jdbc.url=...
jdbc.username=...
jdbc.password=...
jdbc.dialect=...
license.file=/path/to/license.dat
```

Set system property (or environment variable) `clover_config_file` pointing to the config properties file.

- go to **Integrated Solutions Console**

(<http://localhost:9060/ibm/console/>)

- Go to **Servers** → **Application servers** → [server-name] → **Java and Process Management** → **Process Definition** → **Environment Entries**
- Create system property named `clover_config_file` whose value is full path to config file named e.g. `cloverServer.properties` on your file system.
- This change requires restarting IBM Websphere.

## Installation of CloverETL Server license

CloverETL Server requires a valid license for executing graphs. You can install CloverETL Server without a license, but no graph will be executed.

1. Get the `license.dat` file.

2. Set CloverETL Server's `license.file` parameter to path to the `license.dat` file.

- Add "license.file" property to the config properties file as described in [Configuration of CloverETL Server on IBM Websphere](#) (p. 12). Value of the property has to be full path to the `license.dat` file.

- Restart CloverETL Server.

There are other ways how to do this. The most direct one is to set system property or environment variable `clover_license_file`. (See Chapter 18, [Configuration](#) (p. 96) for description of all possibilities).



## Note

Properly configured CloverETL license can be **changed** any time by replacing file `license.dat`. Then you have to let CloverETL Server know the license has changed.

- Go to **web GUI** → **monitoring section** → **license tab**
- Click button **Reload license**.
- Alternatively, you can restart the CloverETL Server application.

---

## Glassfish / Sun Java System Application Server

---

### Installation of CloverETL Server

---

1. Get CloverETL Server web archive file (`clover.war`) which is built for Glassfish (Tomcat).
2. Check if you meet prerequisites

- JDK or JRE version 1.6.x or higher
- Glassfish (CloverETL Server is tested with V2.1)
- Memory allocation settings

It involves JVM parameters: `-Xms` `-Xmx` and `-XX:MaxPermSize` See section the section called “[Memory Settings](#)” (p. 23) for details.

You can set heap size and perm space in XML file `[glassfish]/domains/domain1/config/domain.xml` Add these sub-elements to `<java-config>`:

```
<jvm-options>-XX:MaxPermSize=512m</jvm-options>
<jvm-options>-Xmx2048m</jvm-options>
```

These changes require restarting Glassfish.

3. Deploy WAR file

- Copy WAR file to the server filesystem. CloverETL Server is packed in a WAR file of 100 MB approx., so it cannot be uploaded directly from your local filesystem using the Admin Console.
- Fill in attributes **Application name** and **Context Root** with "clover". Fill in path to the WAR file on the server filesystem.
- Go to **Glassfish Admin Console**

It is accessible at <http://localhost:4848/> by default; default username/password is admin/adminadmin

- Go to **Applications** → **Web Applications** and click **Deploy**.
- Submit form

## Configuration of CloverETL Server on Glassfish

---

Default installation (without any configuration) is recommended only for evaluation purposes. For production, configuring at least the DB data source and SMTP server is recommended.

There are more ways how to set config properties. The most common one is properties file in a specified location.

### Properties File in Specified Location

Example of such a file:

```
jdbc.driverClassName=...
jdbc.url=...
jdbc.username=...
jdbc.password=...
jdbc.dialect=...
license.file=/path/to/license.dat
```

Set system property (or environment variable) `clover_config_file` pointing to the config properties file:

- Go to **Glassfish Admin Console**

By default accessible at <http://localhost:4848/> with username/password: admin/adminadmin

- Go to **Configuration** → **System Properties**
- Create system property named `clover_config_file` whose value is full path to a file on your file system named e.g. `cloverServer.properties`.
- This change requires restarting Glassfish.

## Installation of CloverETL Server License

---

CloverETL Server requires a valid license for executing graphs. You can install CloverETL Server without a license, but no graph will be executed.

License configuration is quite similar to WebSphere (p. 10).

1. Get the `license.dat` file.
2. Set CloverETL Server's `license.file` parameter to path to `license.dat`.
  - Add "license.file" property to the config properties file as described in [Properties File in Specified Location](#) (p. 14). Set its value to full path to the `license.dat` file.
  - Restart CloverETL Server.

There are of course other ways how to do this. The most direct one is setting system property or environment variable `clover_license_file`. (See Chapter 18, [Configuration](#) (p. 96) for description of all possibilities).



### Note

Properly configured CloverETL license can be **changed** any time by replacing `license.dat`. Next, you need to let CloverETL Server know the license has changed.

- Go to **web GUI** → **Monitoring** → **License**
- Click **Reload license**.

- Alternatively, you can restart CloverETL Server.

## JBoss

### Installation of CloverETL Server

1. Get CloverETL Server web archive file (clover.war) which is built for JBoss.
2. Check if you meet prerequisites

- JDK or JRE version 1.6.x or higher
- JBoss 6.0 or JBoss 5.1 - see <http://www.jboss.org/jbossas/downloads>
- Memory settings for jboss java process. See section the section called “[Memory Settings](#)”(p. 23) for details.

You can set the memory limits in [ jboss-home ] /bin/run.conf (run.conf.bat on Windows OS):

```
JAVA_OPTS="$JAVA_OPTS -XX:MaxPermSize=512m -Xms128m -Xmx2048m"
```

On Windows, perform steps analogic to the ones above.

3. Configure DB data source

Since JBoss does not work with embedded derby DB, a DB connection always has to be configured. We used MySQL in this case

- Create datasource config file [ jboss-home ] /server/default/deploy/mysql-ds.xml

```
<datasources>
  <local-tx-datasource>
    <jndi-name>CloverETLServerDS</jndi-name>
    <connection-url>jdbc:mysql://localhost:3306/cloverServerDB</connection-url>
    <driver-class>com.mysql.jdbc.Driver</driver-class>
    <user-name>root</user-name>
    <password></password>
  </local-tx-datasource>
</datasources>
```



### Note

Special characters in the XML file have to be typed in as XML entities. For instance, ampersand "&" as "&#38;" etc.

JNDI name has to be exactly "CloverETLServerDS". The thing to do here is to set DB connection parameters (connection-url, driver-class, user-name and password) to the created database. The database has to be empty before the first execution, the server creates its tables itself.

JNDI data source is the only way of configuring CloverETL Server DB connection in JBoss.

- Put JDBC driver for your DB to the app server classpath. We copied JDBC driver mysql-connector-java-5.1.5-bin.jar to [ jboss-home ] /server/default/lib

4. Configure CloverETL Server according to description in the next section (p. 16).

## 5. Deploy WAR file

Copy `clover.war` to `[jboss-home]/server/default/deploy`

## 6. Start jboss via `[jboss-home]/bin/run.sh` (or `run.bat` on Windows OS)

It may take a couple of minutes until all applications are started.

## 7. Check JBoss response and CloverETL Server response

- JBoss administration console is accessible at <http://localhost:8080/> by default. Default username/password is admin/admin
- CloverETL Server is accessible at <http://localhost:8080/clover> by default.

## 8. If you like, you can move default and example sandboxes (created automatically in the `temp` directory) to a more suitable directory on your filesystem.

- These sandboxes are created automatically during the first deployment and are located in the `web-app` directory, which is related to the specific deployment. If you redeployed the web application for a reason, the directory would be recreated. That is why it is better to move the sandboxes to a location which will not change.

---

## Configuration of CloverETL Server on JBoss

Default installation (without any configuration) is recommended only for evaluation purposes. For production, configurin at least tha DB data source and SMTP server is recommended.

There are more ways how to set config properties. The most common one is properties file in a specified location.

### Properties File in Specified Location

- Create `cloverServer.properties` in a suitable directory

```
datasource.type=JNDI
datasource.jndiName=java:/CloverETLServerDS
jdbc.dialect=org.hibernate.dialect.MySQLDialect
license.file=/home/clover/config/license.dat
```

Do not change `datasource.type` and `datasource.jndiName` properties, but set a correct JDBC dialect according to your DB server (Chapter 18, [Configuration](#) (p. 96)). Also set path to your license file.

- Set system property (or environment property) `clover_config_file`.

It should contain the full path to the `cloverServer.properties` file created in the previous step.

The simplest way is seting java parameter in `[jboss-home]/bin/run.sh`, e.g.:

```
export JAVA_OPTS="$JAVA_OPTS -Dclover_config_file=/home/clover/config/cloverServer.properties"
```

Please do not override other settings in the `JAVA_OPTS` property. i.e. memory settings described above.

On Windows OS, edit `[jboss-home]/bin/run.conf.bat` and add this line to the section where options are passed to the JVM:

```
set JAVA_OPTS=%JAVA_OPTS% -Dclover_config_file=C:\JBoss6\cloverServer.properties
```

- This change requires restarting JBoss.

## Installation of CloverETL Server License

---

CloverETL Server requires a valid license for executing graphs. You can install CloverETL Server without a license, but no graph will be executed.

1. Get the `license.dat` file.

If you only have `clover_license.war`, extract it as a common zip archive and you will find `license.dat` in the `WEB-INF` subdirectory

2. Fill CloverETL Server parameter `license.file` with path to `license.dat`.

The best way how to configure license is setting the `license.file` property in the `cloverServer.properties` file as described in the previous section.

There are other ways how to do this. (See Chapter 18, [Configuration](#) (p. 96) for description of all possibilities).

3. Changes in configuration require restarting the app-server.



### Note

CloverETL license can be **changed** any time by replacing file `license.dat`. Then you have to let CloverETL Server know the license is changed.

- Go to **web GUI** → **Monitoring** → **License**
- Then click **Reload license**.
- Alternatively, you can restart CloverETL Server application.

## Oracle WebLogic Server

---

### Installation of CloverETL Server

---

1. Get CloverETL Server web archive file (`clover.war`) which is built for WebLogic.

2. Check if you meet prerequisites

- JDK or JRE version 1.6.x or higher
- WebLogic (CloverETL Server is tested with 10.3.5, see <http://www.oracle.com/technetwork/middleware/ias/downloads/wls-main-097127.html>)

WebLogic has to be running and a domain has to be configured. You can check it by connecting to **Administration Console**: <http://hostname:7001/console/> (7001 is the default port for HTTP). Username and password are specified during installation.

- Memory allocation settings

It involves JVM parameters: `-Xms -Xmx` and `-XX:MaxPermSize`

See section the section called “[Memory Settings](#)” (p. 23) for details.

You can set it i.e. by adding

```
export JAVA_OPTIONS='$JAVA_OPTIONS -Xms128m -Xmx2048m -XX:MaxPermSize=512m' to the start script
```

This change requires restarting the domain.

### 3. Change HTTP Basic Authentication configuration

- When WebLogic finds "Authentication" header in an HTTP request, it tries to find a user in its own realm. His behavior has to be disabled so CloverETL could authenticate users itself.
- Modify config file [domainHome]/config/config.xml. Add element: `<enforce-valid-basic-auth-credentials>false</enforce-valid-basic-auth-credentials>` into element `<security-configuration>` (just before the end tag).

### 4. Deploy WAR file

- Upload the WAR to server filesystem. When it is done, move it to [domainHome]/autodeploy. Since the WAR file size is 100 MB approx., it is recommended you move the file, not copy it, because WebLogic might start deploying when the file is still incomplete. You can also deploy the application using **Administration Console**.

### 5. Configure license (and other configuration properties)

- See separate section (p. 18) below

### 6. Check CloverETL Server URL

- Web-app is started automatically after deploy, so you can check whether it is up and running.

CloverETL Server is accessible at <http://host:7001/clover> by default. Port 7001 is the default WebLogic HTTP Connector port.

---

## Configuration of CloverETL Server on Weblogic

Default installation (without any configuration) is recommended only for evaluation purposes. For production, at least the DB data source and SMTP server configuration is recommended.

There are more ways how to set config properties. The most common one is properties file in a specified location.

### Properties File in Specified Location

Create `cloverServer.properties` in a suitable directory.

Config file should contain DB datasource config, SMTP connection config, etc.

Set system property (or environment variable) `clover_config_file` pointing to the config properties file

- Set `JAVA_OPTIONS` variable in the WebLogic domain start script [domainHome]/startWebLogic.sh

```
JAVA_OPTIONS="$ {JAVA_OPTIONS} -Dclover_config_file=/path/to/clover-config.properties
```

- This change requires restarting Weblogic.

---

## Installation of CloverETL Server License

---

CloverETL Server requires a valid license for executing graphs. You can install CloverETL Server without a license, but no graph will be executed.

1. Get the `license.dat` file.

If you only have `clover_license.war`, extract it as a common zip archive and you will find `license.dat` file in `WEB-INF` subdirectory

2. Fill CloverETL Server parameter `license.file` with path to `license.dat` file

The best way how to configure license, is setting property `license.file` in the `cloverServer.properties` file as described in the previous section.

There are other ways how to do this. (See Chapter 18, [Configuration](#) (p. 96) for description of all possibilities).

3. Changes in configuration require restarting the app-server.



### Note

Properly configured CloverETL license can be **changed** any time by replacing file `license.dat`. Then you have to let CloverETL Server know the license has changed.

- Go to **web GUI** → **Monitoring** → **License**
- Click **Reload license**.
- Or you can restart CloverETL Server application.

---

## Possible issues during installation

---

Since CloverETL Server is considered a universal JEE application running on various application servers, databases and jvm implementations, problems may occur during the installation. These can be solved by a proper configuration of the server environment. This section contains tips for the configuration.

---

### Memory issues on Derby

---

If your server suddenly starts consuming too much resources (CPU, memory) despite having been working well before, it might be because of running the internal Derby DB. Typically, causes are incorrect/incomplete shutdown of Apache Tomcat and parallel (re)start of Apache Tomcat.

Solution: move to a standard (standalone) database.

How to fix this? Redeploy CloverETL Server:

1. Stop Apache Tomcat and verify there are no other instances running. If so, kill them.
2. Backup `config.properties` from `webapps/clover/WEB-INF` and `clover/WEB-INF/sandboxes` (if you have any data there).
3. Delete the `webapps/clover` directory.
4. Start Apache Tomcat server. It will automatically redeploy Clover Server.
5. Verify you can connect from Designer and from web.

6. Shutdown Apache Tomcat.
7. Restore `config.properties` and point it to your regular database.
8. Start Apache Tomcat.

---

## JAVA\_HOME or JRE\_HOME environment variables are not defined

---

If you are getting this error message during an attempt to start your application server (mostly Tomcat), perform the following actions.

### Linux:

These two commands will help you set paths to the variables on the server.

- `[root@server /] export JAVA_HOME=/usr/local/java`
- `[root@server /] export JRE_HOME=/usr/local/jdk`

As a final step, restart the application server.

### Windows OS:

Set `JAVA_HOME` to your JDK installation directory, e.g. `C:\Program Files\java\jdk1.6.0`. Optionally, set also `JRE_HOME` to the JRE base directory, e.g. `C:\Program Files\java\jre6`.



### Important

If you only have JRE installed, specify only `JRE_HOME`.

---

## Tomcat log file catalina.out is missing on Windows

---

Tomcat start batch files for Windows aren't configured to create `catalina.out` file which contains standard output of the application. `Catalinal.out` may be vital when the Tomcat isn't started in console and any issue occurs. Or even when Tomcat is executed in the console, it may be closed automatically just after the error message appears in it.

Please follow these steps to enable `catalina.out` creation:

- Modify `[tomcat_home]/bin/catalina.bat`. Add parameter `"/B"` to lines where `"_EXECJAVA"` variable is set. There should be two these lines. So they will look like this:

```
set _EXECJAVA=start /B [the rest of the line]
```

Parameter `/B` causes, that "start" command doesn't open new console window, but runs the command it's own console window.

- Create new startup file. e.g. `[tomcat_home]/bin/startupLog.bat`, containing only one line:

```
catalina.bat start > ..\logs\catalina.out 2<&1
```

It executes Tomcat in the usual way, but standard output isn't put to the console, but to the `catalina.out` file.

Then use new startup file instead of `[tomcat_home]/bin/startup.bat`

---

## Timeouts waiting for JVM

---

If you get the Jetty application server successfully running but cannot start Clover Server, it might be because of the wrapper waiting for JVM too long (it is considered a low-memory issue). Examine `[JETTY_HOME]\logs\jetty-service.log` for a line like this:



```
Startup failed: Timed out waiting for signal from JVM.
```

If it is there, edit `[JETTY_HOME]\bin\jetty-service.conf` and add these lines:

```
wrapper.startup.timeout=60
wrapper.shutdown.timeout=60
```

If that does not help either, try setting 120 for both values. Default timeouts are 30 both.

## clover.war as default context on Websphere (Windows OS)

If you are deploying `clover.war` on the IBM Websphere server without context path specified, be sure to check whether it is the only application running in the context root. If you cannot start Clover Server on Websphere, check the log and look for a message like this:

```
com.ibm.ws.webcontainer.exception.WebAppNotLoadedException:
Failed to load webapp: Failed to load webapp: Context root /* is already bound.
Cannot start application CloverETL
```

If you can see it, then this is the case. Getting rid of the issue, the easiest way is to stop all other (sample) applications and leave only `clover.war` running on the server. That should guarantee the server will be available in the context root from now on (e.g. <http://localhost:9080/>).

Cell=DHIM079Node01Cell, Profile=AppSrv01

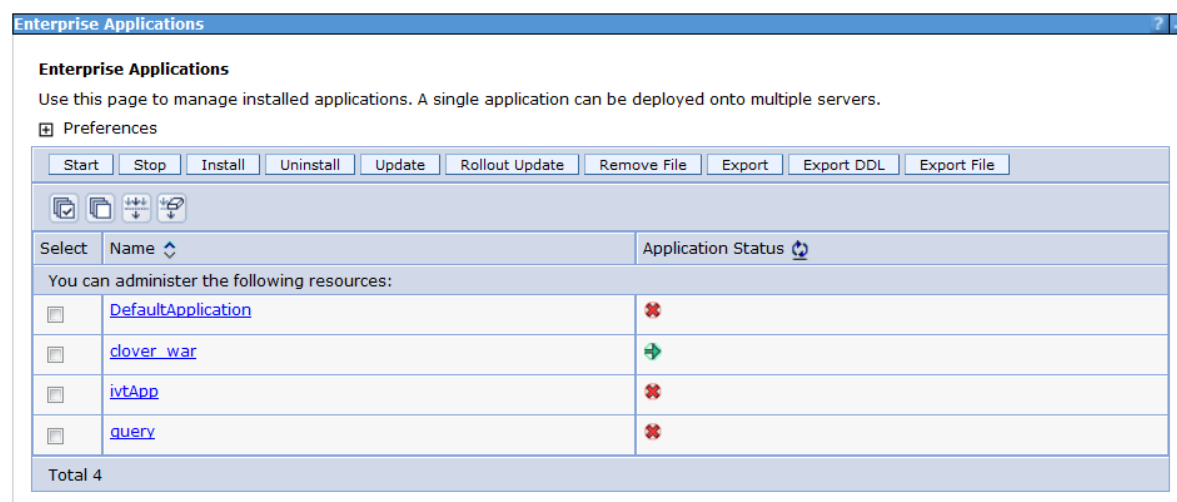


Figure 2.2. Clover Server as the only running application on IBM Websphere

## Tomcat 6.0 on Linux - Default DB

When using the internal (default) database on Linux, your Clover Server might fail on first start for no obvious reasons. Chances are that the `/var/lib/tomcat6/databases` directory was not created (because of access rights in parent folders).

Solution: Create the directory yourself and try restarting the server. This simple fix was successfully tested with Clover Server deployed as a WAR file via Tomcat web admin.

## Derby.system.home cannot be accessed

---

If the server cannot start and the following message is in the log:

```
java.sql.SQLException: Failed to start database 'databases/cloverserver'
```

then see the next exception for details. After that check settings of the `derby.system.home` system property. It may point to an inaccessible directory, or files may be locked by another process. We suggest you set a specific directory as the system property.

## Environment variables and more than one CloverETL Server instances running on single machine

---

If you are setting environment variables like `clover_license_file` or `clover_config_file`, remember you should not be running more than one CloverETL Server. Therefore if you ever needed to run more instances at once, use other ways of setting parameters (see Chapter 18, [Configuration](#) (p. 96) for description of all possibilities) The reason is the environment variable is shared by all applications in use causing them to share configurations and fail unexpectedly. Instead of environment variables you can use system properties (passed to the application container process using parameter with `-D` prefix: `-Dclover_config_file`).

## Special characters and slashes in path

---

When working with servers, you ought to stick to folder naming rules more than ever. Do not use any special characters in the server path, e.g. spaces, accents, diacritics are all not recommended. It's unfortunately common naming strategy on Windows systems. It can produce issues which are hard to find. If you are experiencing weird errors and cannot trace the source of them, why not install your application server in a safe destination like:

```
C:\JBoss6\
```

Similarly, use slashes but never backslashes in paths inside the `*.properties` files, e.g. when pointing to the Clover Server license file. If you incorrectly use backlash, it will be considered an escape character and the server may not work fine. This is an example of a correct path:

```
license.file=C:/CoverETL/Server/license.dat
```

## JAXB and early versions of JVM 1.6

---

CloverETL Server contains jaxb 2.1 libraries since version 1.3. This may cause conflicts on early versions of JVM 1.6 which contain jaxb 2.0. However JDK6 Update 4 release finally contains jaxb 2.1, thus update to this or newer version of JVM solves possible conflicts.

## File system permissions

---

Application server must be executed by OS user which has proper read/write permissions on file system. Problem may occur, if app-server is executed by root user for the first time, so log and other temp files are created by root user. When the same app-server is executed by another user, it will fail because it cannot write to root's files.

## JMS API and JMS third-party libraries

---

Missing JMS libraries do not cause fail of server startup, but it is issue of deployment on application server, thus it still suits to this chapter.

clover.war itself does not contain jms.jar, thus it has to be on application server's classpath. Most of the application servers have jms.jar by default, but i.e. tomcat does not. so if the JMS features are needed, the jms.jar has to be added explicitly.

If "JMS Task" feature is used, there must be third-party libraries on server's classpath as well. The same approach is recommended for JMS Reader/Writer components, even if these components allow to specify external libraries. It is due to common memory leak in these libraries which causes "OutOfMemoryError: PermGen space".

---

## Memory Settings

Current implementation of Java Virtual Machine allows only global configuration of memory for the JVM system process. Thus whole application server, together with WARs and EARs running on it, share one memory space.

Default JVM memory settings is to low for running application container with CloverETL Server. Some application servers, like IBM Websphere, increase JVM defaults themselves, however they still may be too low.

The best memory limits depend on many conditions, i.e. transformations which CloverETL should execute. Please note, that maximum limit isn't amount of permanently allocated memory, but limit which can't be exceeded. If the limit was exhausted, the OutOfMemoryError would be raised.

You can set the minimum and maximum memory heap size by adjusting the "Xms" and "Xmx" JVM parameters. There are more ways how to change the settings depending on the used application container.

If you have no idea about the memory required for the transformations, a maximum of 1-2 GB heap memory is recommended. This limit may be increased during transformations development when OutOfMemoryError occurs.

Memory space for loading classes (so called "PermGen space") is separated from heap memory, and can be set by the JVM parameter "-XX:MaxPermSize". By default, it is just 64 MB which is not enough for enterprise applications. Again, suitable memory limit depends on various criteria, but 512 MB should be enough in most cases. If the PermGen space maximum is too low, OutOfMemoryError: PermGen space may occur.

Please see the specific container section for details how to make the settings.

---

## Upgrading Server to Newer Version

### Getting New Version to Work

1. Get the web archive file (WAR) with a newer build of CloverETL Server.
2. Re-deploy the web application. Instructions how to do that are application server dependant - see [Enterprise Server](#) (p. 4) for installation details on all supported servers. After you re-deploy, your new server will be configured based on the previous version's configuration.
3. If any changes to the database schema are necessary, the new server will automatically make them when you run it for the first time. It's recommended to backup database before upgrade.

### Upgrading Server License

1. The license file is shipped as a text containing a unique set of characters. If you:
  - received the new license as a file (\*.dat), then simply overwrite your old license file.
  - have been sent the licence text e.g inside an e-mail, then copy the license contents (i.e. all text between Company and END LICENSE) into a new file called clover-license.dat. Next, overwrite the old license file with the new one.
2. In Clover Server configuration, change the full path to your new license file if necessary.

3. In **server web GUI** → **Monitoring** → **License**, click **Reload license**. Alternatively, restart Clover Server.



### **Important**

**Evaluation Version** - a mere upgrade of your license is not sufficient. When moving from evaluation to enterprise server, you should not use the default configuration and database. Instead, take some time to configure Clover Server so that it best fits your production environment.

## Chapter 3. Server Side Job files - Sandboxes

Sandbox is a base storage unit for project. Sandbox is actually a server-side analogy to a CloverETL Designer project. Since CloverETL Designer has a connector to CloverETL Server, a designer project and a server sandbox may be linked together. This remote CloverETL Designer project looks and works like common local project, but all files are stored on the server side and all operations are performed on server side. See CloverETL Designer manual for details on configuring a connection to the server.

Technically speaking, a sandbox is a dedicated directory on the server file system. A sandbox cannot contain another sandbox. It is recommended to have one directory as sandboxes container and create a subdirectory for each sandbox. Files and directories in sandboxes are read by JVM of Application Server. Thus, all these directories must be accessible to the OS user who executes JVM of Application Server. i.e. If Apache Tomcat is executed as an OS service by "tomcat" user, all sandboxes must be accessible to this user.

In cluster mode, there are three sandbox types: "shared", "local" and "partitioned". See Chapter 24, [Clustering](#) (p. 115) for details.

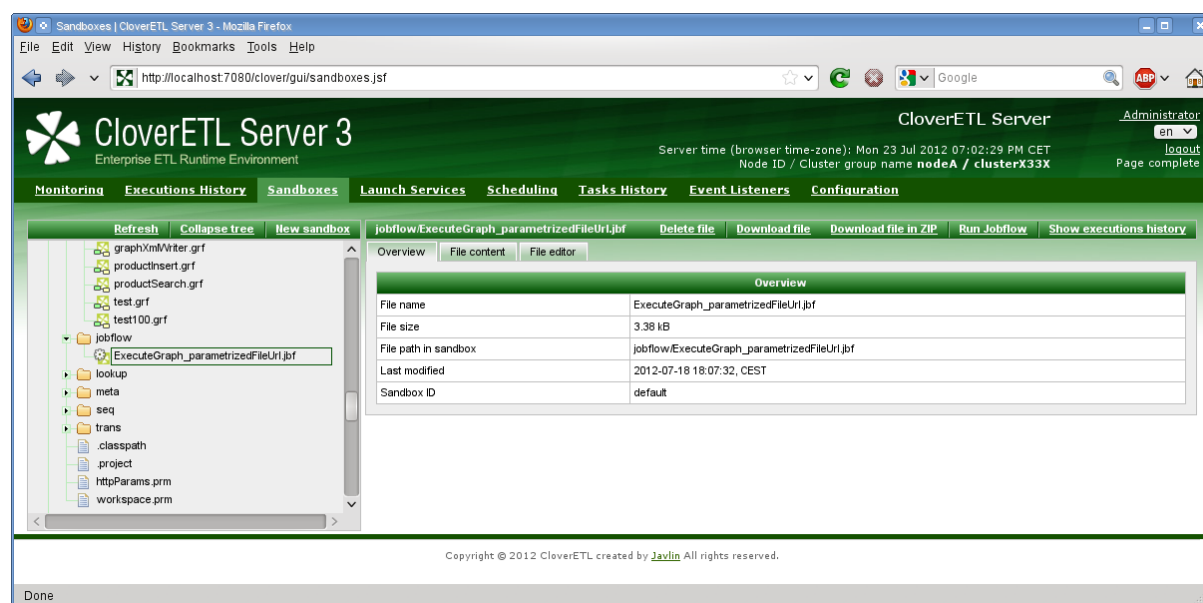


Figure 3.1. Sandboxes Section in CloverETL Server Web GUI

Each sandbox is defined by following attributes:

Table 3.1. Sandbox attributes

ID	Unique "name" of the sandbox. It is used in server APIs to identify sandbox. It must meet common rules for identifiers. It is specified by user in during sandbox creation and it can be modified later. <i>Note: modifying is not recommended, because it may be already used by some CS APIs clients.</i>
Name	Sandbox name used just for display. It is specified by user in during sandbox creation and it can be modified later.
Root path	Absolute server side file system path to sandbox root. It is specified by user during sandbox creation and it can be modified later. This attribute is used only in standalone mode. See Chapter 24, <a href="#">Clustering</a> (p. 115) for details about cluster mode.
Owner	It is set automatically during sandbox creation. It may be modified later.

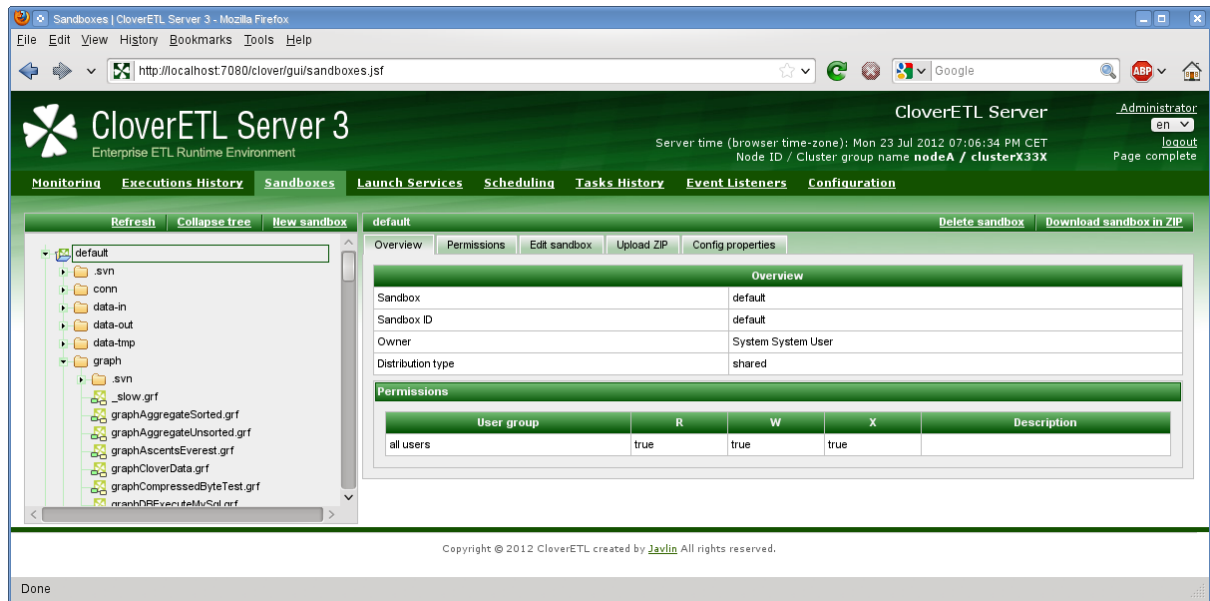


Figure 3.2. Sandbox Detail in CloverETL Server Web GUI

## Referencing files from the ETL graph or Jobflow

In some components you can specify file URL attribute as a reference to some resource on the file system. Also external metadata, lookup or DB connection definition is specified as reference to some file on the filesystem. With CloverETL Server there are more ways how to specify this relation.

- Relative path

All relative paths in your graphs are considered as relative paths to the root of the same sandbox which contains job file (ETL graph or Jobflow).

- sandbox:// URLs

Sandbox URL allows user to reference the resource from different sandboxes with standalone CloverETL Server or the cluster. In cluster environment, CloverETL Server transparently manages remote streaming if the resource is accessible only on some specific cluster node.

See [Using a Sandbox Resource as a Component Data Source](#) (p. 119) for details about the sandbox URLs.

## Sandbox Content Security and Permissions

Each sandbox has its owner which is set during sandbox creation. This user has unlimited privileges to this sandbox as well as administrators. Another users may have access according to sandbox settings.

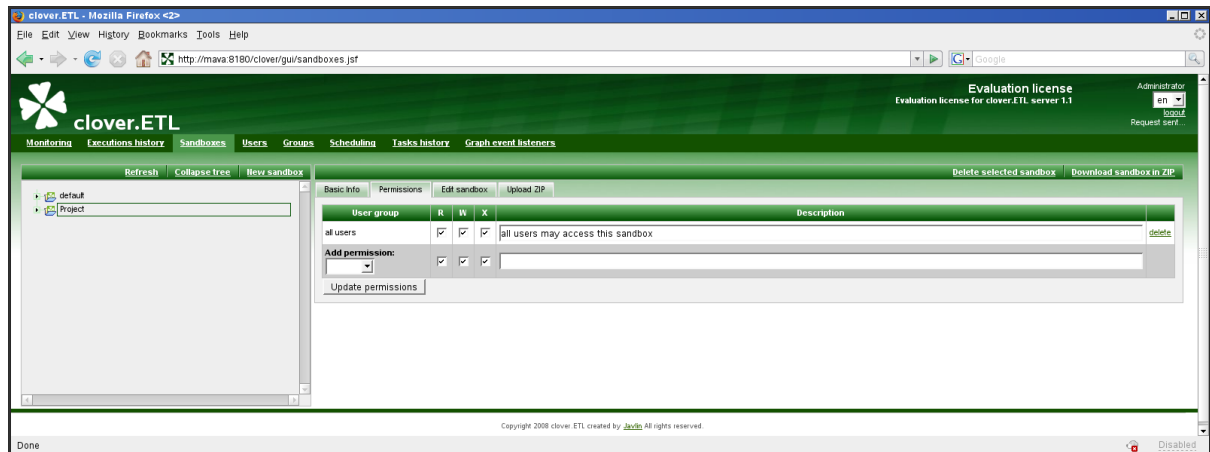


Figure 3.3. Sandbox Permissions in CloverETL Server Web GUI

Permissions to specific sandbox are modifiable in **Permissions** tab in sandbox detail. In this tab, selected user groups may be allowed to perform particular operations.

There are 3 types of operations:

Table 3.2. Sandbox permissions

R - read	Users can see this sandbox in their sandboxes list.
W - write	Users can modify files in the sandbox through CS APIs.
X - execution	Users can execute graphs in this sandbox. <i>Note: graph executed by "graph event listener" is actually executed by the same user as graph which is source of event. See details in "graph event listener". Graph executed by schedule trigger is actually executed by the schedule owner. See details in Chapter 6, <a href="#">Scheduling</a> (p. 45).</i>

Please note that, these permissions modify access to the content of specific sandboxes. In additions, it's possible to configure permissions to perform operations with sandbox configuration. e.g. create sandbox, edit sandbox, delete sandbox, etc. Please see Chapter 5, [Users and Groups](#) (p. 38) for details.

## Sandbox Content

Sandbox should contain jobflows, graphs, metadata, external connection and all related files. Files especially graph or jobflow files are identified by relative path from sandbox root. Thus you need two values to identify specific job file: sandbox and path in sandbox. Path to the Jobflow or ETL graph is often referred as "Job file".

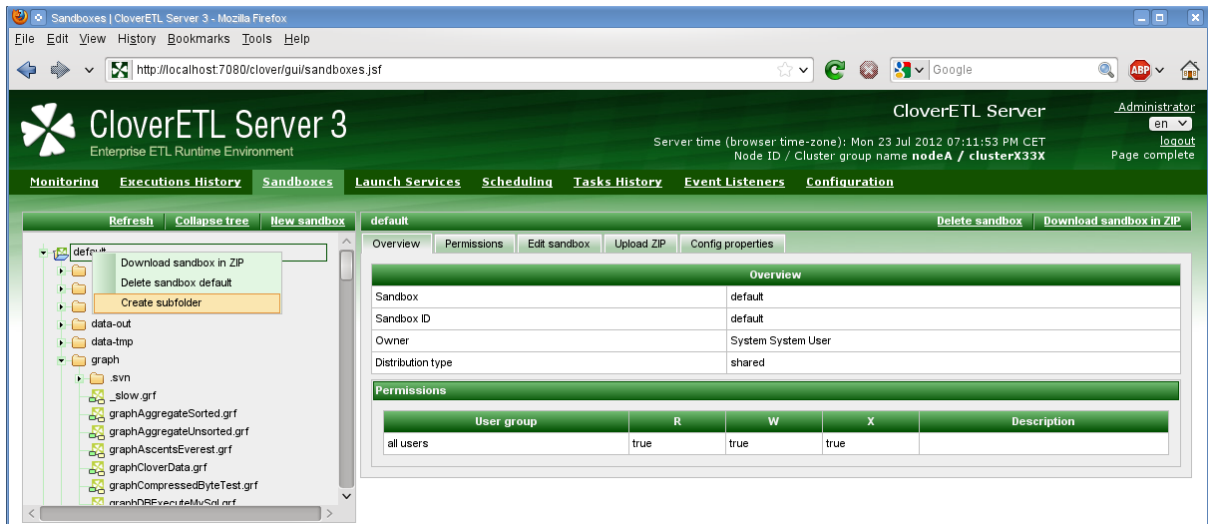


Figure 3.4. Web GUI - section "Sandboxes" - context menu on sandbox

Although web GUI section **sandboxes** isn't file-manager, it offers some useful features for sandbox management.

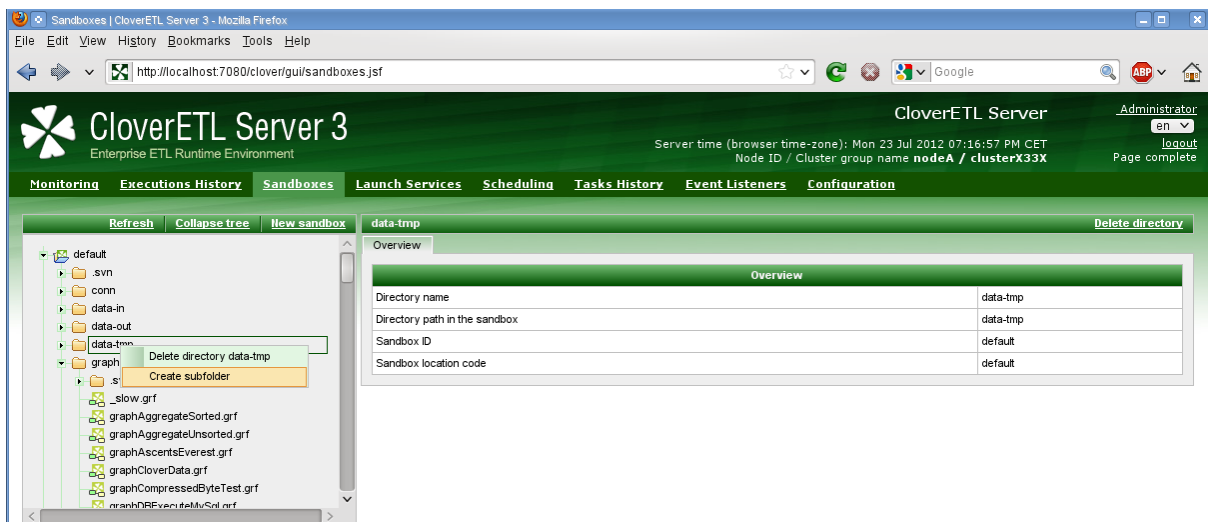


Figure 3.5. Web GUI - section "Sandboxes" - context menu on folder

## Download sandbox in ZIP

Select sandbox in left panel, then web GUI displays button "Download sandbox in ZIP" in the tool bar on the right side.

Created ZIP contains all readable sandbox files in the same hierarchy as on file system. You can use this ZIP file for upload files to the same sandbox, or another sandbox on different server instance.

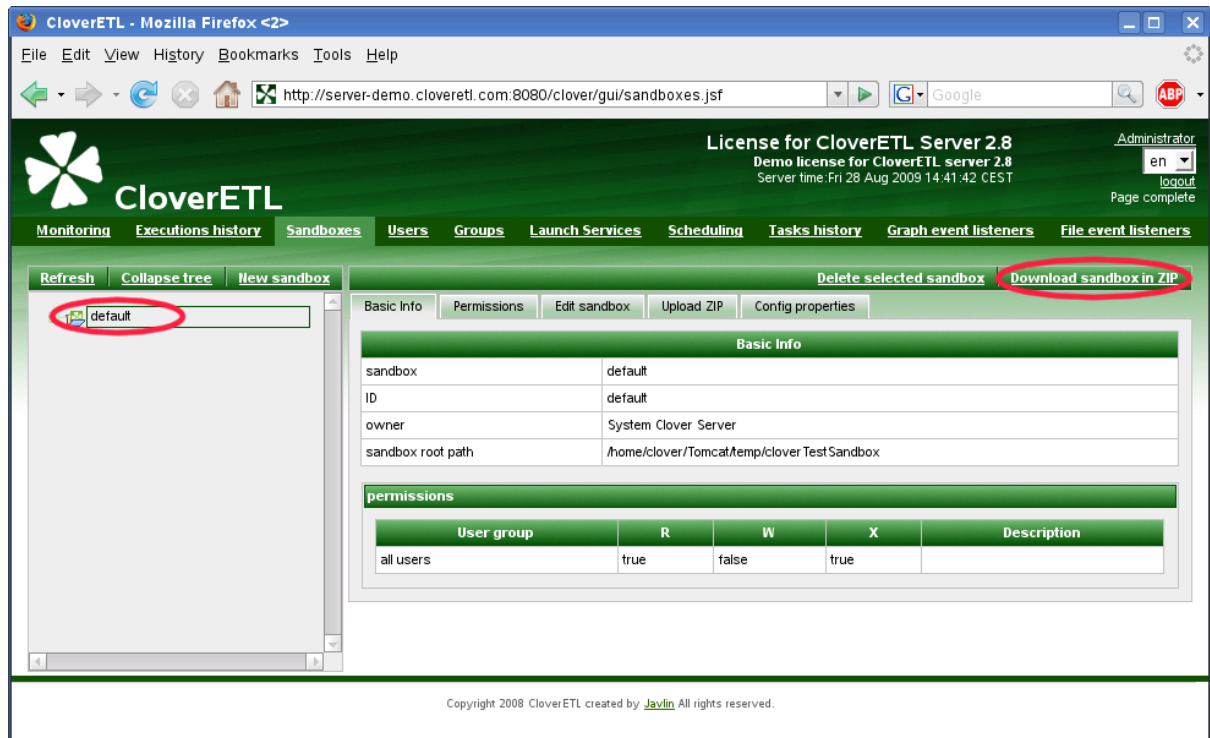


Figure 3.6. Web GUI - download sandbox in ZIP

## Upload ZIP to sandbox

Select sandbox in left panel. You must have write permission to the selected sandbox. Then select tab "Upload ZIP" in the right panel. Upload of ZIP is parametrized by couple of switches, which are described below. Open common file chooser dialog by button "+ Upload ZIP". When you choose ZIP file, it is immediately uploaded to the server and result message is displayed. Each row of the result message contains description of one single file upload. Depending on selected options, file may be skipped, updated, created or deleted.

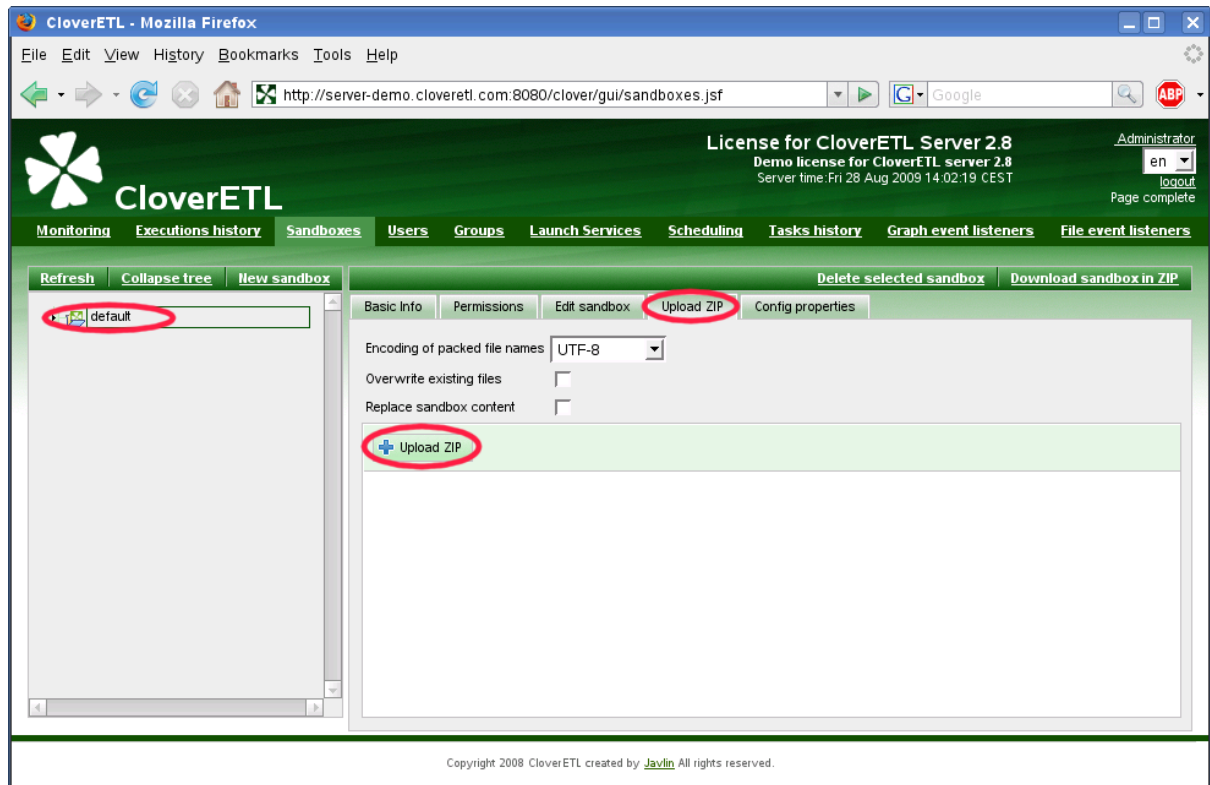


Figure 3.7. Web GUI - upload ZIP to sandbox

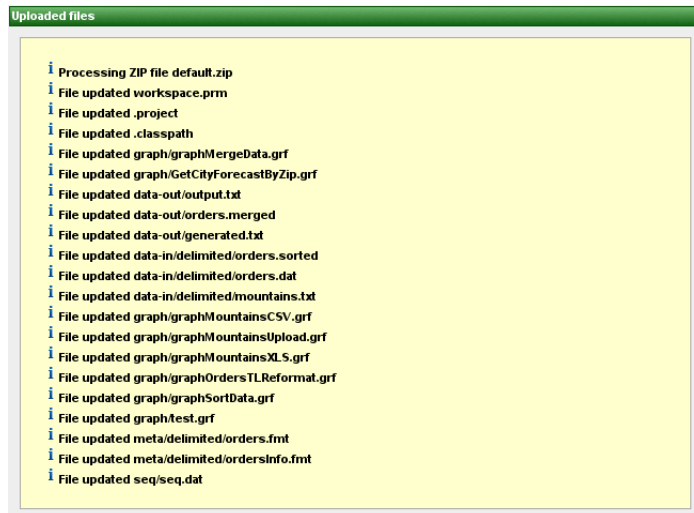


Figure 3.8. Web GUI - upload ZIP results

Table 3.3. ZIP upload parameters

Label	Description
Encoding of packed file names	File names which contain special characters (non ASCII) are encoded. By this select box, you choose right encoding, so filenames are decoded properly.
Overwrite existing files	If this switch is checked, existing file is overwritten by new one, if both of them are stored in the same path in the sandbox and both of them have the same name.
Replace sandbox content	If this option is enabled, all files which are missing in uploaded ZIP file, but they exist in destination sandbox, will be deleted. This option might cause loose of data, so user must have special permission "May delete files, which are missing in uploaded ZIP" to enable it.

## Download file in ZIP

Select file in left panel, then web GUI displays button "Download file in ZIP" in the tool bar on the right side.

Created ZIP contains just selected file. This feature is useful for large files (i.e. input or output file) which cannot be displayed directly in web GUI. So user can download it.

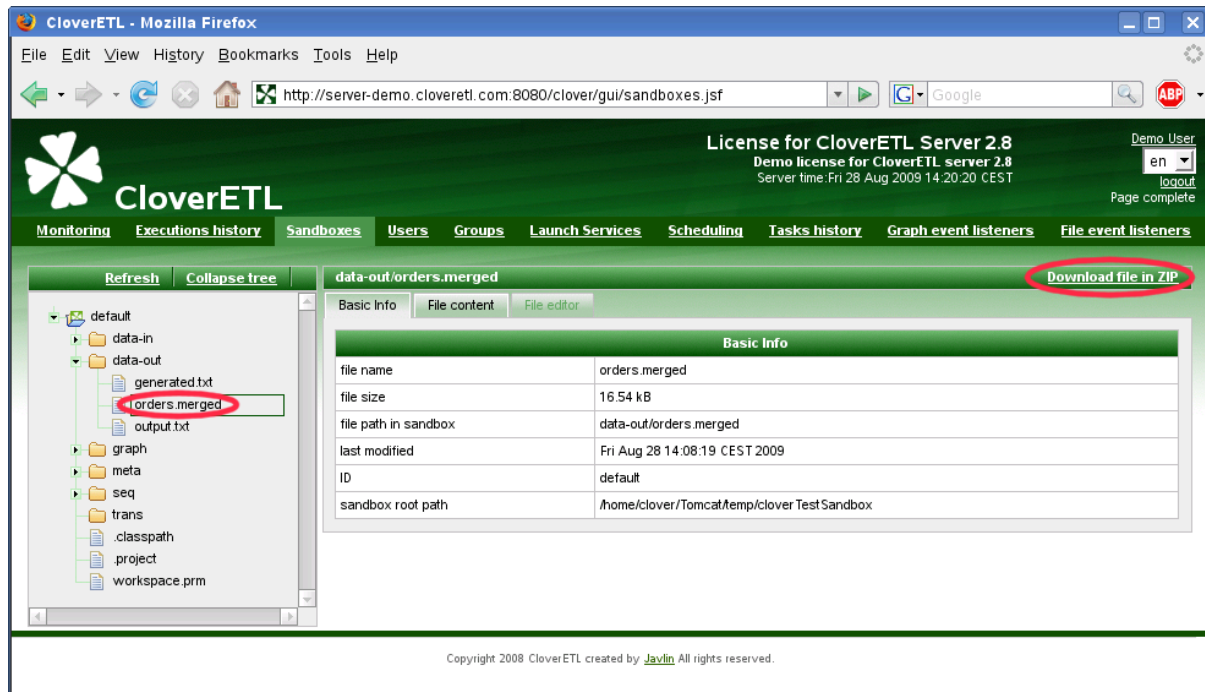


Figure 3.9. Web GUI - download file in ZIP

## Download file HTTP API

It is possible to download/view sandbox file accessing "download servlet" by simple HTTP GET request:

```
http://[host]:[port]/[Clover Context]/downloadFile?[Parameters]
```

Server requires BASIC HTTP Authentication. Thus with linux command line HTTP client "wget" it would look like this:

```
wget --user=clover --password=clover  
http://localhost:8080/clover/downloadFile?sandbox=default&file=data-out/data.dat
```

Please note, that ampersand character is escaped by back-slash. Otherwise it would be interpreted as command-line system operator, which forks processes.

### URL Parameters

- sandbox - Sandbox code. Mandatory parameter.
- file - Path to the file relative from sandbox root. Mandatory parameter.
- zip - If set to "true", file is returned as ZIP and response content type is "application/x-zip-compressed". By default it is false, so response is content of the file.

## Job config properties

Each ETL graph or Jobflow may have set of config properties, which are applied during the execution. Properties are editable in web GUI section "sandboxes". Select job file and go to tab "Config properties".

The same config properties are editable even for each sandbox. Values specified for sandbox are applied for each job in the sandbox, but with lower priority then config properties specified for the job.

If neither sandbox or job have config properties specified, defaults from main server configuration are applied. Global config properties related to Job config properties have prefix "execution.". E.g. server property "executor.classpath" is default for Job config property "classpath". (See Chapter 18, [Configuration](#) (p. 96) for details)

In addition, it is possible to specify additional job parameters, which can be used as placeholders in job XML. Please keep in mind, that these placeholders are resolved during loading and parsing of XML file, thus such job couldn't be pooled.

tracking_interval	2000	Interval in ms for sampling nodes status in running transformation.
max_running_concurrently	unlimited	Max number of concurrently running instances of this transformation.
enqueue_executions	false	Boolean value. If it is true, executions above max_running_concurrently are enqueued, if it is false executions above max_running_concurrently fail.
log_level	INFO	Log4j log level for this graph executions. (ALL   TRACE   DEBUG   INFO   WARN   ERROR   FATAL) For lower levels (ALL, TRACE or DEBUG), also root logger level must be set to lower level. Root logger log level is INFO by default, thus transformation run log does not contain more detail messages then INFO event if job config parameter "log_level" is set properly. See Chapter 21, <a href="#">Logging</a> (p. 110) for details about log4j configuration.
max_graph_instance_age	0	Time interval in ms which specifies how long may transformation instance last in server's cache. 0 means that transformation is initialized and released for each execution. Transformation cannot be stored in the pool and reused in some cases (transformation uses placeholders using dynamically specified parameters)
classpath		List of paths or jar files which contain external classes used in the job file (transformations, generators, JMS processors). Separator is specified by Engine property "DEFAULT_PATH_SEPARATOR_REGEX". Directory path must always end with slash character "/", otherwise ClassLoader doesn't recognize it's a directory. Server always automatically adds "trans" subdirectory of job's sandbox, so It doesn't have to be added explicitly.
skip_check_config	default value is taken from engine property	Switch which specifies whether check config must be performed before transformation execution.
password		Password for decoding of encoded DB connection passwords.
verbose_mode	true	If true, more descriptive logs of job runs are generated.
use_jmx	true	If true, job executor registers jmx mBean of running transformation.
debug_mode	false	If true, edges with enabled debug store data into files in debug directory. See property "graph.debug_path".  Without explicit setting, running of a graph from Designer with server integration would set the debug_mode to true. On the other hand, running of a graph from the server console sets the debug_mode to false.
executor.use_local_context_url	If true, the context URL of a running job will be a local "file:" URL. Otherwise, a "sandbox:" URL will be used.	false
executor.jobflow_token_tracking	If false, token tracking in jobflow executions will be disabled.	true

## Chapter 3. Server Side

### Job files - Sandboxes

The screenshot displays the CloverETL Server 3 web interface. The top navigation bar includes links for Monitoring, Executions History, Sandboxes, Users, Groups, Launch Services, Scheduling, Tasks history, and Event listeners. The main content area is titled 'graph/graphDebuggingGraph.grf' and shows the 'Config properties' tab. On the left, a tree view shows the file structure under 'RealWorldExamples' > 'data-in' > 'graph'. The main panel shows a table of configuration properties for the selected file.

Name	Value	
max_graph_instance_age	5000 Specifies how long may be graph instance kept in the pool. In millis.	<a href="#">delete</a>
log_level	debug Log4j log level for this graph executions. (ALL   TRACE   DEBUG   INFO   WARN   ERROR   FATAL)	<a href="#">delete</a>
max_running_concurrently	1 Max number of concurrently running instances of this graph.	<a href="#">delete</a>

Below the table, there is an 'Update' button and a section for 'Properties inherited from sandbox'.

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Figure 3.10. Job config properties

## Chapter 4. Viewing Job Runs - Executions History

Section Executions History shows all persistent job executions. Table shows only basic info about the job: Run Id, Job file, current status, time of execution, and some useful links.

### Filtering and ordering

User may filter records in the table by various criteria: Run ID, Job File, Date/time of execution, Status, user who executed the job. Also user may show children executions, which are filtered-out by default (e.g. workers of partitioned executions or jobs executed from jobflows).

Last jobs are on the top by default.

Please note, that some jobs may have disabled persistence to increase performance. It would be typically jobs executed by Launch Services, since the performance may be more important then detail info about the execution.

Run ID	Node	Job	Executed by	Status	Started
258	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:28:29, CEST
257	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:28:09, CEST
256	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:27:18, CEST
255	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:26:28, CEST
254	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:26:10, CEST
253	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	⚠	2012-08-20 20:26:04, CEST
252	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 20:25:45, CEST
251	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✗	2012-08-20 19:58:06, CEST
250	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	✓	2012-08-20 19:55:46, CEST
249	nodeB	CLS-960 graphPartitionedWriting-cluster.grt	clover	⚠	2012-08-20 19:55:39, CEST

Figure 4.1. Executions History - executions table

When some job execution is selected in the table, the detail info is shown on the right side.

Table 4.1. Persistent run record attributes

Attribute	Description
Run ID	Unique number identifying the run of the job. Server APIs usually return this number as simple response of execution request. It's useful as parameter of subsequent calls for specification of the job execution.
Execution type	Type of job as recognized by the server. STANDALONE for ETL graph, JOBFLOW for Jobflow, MASTER for main record of partitioned execution in cluster, PARTITIONED_WORKER for worker record of partitioned execution in cluster
Parent run ID	Run ID of the parent job. Typically Jobflow which executed this job, or master execution which encapsulate this worker execution.
Root run ID	Run ID of the root parent job. Job execution which wasn't executed by another parent job.
Nested jobs	Indication that this job execution has or has not any child execution.
Node	In cluster mode shows ID of the cluster node which this execution was running on.
Executed by	User which executed the job. Either directly using some API/GUI or indirectly using the scheduling or event listeners.
Sandbox	Sandbox containing job file. For jobs which are sent together with execution request, so the job file doesn't exist on the server site, it's set to "default" sandbox.
Job file	Path to job file, relative to the sandbox root. For jobs which are sent together with execution request, so the job file doesn't exist on the server site, it's set to generated string.
Job version	Revision of the job file. It's string generated by CloverETL Designer and stored in the job file.
Status	Status of the job execution. READY - waiting for execution start, RUNNING - processing job, FINISHED OK - job finished without any error, ABORTED - job was aborted directly using some API/GUI or by parent Jobflow, ERROR - job failed, N/A (not available) - server process died suddenly, so it couldn't properly abort the jobs, so after start the jobs with unknown status are set as N/A
Started	Server date-time (and timezone) of the execution start.
Finished	Server date-time (and timezone) of the execution finish.
Duration	Execution duration
Error in component ID	If the job failed due the error in a component, this field contains ID of the component.
Error in component type	If the job failed due the error in a component, this field contains type of the component.
Error message	If the job failed, this field contains error description.
Exception	If the job failed, this field contains error stack trace.
Input parameters	List of input parameters passed to the job. Job file can't be cached, since the parameters are applied during loading from the job file. Job file isn't cached by default.
Input dictionary	List of dictionary elements passed to the job. Dictionary is used independently on job file caching.
Output dictionary	List of dictionary elements at the moment the job ends.

For jobs which have some children executions, e.g. partitioned or jobflows also executions hierarchy tree is shown.

## Chapter 4. Viewing Job Runs - Executions History

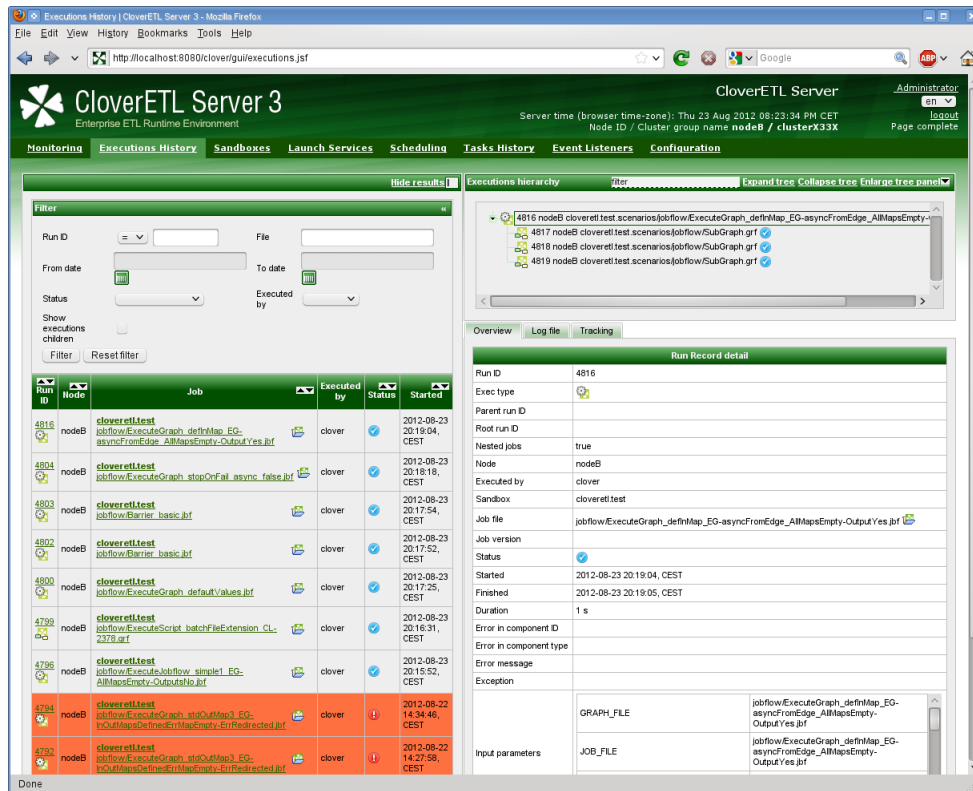


Figure 4.2. Executions History - overall perspective

Since the detail panel and especially job logs may be wide, it may be useful to hide table on the left, so the detail panel spreads. Click on the link "Hide results" on the top of the list panel to hide panel. Then to show list panel again, click to the "Show results" button on the left.

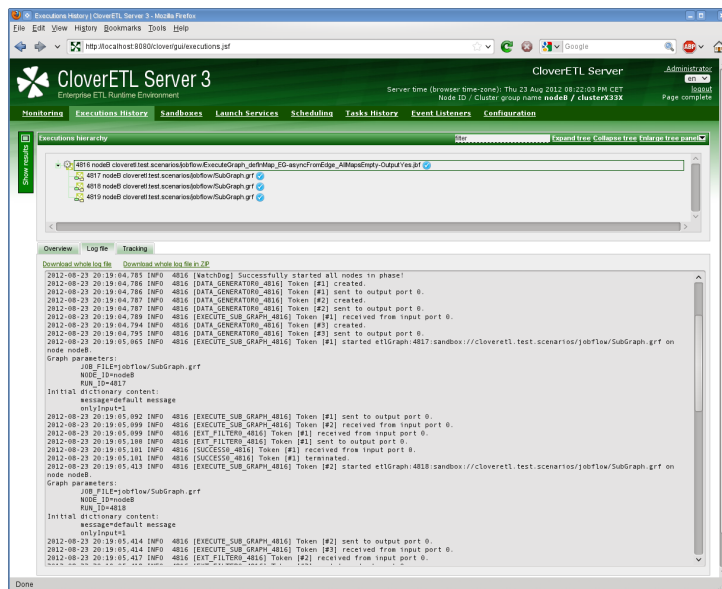


Figure 4.3. Executions Hierarchy with docked list of jobs

Executions hierarchy may be rather complex, so it's possible to filter the content of the tree by fulltext filter. However when the filter is used, the selected executions aren't hierarchically structured.

---

## Chapter 5. Users and Groups

CloverETL Server implements security module, which manages users and groups. Security module may be globally switched off (see Chapter 18, [Configuration](#) (p. 96) for details), but by default it is on, and all interfaces require client authentication by username and password. Relation between users and groups is N:M, thus one user may be assigned in more groups and one group may be assigned in more users.

All relations between users and groups are configurable in web GUI in sections **Users** and **Groups**.

Both sections are accessible only for users which have "List users" ("List groups" resp.) permission. To modify users/groups "create", "edit" and "delete" permissions are necessary.

---

### LDAP authentication

Since 3.2 it's possible to configure CloverETL Server to use LDAP server for users authentication. So the credentials of users registered in LDAP may be used for authentication to any CloverETL Server interface (API or GUI).

However authorization (access levels to sandboxes content and privileges for operations) is still handled by Clover security module. Each user, even though logged-in using LDAP authentication, must have his own "user" record (with related groups) in CloverETL security module. So there must be the user with the same username and domain set to "LDAP". If no such user record exists, it's automatically created according to CloverETL configuration.

What does the CloverETL do to authenticate a LDAP user?

1. User specifies the LDAP credentials i.e. in login form to the web GUI
2. CloverETL Server connects to the LDAP and checks whether the user exists (it uses specified search to lookup in LDAP)
3. If the user exists in LDAP, CloverETL Server performs authentication
4. If succeeded, CloverETL Server searches for LDAP user's groups.
5. CloverETL Server checks whether the user is assigned in LDAP groups which are allowed to login to Clover.
6. Clover user record is created/updated according to current LDAP values.
7. Clover user is assigned to the Clover groups according to his current assignment to the LDAP groups.
8. User is logged-in



#### Note

Switching domains:

- If a user was **created as LDAP** and then switched to clover domain, you have to **set a password** for him in **Change password tab**.
- If a user was **created as clover** and then switched to LDAP domain, he has a password in clover domain, but it is overridden by the LDAP password. After switching back to clover domain, the **original password is re-used**. It can be reset in the **Change password** tab if needed (e.g. forgotten).

---

### Configuration

By default CloverETL Server allows only its own internal mechanism for authentication. To enable authentication with LDAP, set config property "security.authentication.allowed\_domains" properly. It's list of user domains which are used for authentication.

Currently there are 2 authentication mechanism implemented: "LDAP" and "clover" ("clover" is identifier of CloverETL internal authentication and may be changed by security.default\_domain property, but only for white-labelling purposes). To enable LDAP authentication, set value to "LDAP" (only LDAP) or "clover,LDAP". Users from both domain may login. It's recommended to allow both mechanisms together, until the LDAP is properly configured. So the admin user can still login to web GUI although the LDAP connection isn't properly configured.

## Basic LDAP connection properties

```
# Implementation of context factory
security.ldap.ctx_factory=com.sun.jndi.ldap.LdapCtxFactory
# timeout for all queries sent to LDAP server
security.ldap.timeout=5000
# limit for number of records returned from LDAP
security.ldap.records_limit=50

# URL of LDAP server
security.ldap.url=ldap://hostname:port
# Some generic UserDN which allows lookup for the user and groups.
security.ldap.userDN=
# Password for the user specified above
security.ldap.password=
```

## Configuration of user lookup

Specified values work for this specific LDAP tree:

- dc=company,dc=com
  - ou=groups
    - cn=admins  
(objectClass=groupOfNames,member=(uid=smith,dc=company,dc=com),member=(uid=jones,dc=company,dc=com))
    - cn=developers (objectClass=groupOfNames,member=(uid=smith,dc=company,dc=com))
    - cn=consultants (objectClass=groupOfNames,member=(uid=jones,dc=company,dc=com))
  - ou=people
    - uid=smith (fn=John,sn=Smith,mail=smith@company.com)
    - uid=jones (fn=Bob,sn=Jones,mail=jones@company.com)

Following properties are necessary for lookup for the LDAP user by his username. (step [2] in the login process above)

```
# Base specifies the node of LDAP tree where the search starts
security.ldap.user_search.base=dc=company,dc=eu
# Filter expression for searching the user by his username.
# Please note, that this search query must return just one record.
# Placeholder ${username} will be replaced by username specified by the logging user.
security.ldap.user_search.filter=(uid=${username})
# Scope specifies type of search in "base". There are three possible values: SUBTREE | ONELEVEL | OBJECT
# http://download.oracle.com/javase/6/docs/api/javax/naming/directory/SearchControls.html
security.ldap.user_search.scope=SUBTREE
```

Following properties are names of attributes from the search defined above. They are used for getting basic info about the LDAP user in case the user record has to be created/updated by Clover security module: (step [6] in the login process above)

```
security.ldap.user_search.attribute.firstname=fn
security.ldap.user_search.attribute.lastname=sn
security.ldap.user_search.attribute.email=mail
# This property is related to the following step "searching for groups".
# Groups may be obtained from specified user's attribute, or found by filter (see next paragraph)
# Please leave this property empty if the user doesn't have such attribute.
security.ldap.user_search.attribute.groups=memberOf
```

In the following step, clover tries to find groups which the user is assigned to. (step [4] in the login process above). There are two ways how to get list of groups which the user is assigned to. The user-groups relation is specified on the "user" side. The user record has some attribute with list of groups. It's "memberOf" attribute usually. Or the relation is specified on the "group" side. The group record has attribute with list of assigned users. It's "member" attribute usually.

In case the relation is specified on users side, please specify property:

```
security.ldap.user_search.attribute.groups=memberOf
```

Leave it empty otherwise.

In case the relation is specified on groups side, please specify properties for searching:

```
security.ldap.groups_search.base=dc=company,dc=com
# Placeholder ${userDN} will be replaced by user DN found by the search above
# If the filter is empty, searching will be skipped.
security.ldap.groups_search.filter=(&(objectClass=groupOfNames)(member=${userDN}))
security.ldap.groups_search.scope=SUBTREE
```

Otherwise, please leave property security.ldap.groups\_search.filter empty, so the search will be skipped.

Clover user record will be assigned to the clover groups according to the LDAP groups found by the search (or the attribute). (Groups check is performed during each login)

```
# Value of the following attribute will be used for lookup for the Clover group by its code.
# So the user will be assigned to the Clover group with the same "code"
security.ldap.groups_search.attribute.group_code=cn
```

It's also possible to specify LDAP groups which are able to login to Clover. (step [5] in the login process above)

```
# Semicolon separated list of LDAP group DNS (distinguished names).
# LDAP user must be assigned to one or more of these groups, otherwise new clover user can't be created.
# Special value "_ANY_" disables this check and basically any LDAP user may login.
# If the LDAP group DNS are configured, also security.ldap.groups_search.* properties must be configured.
# value could be e.g. "cn=developers,dc=company,dc=com;cn=admins,dc=company,dc=com"
security.ldap.allowed_ldap_groups=_ANY_
```

---

## Web GUI section Users

This section is intended to users management. It offers features in dependence of user's permissions. i.e. User may enter this section, but cannot modify anything. Or user may modify, but cannot create new users.

All possible features of users section:

- *create new user*
- *modify basic data*
- *change password*
- *disable/enable user*
- *assign user to groups* - Assignment to groups gives user proper permissions

Table 5.1. After default installation above empty DB, there are two users created

User name	Description
clover	Clover user has admin permissions, thus default password "clover" should be changed after installation.
system	System user is used by application instead of common user, when no other user can be used. i.e. when security is globally switched off. This user cannot be removed and it is impossible to login as this user.



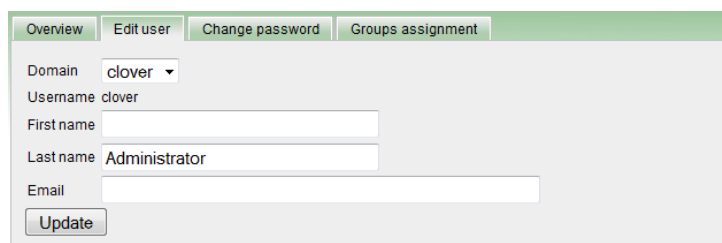
Figure 5.1. Web GUI - section "Users" under "Configuration"

Table 5.2. User attributes

Attribute	Description
username	Common user identifier. Must be unique, cannot contain spaces or special characters, just letters and numbers.
password	Case sensitive password. If user loses his password, the new one must be set. Password is stored in encrypted form for security reasons, so it cannot be retrieved from database and must be changed by the user who has proper permission for such operation.
first name	
last name	
email	Email which may be used by CloverETL administrator or by CloverETL server for automatic notifications. See <a href="#">Task - Send Email</a> (p. 57) for details.

## Edit user record

User with permission "Create user" or "Edit user" can use this form to set basic user parameters.

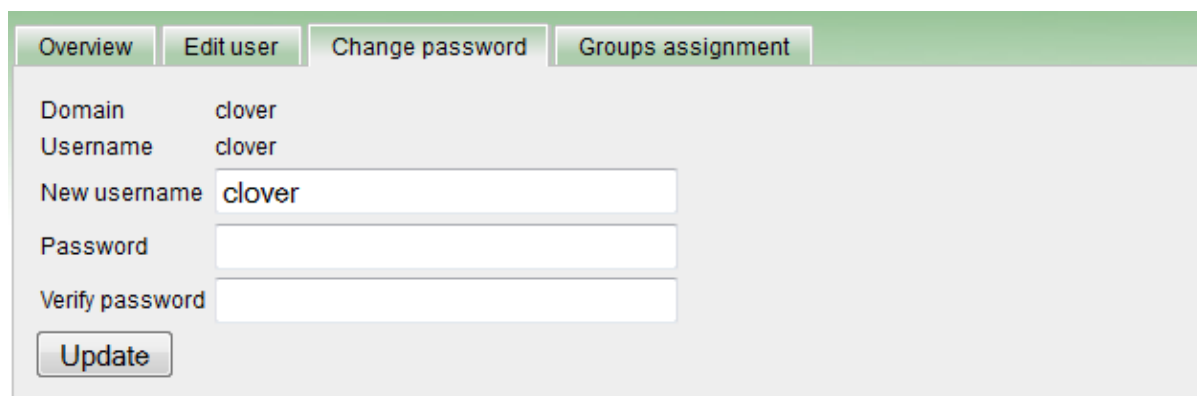


The 'Edit user' form in the web GUI. It features a tabbed interface with 'Overview', 'Edit user', 'Change password', and 'Groups assignment'. The 'Edit user' tab is active. The form contains fields for 'Domain' (a dropdown menu set to 'clover'), 'Username' (text 'clover'), 'First name' (empty text box), 'Last name' (text 'Administrator'), and 'Email' (empty text box). An 'Update' button is located at the bottom left.

Figure 5.2. Web GUI - edit user

## Change users Password

If user loses his password, the new one must be set. So user with permission "Change passwords" can use this form to do it.

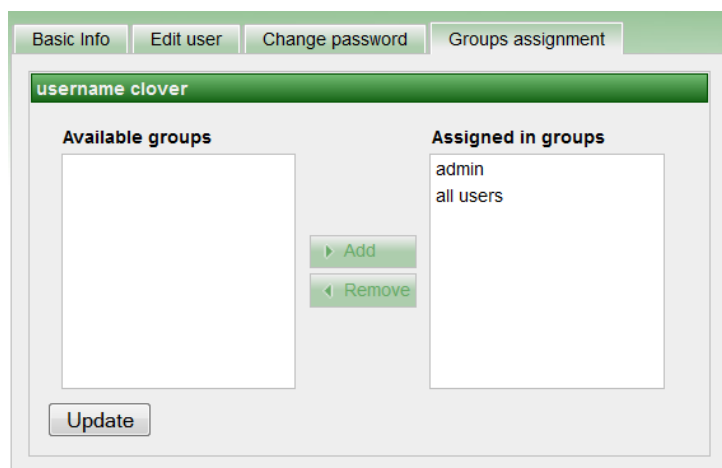


The 'Change password' form in the web GUI. It features a tabbed interface with 'Overview', 'Edit user', 'Change password', and 'Groups assignment'. The 'Change password' tab is active. The form contains fields for 'Domain' (text 'clover'), 'Username' (text 'clover'), 'New username' (text box with 'clover'), 'Password' (empty text box), and 'Verify password' (empty text box). An 'Update' button is located at the bottom left.

Figure 5.3. Web GUI - change password

## Group assignment

Assignment to groups gives user proper permissions. Only logged user with permission "Groups assignment" can access this form and specify groups which the user is assigned in. See [Web GUI section Groups](#) (p. 43) for details about permissions.



The 'Groups assignment' form in the web GUI. It features a tabbed interface with 'Basic Info', 'Edit user', 'Change password', and 'Groups assignment'. The 'Groups assignment' tab is active. The form has a header bar with 'username clover'. Below it, there are two columns: 'Available groups' (empty list box) and 'Assigned in groups' (list box containing 'admin' and 'all users'). Between these columns are 'Add' and 'Remove' buttons. An 'Update' button is located at the bottom left.

Figure 5.4. Web GUI - groups assignment

## Disabling / enabling users

Since user record has various relations to the logs and history records, it can't be deleted. So it's disabled instead. It basically means, that the record doesn't display in the list and the user can't login.

However disabled user may be enabled again. Please note, that disabled user is removed from its groups, so groups should be assigned properly after re-enabling.

## Web GUI section Groups

Group is abstract set of users, which gives assigned users some permissions. So it is not necessary to specify permission for each single user.

There are independent levels of permissions implemented in CloverETL Server

- *permissions to Read/Write/execute in sandboxes* - sandbox owner can specify different permissions for different groups. See [Sandbox Content Security and Permissions](#) (p. 26) for details.
- *permissions to perform some operation* - user with operation permission "Permission assignment" may assign specific permission to existing groups.
- *permissions to launch specific service* - see Chapter 17, [Launch Service](#) (p. 89) for details.

Table 5.3. Default groups created during installation

Group name	Description
admins	This group has operation permission "all" assigned, which means, that it has unlimited permission. Default user "clover" is assigned to this group, which makes him administrator.
all users	Every single CloverETL user is assigned to this group by default. It is possible to remove user from this group, but it is not a recommended approach. This group is useful for some permissions to sandbox or some operation, which you would like to make accessible for all users without exceptions.

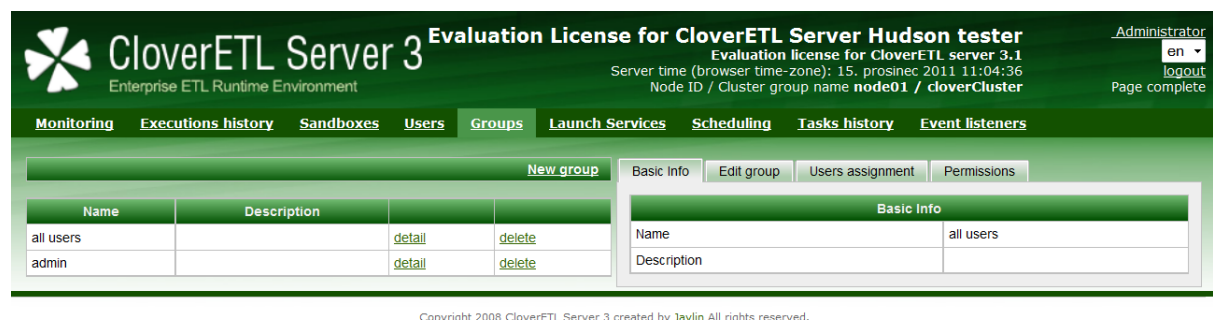


Figure 5.5. Web GUI - section "Groups"

## Users Assignment

Relation between users and groups is N:M. Thus in the same way, how groups are assignable to users, users are assignable to groups.

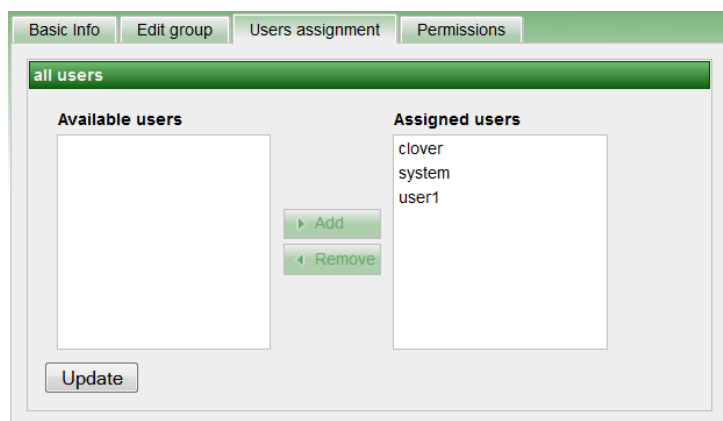


Figure 5.6. Web GUI - groups assignment

## Groups permissions

Groups permissions are structured as tree, where permissions are inherited from root to leafs. Thus if some permission (tree node) is enabled (blue dot), all permissions in sub tree are automatically enabled (white dot). Permissions with red cross are disabled.

Thus for "admin" group just "all" permission is assigned, every single permission in sub tree is assigned automatically.

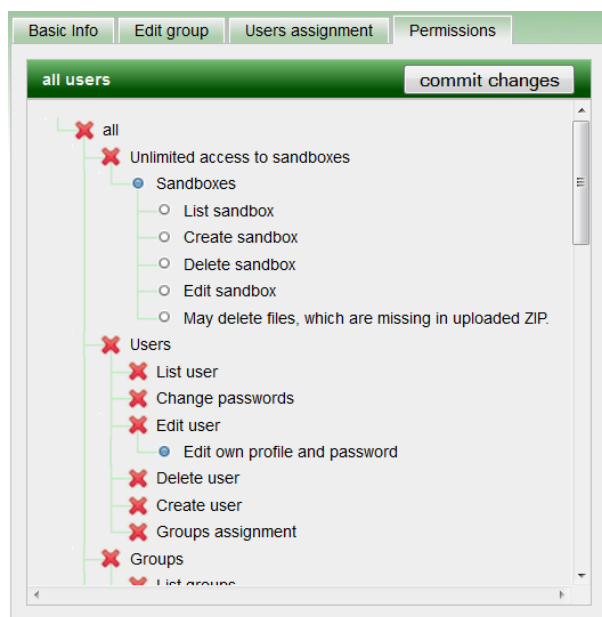


Figure 5.7. Tree of permissions

## Chapter 6. Scheduling

Scheduling allows user to create his own timetable for operations which he does not want to trigger manually. Each schedule represents separated timetable and basically its specification WHEN to do something and WHAT to do.

In cluster environment, scheduling is processed only on master node, thus tasks are triggered only on master node.

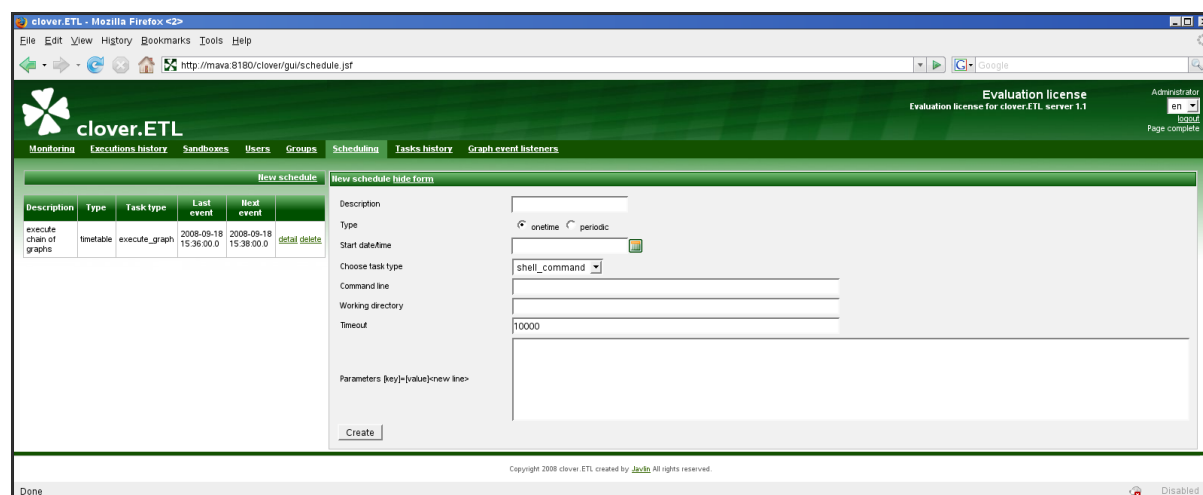


Figure 6.1. Web GUI - section "Scheduling" - create new

### Timetable Setting

This section should describe how to specify WHEN schedule should be triggered. Please keep in mind, that exact trigger times are not guaranteed. There may be couple of seconds delay. Schedule itself can be specified in different ways.

- [Onetime Schedule](#) (p. 45)
- [Periodical schedule by Interval](#) (p. 46)
- [Periodical schedule by timetable \(Cron Expression\)](#) (p. 47)

### Onetime Schedule

It is obvious, that this schedule is triggered just once.

Table 6.1. Onetime schedule attributes

Type	"onetime"
Start date/time	Date and time, specified with minutes precision.

Figure 6.2. Web GUI - onetime schedule form

Figure 6.3. Web GUI - schedule form - calendar

## Periodical schedule by Interval

This type of schedule is the simplest periodical type. Trigger times are specified by these attributes:

Table 6.2. Periodical schedule attributes

Type	"periodic"
Periodicity	"interval"
Start date/time	Date and time, specified with minutes precision.
End date/time	Date and time, specified with minutes precision.
Interval in minutes	Specifies interval between two trigger times. Next task is triggered even if previous task is still running.
Fire misfired ASAP switch	If checked and trigger time is missed because of any reason (i.e. server restart), it will be triggered immediately, when it is possible. Otherwise it is ignored and it will be triggered at next scheduled time.

Figure 6.4. Web GUI - periodical schedule form

## Periodical schedule by timetable (Cron Expression)

Timetable is specified by powerful (but a little bit tricky) cron expression.

Table 6.3. Cron periodical schedule attributes

Type	"periodic"
Periodicity	"interval"
Start date/time	Date and time, specified with minutes precision.
End date/time	Date and time, specified with minutes precision.
Cron expression	Cron is powerful tool, which uses its own format for scheduling. This format is well known among UNIX administrators. i.e. "0 0/2 4-23 * * ?" means "every 2 minutes between 4:00am and 11:59pm".
Fire misfired ASAP switch	If checked and trigger time is missed because of any reason (i.e. server restart), it will be triggered immediately when it is possible. Otherwise it is ignored and it will be triggered at next scheduled time.

Figure 6.5. Cron periodical schedule form

## Tasks

Task basically specifies WHAT to do at trigger time. There are several tasks implemented for schedule and for graph event listener as follows:

- [Task - Execution of Graph](#) (p. 48)
- [Task - Execution of Jobflow](#) (p. 49)
- [Task - Kill Job](#) (p. 50)
- [Task - Execution of Shell Command](#) (p. 51)
- [Task - Send Email](#) (p. 52)
- [Task - Execute Groovy Code](#) (p. 52)
- [Task - Archive Records](#) (p. 53)

### Task - Execution of Graph

Please note that behaviour of this task type is almost the same as [Task - Execution of Jobflow](#) (p. 49)

Table 6.4. Attributes of "Graph execution" task

Task type	"execute graph"
Sandbox	This select box contains sandboxes which are readable for logger user. Select sandbox which contains graph to execute.
Graph	This select box is filled by all graphs files accessible in selected sandbox.
Parameters	<p>Key-value pairs which are passed to the executed job as parameters. Besides, if this task is triggered by job (graph or jobflow) event, you can specify source job parameters, which shall be passed from the source job to executed job. i.e. event source has these parameters: paramName2 with value "val2", paramName3 with value "val3", paramName5 with value "val5". Task has "Parameters" attribute set like this:</p> <pre>paramName1=paramValue1 paramName2= paramName3 paramName4</pre> <p>So executed job gets these parameters and values: paramName1 with value "paramValue1" (specified explicitly in the task configuration) paramName2 with value "" (empty string specified explicitly in the task configuration overrides event source parameters), paramName3 with value "val3" (value is taken from event source). These parameters aren't passed: paramName4 isn't passed, since it does not have any value in event source. paramName5 isn't passed, since it is not specified among the parameters to pass in the task.</p> <p>Event parameters like "EVENT_RUN_RESULT", "EVENT_RUN_ID" etc. are passed to the executed job without limitations.</p>

Figure 6.6. Web GUI - Graph execution task

## Task - Execution of Jobflow

Please note that behaviour of this task type is almost the same as [Task - Execution of Graph](#) (p. 48)

Table 6.5. Attributes of "Jobflow execution" task

Task type	"execute jobflow"
Sandbox	This select box contains sandboxes which are readable for logger user. Select sandbox which contains jobflow to execute.
Jobflow	This select box is filled by all jobflow files accessible in selected sandbox.
Parameters	<p>Key-value pairs which are passed to the executed job as parameters. Besides, if this task is triggered by job (graph or jobflow) event, you can specify source job parameters, which shall be passed from the source job to executed job. i.e. event source has these parameters: paramName2 with value "val2", paramName3 with value "val3", paramName5 with value "val5". Task has "Parameters" attribute set like this:</p> <pre> paramName1=paramValue1 paramName2= paramName3 paramName4 </pre> <p>So executed job gets these parameters and values: paramName1 with value "paramValue1" (specified explicitly in the task configuration) paramName2 with value "" (empty string specified explicitly in the task configuration overrides event source parameters), paramName3 with value "val3" (value is taken from event source). These parameters aren't passed: paramName4 isn't passed, since it does not have any value in event source. paramName5 isn't passed, since it is not specified among the parameters to pass in the task.</p> <p>Event parameters like "EVENT_RUN_RESULT", "EVENT_RUN_ID" etc. are passed to the executed job without limitations.</p>

Figure 6.7. Web GUI - Jobflow execution task

## Task - Kill Job

This task, when activated kills/aborts specified job (ETL graph or jobflow), if it is currently running.

Table 6.6. Attributes of "Kill Job" task

Task type	"kill job"
Kill source of event	If this switch is on, task will kill job which is source of the event, which activated this task. Attributes sandbox and job are ignored.
Sandbox	Select sandbox which contains job to kill. This attribute works only when "Kill source of event" switch is off.
Job	This select box is filled by all jobs accessible in selected sandbox. All instances of selected job, whose are currently running will be killed. This attribute works only when "Kill source of event" switch is off.

Figure 6.8. Web GUI - "Kill job"

## Task - Execution of Shell Command

Table 6.7. Attributes of "Shell command" task

Task type	"shell command"
Command line	Command line for execution of external process.
Working directory	Working directory for process. If not set, working directory of application server process is used.
Timeout	Timeout in milliseconds. After period of time specified by this number, external process is terminated and all results are logged.

Figure 6.9. Web GUI - shell command

## Task - Send Email

This task is very useful, but for now only as response for graph events. This feature is very powerful for monitoring. (see Chapter 7, [Graph Event Listeners](#) (p. 55) for description of this task type).

*Note: It seems useless to send emails periodically, but it may send current server status or daily summary. These features will be implemented in further versions.*

## Task - Execute Groovy Code

This type of task allows execute code written in script language Groovy. It is possible to use some variables. Only parameter of this task is source code of written in Groovy.

Table 6.8. List of variables available in Groovy code

variable	class	description	availability
event	com.cloveretl.server.events.AbstractServerEvent		every time
task	com.cloveretl.server.persistent.Task		every time
now	java.util.Date	current time	every time
parameters	java.util.Properties	Properties of task	every time
user	com.cloveretl.server.persistent.User	Same as event.getUser()	every time
run	com.cloveretl.server.persistent.RunRecord		When the event is instance of GraphServerEvent
tracking	com.cloveretl.server.persistent.TrackingGraph	Same as run.getTrackingGraph()	When the event is instance of GraphServerEvent
sandbox	com.cloveretl.server.persistent.Sandbox	Same as run.getSandbox()	When the event is instance of GraphServerEvent
schedule	com.cloveretl.server.persistent.Schedule	Same as ((ScheduleServerEvent)event).getSchedule()	When the event is instance of ScheduleServerEvent
servletContext	javax.servlet.ServletContext		every time
cloverConfiguration	com.cloveretl.server.spring.CloverConfiguration	Configuration values for CloverETL Server	every time
serverFacade	com.cloveretl.server.facade.api.ServerFacade	Reference to the facade interface. Useful for calling CloverETL Server core.  WAR file contains Javadoc of facade API and it is accessible on URL: <a href="http://host:port/clover/javadoc/index.html">http://host:port/clover/javadoc/index.html</a>	every time
sessionToken	String	Valid session token of the user who owns the event. It is useful for authorisation to the facade interface.	every time

Variables run, tracking and sandbox are available only if event is instance of GraphServerEvent class. Variable schedule is available only for ScheduleServerEvent as event variable class.

## Example of use Groovy script

This example shows script which writes text file describing finished graph. It shows use of 'run' variable.

```

import com.cloveretl.server.persistent.RunRecord;
String dir = "/tmp/";
RunRecord rr = (RunRecord)run;

String fileName = "report"+rr.getId()+"_finished.txt";

FileWriter fw = new FileWriter(new File(dir+fileName));
fw.write("Run ID      :"+rr.getId()+"\n");
fw.write("Graph ID    :"+rr.getGraphId()+"\n");
fw.write("Sandbox      :"+rr.getSandbox().getName()+"\n");
fw.write("\n");
fw.write("Start time   :"+rr.getStartTime()+"\n");
fw.write("Stop time    :"+rr.getStopTime()+"\n");
fw.write("Duration     :"+rr.getDurationString()+"\n");
fw.write("Final status  :"+rr.getFinalStatus()+"\n");
fw.close();

```

## Task - Archive Records

As name suggests, this task can archive (or delete) obsolete records from DB.

*Table 6.9. Attributes of "archive records" task*

Task type	"archivator"
Older then	Time period (in minutes) - it specifies which records are evaluated as obsolete. Records older then the specified interval are stored in archives.
Archivator type	There are two possible values: "archive" or "delete". Delete removes records without any possibility of UNDO operation. Archive removes records from DB, but creates ZIP package with CSV files containing deleted data.
Output path for archives	This attribute makes sense only for "archive" type.
Include executions history	
Run record with status	If status is selected, only run records with specified status will be archived. It is useful e.g. If you want to delete records for successfully finished jobs, but you want to keep failed jobs for further investigation.
Include temp files	
Temp files with record status	If status is selected, only temp files related to the run records with selected status will be archived. It is useful e.g. If you want to delete files for successfully finished jobs, but you want to keep failed jobs for further investigation.
Include tasks history	If checked, archivator will include run records. Log files of graph runs are included as well.
Task types	If this task type is selected, only logs for selected task type are archived.
Task result mask	Mask applied to task log result attribute. Only records whose result meets this mask are archived. Specify string without any wildcards. Each task log which contains specified string in the "result" attribute will be deleted/archived. Case sensitivity depends on database collation.
Include debug files	If checked, archivator removes all graph debug files older then given timestamp defined in "Older than" attribute.
Include dictionary files	If checked, archivator removes all dictionary temporary files older then given timestamp defined in "Older than" attribute.


**New schedule** hide form


Enabled ☒

Description

Type ☐ onetime ☒ periodic

Periodicity ☐ by interval ☒ by timetable

Start date/time  

End date/time  

Cron expression

Fire mistired event as soon as possible ☒

Choose task type

Older than (minutes)

Archivator type

Output path for archives

Include executions history ☒

Run record with status

Include tasks history ☒

Task types

Task result mask

Figure 6.10. Web GUI - archive records

---

## Chapter 7. Graph Event Listeners

Graph event listener is powerful feature, which allows user to monitor success or failure of ETL graph executions. It is also possible to create relations between executions, or execute backup script in dependence of graph success or failure.

Please note that Graph Event Listeners work very similar to Jobflow Event Listeners (Chapter 8, [Jobflow Event Listeners](#) (p. 63)) in many ways, since ETL Graph and Jobflow are both "jobs" from the point of view of CloverETL Server.

In cluster environment, event exists only on cluster node, which runs jobflow, thus if the node isn't explicitly specified, the task is triggered on the same node.

---

### Graph Events

Each event carries properties of graph, which is source of event. If there is an event listener specified, task may use these properties. i.e. next graphs in the chain may use "EVENT\_FILE\_NAME" placeholder which activated first graph in the chain. Graph properties, which are set specifically for each graph run (i.e. RUN\_ID), are overridden by last graph.

For now, there are these types of graph events:

- [graph started](#) (p. 55)
- [graph phase finished](#) (p. 55)
- [graph finished OK](#) (p. 55)
- [graph error](#) (p. 55)
- [graph aborted](#) (p. 56)
- [graph timeout](#) (p. 56)
- [graph status unknown](#) (p. 56)

#### **graph started**

---

Event of this type is created, when ETL graph execution successfully started.

#### **graph phase finished**

---

Event of this type is created, everytime when graph phase is finished and all its nodes are finished with status FINISHED\_OK.

#### **graph finished OK**

---

Event of this type is created, when all phases and nodes of graph are finished with status FINISHED\_OK.

#### **graph error**

---

Event of this type is created, when graph cannot be executed from any reason, or when any node of graph fails.

## graph aborted

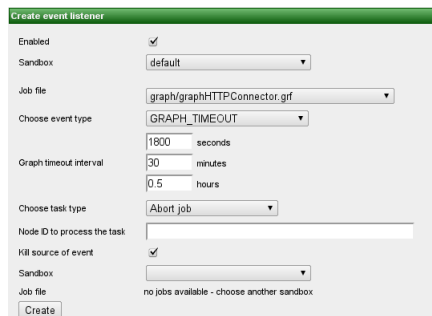
---

Event of this type is created, when graph is explicitly aborted.

## graph timeout

---

Event of this type is created, when graph runs longer then specified interval. Thus you have to specify "Job timeout interval" attribute for each listener of graph timeout event. You can specify this interval in seconds or in minutes or in hours.



The screenshot shows a web form titled "Create event listener". It contains several fields: "Enabled" with a checked checkbox, "Sandbox" with a dropdown menu showing "default", "Job file" with a dropdown menu showing "graph/graphHTTPConnector.grf", "Choose event type" with a dropdown menu showing "GRAPH\_TIMEOUT", "Graph timeout interval" with three input fields: "1800" for seconds, "30" for minutes, and "0.5" for hours, "Choose task type" with a dropdown menu showing "Abort job", "Node ID to process the task" with an empty text input field, "Kill source of event" with a checked checkbox, "Sandbox" with a dropdown menu showing "no jobs available - choose another sandbox", and "Job file" with a dropdown menu showing "no jobs available - choose another sandbox". At the bottom left is a "Create" button.

Figure 7.1. Web GUI - graph timeout event

## graph status unknown

---

Event of this type is created, when the server, during the startup, detects run records with undefined status in the executions history. Undefined status means, that server has been killed during graph run. Server automatically changes state of graph to "Not Available" and sends 'graph status unknown' event. Please note, that this works just for executions, which have persistent record in executions history. It is possible to execute transformation without persistent record in executions history, typically for better performance of fast running transformations (i.e. using Launch Services).

---

## Listener

User may create listener for specified event type and graph (or all graphs in sandbox). Listener is actually connection between graph event and task, where graph event specifies WHEN and task specifies WHAT to do.

So progress is like this:

- event is created
- listeners for this event are notified
- each listener performs related task

---

## Tasks

Task types "execute shell command", "execute graph" and "archivator" are described in section "scheduling" see this section for details about these task types. There is one more task type, which is useful especially with graph event listeners, thus it is described here. It is task type "send email".

*Note: You can use task of any type for both scheduling and graph event listener. Description of task types is divided into two sections just to show the most obvious use cases.*

- [Task - Send Email](#) (p. 57)
- [Task - JMS Message](#) (p. 59)

## Task - Send Email

This type of task is useful for notifications about result of graph execution. I.e. you can create listener with this task type to be notified about each failure in specified sandbox or failure of particular graph.

*Table 7.1. Attributes of "Send email" task*

Task type	"email"
Email pattern	This select box contains all predefined email patterns. If user chooses any of them, all fields below are automatically filled by values from pattern.
To	Recipient's email address. It is possible to specify more addresses separated by comma. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
Cc	Cc stands for 'carbon copy'. Copy of email will be delivered to these addresses. It is possible to specify more addresses separated by comma. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
Bcc	Bcc: stands for 'Blind carbon copy'. It is the same as Cc, but the others recipients aren't aware, that these recipients get copy of email.
Reply-to (Sender)	Email address of sender. It must be valid address according to SMTP server. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
Subject	Email subject. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
Plain text	Body of email in plain text. Email is created as multipart, so HTML body should have a precedence. Plain text body is only for email clients which do not display HTML. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
HTML	Body of email in HTML. Email is created as multipart, so HTML body should have a precedence. Plain text body is only for email clients which do not display HTML. It is also possible to use placeholders. <i>See <a href="#">Placeholders</a> (p. 58) for details.</i>
Log file as attachment	If this switch is checked, email will have an attachment with packed log file of related graph execution.

**Create event listener**

Enabled: ☒

Sandbox: default

Graph: graphSortData.grf

Choose event type: GRAPH\_ERROR

Choose task type: email

Fill form with values from email pattern:

To: \${user.email}

Cc:

Bcc:

Reply-to: clover.server@

Subject: CloverETL Server notification - Graph \${run.graphId} finished

text:
 

```

Sandbox: ${sandbox.code}
Sandbox root: ${sandbox.rootPath}
Graph: ${run.graphId}

Result: ${run.finalStatus}
Started: ${run.startTime}
Finished: ${run.stopTime}

Error node: ${run.errNode}
Error message: ${run.errMessage}
Error exception: ${run.errException}
    
```

HTML:
 

```

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<html><head>
<meta http-equiv="content-type" content="text/html; charset=utf-8">
<meta http-equiv="content-language" content="en">
<meta http-equiv="Cache-Control" content="no-cache">
<meta http-equiv="pragma" content="no-cache">
<meta http-equiv="Expires" content="Mon, 26 Jul 1997 05:00:00 GMT">
<title>Graph ${sandbox.code} / ${run.graphId} finished</title>
    
```

Log file as attachment (if it's available): ☐

Create

hide form

Figure 7.2. Web GUI - send email

*Note: Do not forget to configure connection to SMTP server (See Chapter 18, [Configuration](#) (p. 96) for details).*

## Placeholders

Place holder may be used in some fields of tasks. They are especially useful for email tasks, where you can generate content of email according to context variables.

*Note: In most cases, you can avoid this by using email patterns (See Email task for details)*

These fields are preprocessed by Apache Velocity templating engine. See Velocity project URL for syntax description <http://velocity.apache.org/>

There are several context variables, which you can use in place holders and even for creating loops and conditions.

- *event*
- *now*
- *user*
- *run*
- *sandbox*

Some of them may be empty in dependence of occasion which field is processed in. I.e. If task is processed because of graph event, then *run* and *sandbox* variables contain related data, otherwise they are empty,

Table 7.2. Placeholders useful in email templates

Variable name	Contains
now	Current date-time
user	User, who caused this event. It may be owner of schedule, or someone who executed graph. Contains sub-properties, which are accessible using dot notation (i.e. <code>\${user.email}</code> ) email, username, firstName, lastName, groups (list of values)
run	Data structure describing one single graph execution. Contains sub-properties, which are accessible using dot notation (i.e. <code>\${run.graphId}</code> ) graphId, finalStatus, startTime, stopTime, errNode, errMessage, errException, logLocation
tracking	<p>Data structure describing status of components in graph execution. Contains sub-properties, which are accessible using Velocity syntax for loops and conditions.</p> <pre> #if (\${tracking}) &lt;table border="1" cellpadding="2" cellspacing="0"&gt; #foreach (\$phase in \$tracking.trackingPhases) &lt;tr&gt;&lt;td&gt;phase: \${phase.phaseNumber}&lt;/td&gt;     &lt;td&gt;\${phase.execTime} ms&lt;/td&gt;     &lt;td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/tr&gt; #foreach (\$node in \$phase.trackingNodes)     &lt;tr&gt;&lt;td&gt;\${node.nodeName}&lt;/td&gt;         &lt;td&gt;\${node.result}&lt;/td&gt;         &lt;td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/tr&gt; #foreach (\$port in \$node.trackingPorts)     &lt;tr&gt;&lt;td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;&lt;/td&gt;         &lt;td&gt;\${port.portType}:\${port.index}&lt;/td&gt;         &lt;td&gt;\${port.totalBytes} B&lt;/td&gt;         &lt;td&gt;\${port.totalRows} rows&lt;/td&gt;&lt;/tr&gt; #end #end #end &lt;/table&gt; #end } </pre>
sandbox	Data structure describing sandbox containing executed graph. Contains sub-properties, which are accessible using dot notation (i.e. <code>\${sandbox.name}</code> ) name, code, rootPath
schedule	Data structure describing schedule which triggered this task. Contains sub-properties, which are accessible using dot notation (i.e. <code>\${schedule.description}</code> ) description, startTime, endTime, lastEvent, nextEvent, fireMisfired

## Task - JMS Message

This type of task is useful for notifications about result of graph execution. I.e. you can create graph event listener with this task type to be notified about each failure in specified sandbox or failure of particular graph.

JMS messaging requires JMS API (jms.jar) and third-party libraries. All these libraries must be available on application server classpath. Some application servers contain these libraries by default, some do not, thus the libraries must be added explicitly.

Table 7.3. Attributes of JMS message task

Task type	"JMS message"
Initial context class name	Full class name of javax.naming.InitialContext implementation. Each JMS provider has own implementation. i.e. for Apache MQ it is "org.apache.activemq.jndi.ActiveMQInitialContextFactory". If it is empty, server uses default initial context
Connection factory JNDI name	JNDI name of connection factory. Depends on JMS provider.
Destination	JNDI name of message queue/topic on the server
Username	Username for connection to JMS message broker
Password	Password for connection to JMS message broker
URL	URL of JMS message broker
JMS pattern	This select box contains all predefined JMS message patterns. If user chooses any of them, text field below is automatically filled by value from pattern.
Text	Body of JMS message. It is also possible to use placeholders. See <a href="#">Placeholders</a> (p. 58) of <i>send email task</i> for details.

**Edit event listener**

Enabled ☒

Sandbox

Graph

Choose event type

Choose task type

Node ID

Initial context class name

Connection factory JNDI name

Destination JNDI name

Username

Password

URL

Text 

```
<jmsmessage>
<sandbox>${sandbox.code}</sandbox>
<graph>${run.graphId}</graph>
<result>${run.finalStatus}</result>
<started>${run.startTime}</started>
<finished>${run.stopTime}</finished>
<error_node>${run.errNode}</error_node>
<error_message>${run.errMessage}</error_message>
<error_exception>${run.errException}</error_exception>
<log_file>${run.logLocation}</log_file>
</jmsmessage>
```

Figure 7.3. Web GUI - Task JMS message editor

## Use cases

Possible use cases are the following:

- [Execute graphs in chain](#) (p. 61)
- [Email notification about graph failure](#) (p. 61)
- [Email notification about graph success](#) (p. 62)
- [Backup of data processed by graph](#) (p. 62)

## Execute graphs in chain

Let's say, that we have to execute graph B, only if another graph A finished without any error. So there is some kind of relation between these graphs. We can achieve this behaviour by creating graph event listener. We create listener for event `graph finished` OK of graph A and choose task type `execute_graph` with graph B specified for execution. And that is it. If we create another listener for graph B with task `execute_graph` with graph C specified, it will work as chain of graphs.

Figure 7.4. Event source graph isn't specified, thus listener works for all graphs in specified sandbox

## Email notification about graph failure

Figure 7.5. Web GUI - email notification about graph failure

## Email notification about graph success

Create event listener

Enabled

☒

Sandbox

default

Graph

Choose event type

GRAPH\_FINISHED

Choose task type

email

Fill form with values from email pattern

To

\$(user.email)

Cc

Bcc

Reply-to

clover.server@

Subject

CloverETL Server notification - Graph \${run.graphId} finished

text

Sandbox: \${sandbox.code}

Sandbox root: \${sandbox.rootPath}

Graph: \${run.graphId}

Result: \${run.finalStatus}

Started: \${run.startTime}

Finished: \${run.stopTime}

Error node: \${!run.errNode}

Error message: \${!run.errMessage}

Error exception: \${!run.errException}

HTML

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">

<html><head>

<meta http-equiv="content-type" content="text/html; charset=utf-8">

<meta http-equiv="content-language" content="en">

<meta http-equiv="Cache-Control" content="no-cache">

<meta http-equiv="pragma" content="no-cache">

<meta http-equiv="Expires" content="Mon, 26 Jul 1997 05:00:00 GMT">

<title>Graph \${sandbox.code} / \${run.graphId} finished</title>

Log file as attachment (if it's available)

☒

Create

hide form

Figure 7.6. Web GUI - email notification about graph success

## Backup of data processed by graph

Create event listener

Enabled☒

Sandbox

default

Graph

graphMergeData.grf

Choose event type

GRAPH\_FINISHED

Choose task type

shell\_command

Command line

/home/clover/backup.sh

Working directory

/home/clover

Timeout

10000

Create

[hide form](#)

Figure 7.7. Web GUI - backup of data processed by graph

---

## Chapter 8. Jobflow Event Listeners

Please note that Jobflow Event Listeners work very similar to Graph Event Listener (the section called “[Tasks](#)” (p. 56)) in many ways, since ETL Graph and Jobflow are both “jobs” from the point of view of CloverETL Server.

In cluster environment, event exists only on cluster node, which runs jobflow, thus if the node isn't explicitly specified, the task is triggered on the same node.

---

### Jobflow Events

Each event carries properties of the event source job. If there is a event listener specified, task may use these properties. e.g. next job in the chain may use “EVENT\_FILE\_NAME” placeholder which activated first job in the chain. Job properties, which are set specifically for each run (e.g. RUN\_ID), are overridden by last job.

There are these types of jobflow events:

- [jobflow started](#) (p. 63)
- [jobflow phase finished](#) (p. 63)
- [jobflow finished OK](#) (p. 63)
- [jobflow error](#) (p. 63)
- [jobflow aborted](#) (p. 63)
- [jobflow timeout](#) (p. 64)
- [jobflow status unknown](#) (p. 64)

---

#### jobflow started

Event of this type is created, when jobflow execution successfully started.

---

#### jobflow phase finished

Event of this type is created, everytime when jobflow phase is finished and all its nodes are finished with status FINISHED\_OK.

---

#### jobflow finished OK

Event of this type is created, when all phases and nodes of jobflow are finished with status FINISHED\_OK.

---

#### jobflow error

Event of this type is created, when jobflow cannot be executed from any reason, or when any node of the jobflow fails.

---

#### jobflow aborted

Event of this type is created, when jobflow is explicitly aborted.

## jobflow timeout

Event of this type is created, when jobflow runs longer then specified interval. Thus you have to specify "Job timeout interval" attribute for each listener of jobflow timeout event. You can specify this interval in seconds or in minutes or in hours.

The screenshot shows a web form titled "Create event listener". It contains the following fields and options:

- Enabled:** A checked checkbox.
- Sandbox:** A dropdown menu with "default" selected.
- Job file:** A dropdown menu with "jobflow/ExecuteGraph\_parametrizedFileUrl.jbf" selected.
- Choose event type:** A dropdown menu with "JOBFLOW\_TIMEOUT" selected.
- Graph timeout interval:** Three input fields for "seconds" (1800), "minutes" (30.0), and "hours" (0.5).
- Choose task type:** A dropdown menu with "Abort job" selected.
- Node ID to process the task:** An empty text input field.
- Kill source of event:** A checked checkbox.
- Sandbox:** A dropdown menu with "no jobs available - choose another sandbox" selected.
- Job file:** A dropdown menu with "no jobs available - choose another sandbox" selected.
- Create:** A button at the bottom left.

Figure 8.1. Web GUI - jobflow timeout event

## jobflow status unknown

Event of this type is created, when the server, during the startup, detects run records with undefined status in the executions history. Undefined status means, that server has been killed during jobflow run. Server automatically changes state of jobflow to "Not Available" and sends 'jobflow status unknown' event. Please note, that this works just for executions, which have persistent record in executions history. It is possible to execute transformation without persistent record in executions history, typically for better performance of fast running transformations (e.g. using Launch Services).

## Listener

User may create listener for specified event type and jobflow (or all jobflows in sandbox). Listener is actually connection between jobflow event and task, where jobflow event specifies WHEN and task specifies WHAT to do.

So progress is like this:

- event is created
- listeners for this event are notified
- each listener performs related task

## Tasks

Task specifies operation which should be performed as the reaction to the triggered event.

Task types are described in the section called "[Tasks](#)" (p. 48) and the section called "[Tasks](#)" (p. 56)

*Note: You can use task of any type for jobflow event listener. Description of task types is divided into two sections just to show the most obvious use cases.*

---

## Chapter 9. JMS messages listeners

This feature allows you to specify listener for incoming JMS messages. Such listener can then process one of predefined tasks as usual for all event listeners. So for each listener user specifies source of JMS messages (JMS Topic or JMS Queue) and task which will be processed as a result of each incoming JMS message.

JMS messaging requires JMS API (jms.jar) and third-party libraries. All these libraries must be available on application server classpath. Some application servers contain these libraries by default, some do not, thus the libraries must be added explicitly.

JMS itself is quite complex topic beyond of scope of this document. Detail information about it can be found on Sun web site: <http://java.sun.com/j2ee/1.4/docs/tutorial/doc/JMS6.html>

*Table 9.1. Attributes of JMS message task*

Attribute	Description
Node ID to handle the event	This attribute makes sense only in cluster environment. It is node ID where the listener should be initialized. If it is not set, listener is initialized on all nodes in the cluster.
Initial context class name	Full class name of javax.naming.InitialContext implementation. Each JMS provider has own implementation. i.e. for Apache MQ it is "org.apache.activemq.jndi.ActiveMQInitialContextFactory". If it is empty, server uses default initial context. Specified class must be on web-app classpath or application-server classpath. It is usually included in one library with JMS API implementation for each specific JMS broker provider.
Connection factory JNDI name	JNDI name of connection factory. Depends on JMS provider.
Destination JNDI name	JNDI name of message queue/topic on the server
Username	Username for connection to JMS message broker
Password	Password for connection to JMS message broker
URL	URL of JMS message broker
Durable subscriber (only for Topics)	<p>If it is false, message consumer is connected to the broker as "non-durable", so it receives only messages which are sent while the connection is active. Other messages are lost. If it is true, consumer is subscribed as "durable" so it receives even messages which are sent while the connection is inactive. The broker stores such messages until they can be delivered or until the expiration is reached. This switch makes sense only for Topics destinations, because Queue destinations always store messages until they can be delivered or the expiration is reached. Please note, that consumer is inactive i.e. during server restart and during short moment when user updates the "JMS message listener" and it must be re-initialized. So during these intervals the message in the Topic may get lost if the consumer does not have durable subscription.</p> <p>If the subscription is durable, client must have "ClientId" specified. This attribute can be set in different ways in dependence of JMS provider. I.e. for ActiveMQ, it is set as URL parameter <code>tcp://localhost:1244?jms.clientID=TestClientID</code></p>
Message selector	This "query string" can be used as specification of conditions for filtering incoming messages. Syntax is well described on Java EE API web site: <a href="http://java.sun.com/j2ee/1.4/docs/api/javax/jms/Message.html">http://java.sun.com/j2ee/1.4/docs/api/javax/jms/Message.html</a> It has different behaviour depending on type of consumer (queue/topic) Queue: If it's a queue the messages that are filtered out remain on the queue. Topic: Messages filtered out by a Topic subscriber's message selector will never be delivered to the subscriber. From the subscriber's perspective, they do not exist.
Groovy code	Groovy code may be used for additional message processing and/or for refusing message. Both features are described below.

## Optional Groovy code

Groovy code may be used for additional message processing or for refusing message.

- **Additional message processing** Groovy code may modify/add/remove values stored in containers "properties" and "data".
- **Refuse/acknowledge the message** if Groovy code returns `Boolean.FALSE`, message is refused. Otherwise, message is acknowledged. Refused message may be redelivered, however JMS broker should have configured some limit for redelivering messages. If groovy code throws an exception, it is considered as coding error and JMS message is NOT refused because of it. So if the message refusal is directed by some exception, it must be handled in groovy.

Table 9.2. Variables accessible in groovy code

type	key	description
<code>javax.jms.Message</code>	<code>msg</code>	instance of JMS message
<code>java.util.Properties</code>	<code>properties</code>	See below for details. Contains values (String or converted to String) read from message and it is passed to the task which may use them somehow. I.e. task "execute graph" passes these parameters to the executed graph.
<code>java.util.Map&lt;String, Object&gt;</code>	<code>data</code>	See below for details. Contains values (Object, Stream, ..) read or proxied from the message instance and it is passed to the task which may use them somehow. I.e. task "execute graph" passes it to the executed graph as "dictionary entries".
<code>javax.servlet.ServletContext</code>	<code>servletContext</code>	instance of ServletContext
<code>javax.jms.Message</code>	<code>msg</code>	instance of JMS message
<code>com.cloveretl.server.api.ServerFacade</code>	<code>serverFacade</code>	instance of serverFacade usable for calling CloverETL Server core features.
<code>String</code>	<code>sessionToken</code>	sessionToken, needed for calling serverFacade methods

## Message data available for further processing

JMS message is processed and data it contains is stored basically in two data structures. "properties" and "data"

Table 9.3. "properties" elements

key	description
JMS_PROP_[property key]	For each message property is created one entry, where "key" is made of prefix "JMS_PROP_" and property key.
JMS_MAP_[map entry key]	If the message is instance of MapMessage, for each map entry is created one entry, where "key" is made of prefix "JMS_MAP_" and map entry key. Values are converted to String.
JMS_TEXT	If the message is instance of TextMessage, this property contains content of the message.
JMS_MSG_CLASS	Class name of message implementation
JMS_MSG_CORRELATIONID	Correlation ID is either provider-specific message ID or application-specific String value
JMS_MSG_DESTINATION	The JMSDestination header field contains the destination to which the message is being sent.
JMS_MSG_MESSAGEID	A JMSMessageID is a String value that should function as a unique key for identifying messages in a historical repository. The exact scope of uniqueness is provider-defined. It should at least cover all messages for a specific installation of a provider, where an installation is some connected set of message routers.
JMS_MSG_REPLYTO	Destination to which a reply to this message should be sent.
JMS_MSG_TYPE	Message type identifier supplied by the client when the message was sent.
JMS_MSG_DELIVERYMODE	The DeliveryMode value specified for this message.
JMS_MSG_EXPIRATION	The time the message expires, which is the sum of the time-to-live value specified by the client and the GMT at the time of the send.
JMS_MSG_PRIORITY	The JMS API defines ten levels of priority value, with 0 as the lowest priority and 9 as the highest. In addition, clients should consider priorities 0-4 as gradations of normal priority and priorities 5-9 as gradations of expedited priority.
JMS_MSG_REDELIVERED	True if this message is being redelivered.
JMS_MSG_TIMESTAMP	The time a message was handed off to a provider to be sent. It is not the time the message was actually transmitted, because the actual send may occur later due to transactions or other client-side queueing of messages.

Please note, that all values in "properties" structure are of String type, nevertheless it is number or text.

All listed properties are accessible with lower-case keys as well for backwards compatibility, however it's deprecated approach.

Table 9.4. "data" elements

key	description
JMS_MSG	instance of javax.jms.Message
JMS_DATA_STREAM	Instance of java.io.InputStream. Accessible only for TextMessage, BytesMessage, StreamMessage, ObjectMessage(only if payload object is instance of String). Strings are encoded in UTF-8.
JMS_DATA_TEXT	Instance of String. Only for TextMessage and ObjectMessage, where payload object is instance of String.
JMS_DATA_OBJECT	Instance of java.lang.Object - message payload. Only for ObjectMessage.

"data" container is passed to the task which may use them somehow according to its implementation. I.e. task "execute graph" passes it to the executed graph as "dictionary entries". Please note that it is not serializable, thus if the task is relying on it, it can be processed properly only on the same cluster node.

Dictionary entries can be used in some of graph component attributes. I.e. in fileURL attribute like this: "dict:JMS\_DATA\_STREAM:discrete". So the reader reads data directly from incoming JMS message using this proxy stream.

All listed dictionary entries are accessible with lower-case keys as well for backwards compatibility, however it's deprecated approach.

---

## Chapter 10. Universal event listeners

Since 2.10

This feature allows you to specify Groovy code, which decides when the event is created. Subsequently specified task is processed. So for each listener user specifies Groovy source code and task which will be processed if groovy code decides to.

*Table 10.1. Attributes of Universal message task*

Attribute	Description
Node ID to handle the event	This attribute makes sense only in cluster environment. It is node ID where the listener should be initialized. If it is not set, listener is initialized on all nodes in the cluster.
Interval of check in seconds	Periodicity of Groovy code execution.
Groovy code	Groovy code is used for deciding whether the event should be created or not. See below for details about groovy code.

---

### Groovy code

Groovy code is used for deciding whether the event should be created or not.

i.e. it may do some checks of data sources, which are vital for execution of graph. Or it may do some complex checks of running graph and make decision to kill it. It may call CloverETL Server core functions using ServerFacade interface, which is described in its own chapter.

Creating "event" is simple. If Groovy code returns Boolean.TRUE, event is created and specified task is processed. Otherwise, nothing happens. If groovy code throws an exception, it is considered as coding error and event is NOT created because of it. So if it is necessary, the exceptions must be handled in groovy code.

*Table 10.2. Variables accessible in groovy code*

type	key	description
java.util.Properties	properties	Empty container which may be filled by String-String key-value pairs in your Groovy code. It is passed to the task which may use them somehow. I.e. task "execute graph" passes these parameters to the executed graph.
java.util.Map<String, Object>	data	Empty container which may be filled by String-Object key-value pairs in your Groovy code. It is passed to the task which may use them somehow according to its implementation. I.e. task "execute graph" passes it to the executed graph as "dictionary entries". Please note that it is not serializable, thus if the task is relying on it, it can be processed properly only on the same cluster node.
javax.servlet.ServletContext	servletContext	instance of ServletContext
com.cloveretl.server.api.ServerFacade	serverFacade	instance of serverFacade usable for calling CloverETL Server core features.
String	sessionToken	sessionToken, needed for calling serverFacade methods

## Chapter 11. Manual task execution

Since 3.1

Manual task execution allows user to invoke task processing. Task is entity which describes how to react to some source event. So normally task is processed only as a response to some source event. Since 3.1 user can manually invoke task processing.

In addition user can specify some parameters to simulate source event which would normally trigger task processing. Following figure displays how could be simulated "file event". Parameters for various event sources are listed in section "Graph parameters"

The screenshot shows the CloverETL Server 3 web GUI. The header includes the CloverETL logo, the text "CloverETL Server 3 Enterprise ETL Runtime Environment", the server time "22. srpen 2012 12:11:12", and the node ID "node01 / cloverCluster". There are links for "Administrator", "en", "logout", and "Page complete". The navigation tabs are: Monitoring, Executions History, Sandboxes, Launch Services, Scheduling, Tasks History, Event Listeners, and Configuration. The "Manual Task Execution" tab is selected. The main content area is titled "Manual task execution" and contains a form. The form has a section for "Task parameters (simulation of the source event)" with a text area containing: `EVENT_FILE_PATH=/home/clover/data`, `EVENT_FILE_NAME=file.data`, and `EVENT_FILE_EVENT_TYPE=size`. Below this is a "Choose task type" section with three dropdown menus: "Start a graph" (selected), "Sandbox" (default), and "Graph" (graph/graphPartition.grf). There is also a "Parameters [key]=[value]<new line>" section with a text area. At the bottom left of the form is an "Execute task" button. The footer of the page says "Copyright © 2012 CloverETL created by Javlin All rights reserved."

Figure 11.1. Web GUI - "Manual task execution" section

## Chapter 12. File event listeners

Since 1.3

File event listener allows system to monitor changes on server filesystem. User may define, which filesystem resource should be observed as a source of file event. User also specifies task, which should be processed as reaction to change on filesystem.

There is process which performs checks for changes on file system. This process works with preconfigured periodicity, thus there is minimal interval which for checks. You can set this minimal interval by clover property "clover.event.fileCheckMinInterval".

In cluster environment, each event listener has attribute "node ID" which specifies cluster node, which checks its local filesystem. In "standalone" environment, "node ID" attribute is ignored.

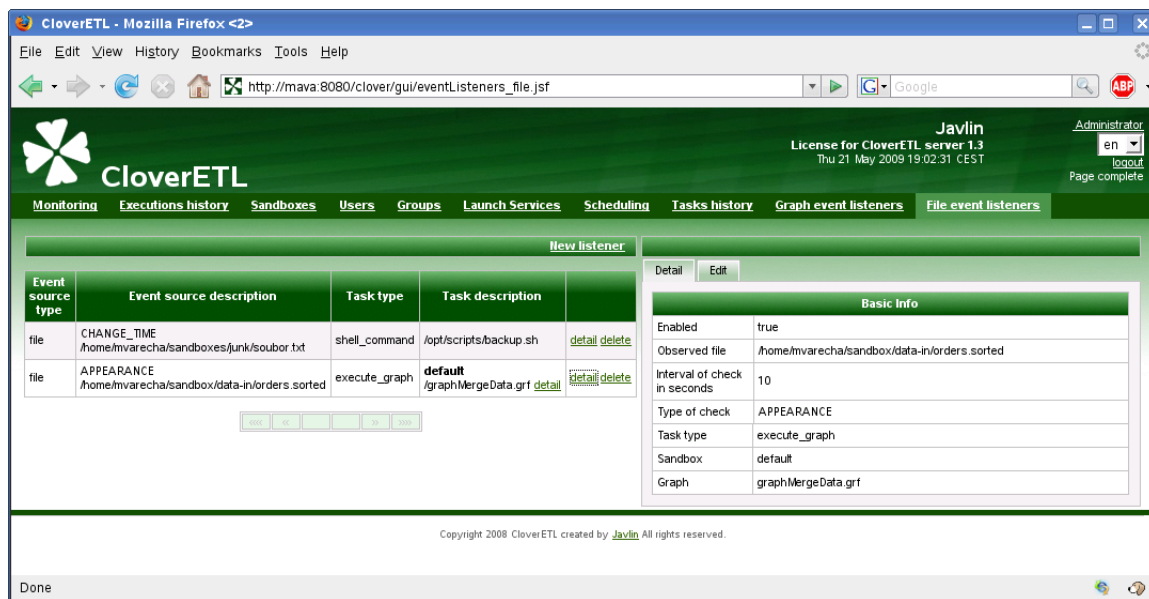


Figure 12.1. Web GUI - "File event listeners" section

### Observed file

Observed file is specified by directory path and file name pattern.

User may specify just one exact file name or file name pattern for observing more matching files in specified directory. If there are more changed files matching the pattern, separated event is triggered for each of these files.

There are three ways how to specify file name pattern of observed file(s)

- [Exact match](#) (p. 71)
- [Wildcards](#) (p. 71)
- [Regullar expression](#) (p. 72)

### Exact match

You specify exact name of the observed file.

### Wildcards

You can use wildcards common in most operating systems (\*, ?, etc.)

- \* - Matches zero or more instances of any character
- ? - Matches one instance of any character
- [...] - Matches any of characters enclosed by the brackets
- \ - Escape character

Examples

- \*.csv - Matches all CSV files
- input\_\*.csv - Matches i.e. input\_001.csv, input\_9.csv
- input\_???.csv - Matches i.e. input\_001.csv, but does not match input\_9.csv

---

## Regular expression

Examples

- (.\*?)(.jpg|jpeg|png|gif)\$ - Matches image files

---

## Notes

- It is strongly recommended to use absolute paths. It is possible to use relative path, but working directory depends on application server.
- Use forward slashes as file separators, even on MS Windows OS. Backslashes might be evaluated as escape sequences.

---

## File Events

For each listener you have to specify event type, which you are interested in.

There are four types of file events:

- [file APPEARANCE](#) (p. 72)
- [file DISAPPEARANCE](#) (p. 72)
- [file SIZE](#) (p. 73)
- [file CHANGE TIME](#) (p. 73)

---

### file APPEARANCE

Event of this type occurs, when the observed file is created or copied from another location between two checks. Please keep in mind, that event of this type occurs immediately when new file is detected, regardless it is complete or not. Thus task which may need complete file is executed when file is still incomplete. Recommended approach is to save file to the different location and when it is complete, move/rename to observed location where CloverETL Server may detect it. File moving/rename should be atomic operation.

Event of this type does not occur when the file has been updated (change of timestamp or size) between two checks. Appearance means that the file didn't exist during previous check and it exists now, during current check.

---

### file DISAPPEARANCE

Event of this type occurs, when observed file is deleted or moved to another location between two checks.

## file SIZE

---

Event of this type occurs when the size of the observed file has changed between two checks. Event of this type is never produced when file is created or removed. File must exist during both checks.

## file CHANGE\_TIME

---

Event of this type occurs, when change time of observed file has changed between two checks. Event of this type is never produced when file is created or removed. File must exist during both checks.

---

## Check interval, Task and Use cases

- User may specify minimal time interval between two checks. It is specified in seconds.
- Each listener defines task, which will be processed as the reaction for file event. All task types and their attributes are described in section Scheduling and GraphEventListeners
- • Graph Execution, when file with input data is accessible
  - Graph Execution, when file with input data is updated
  - Graph Execution, when file with generated data is removed and must be recreated

## How to use source of event during task processing

---

File, which caused event (considered as source of event) may be used during task processing. i.e. reader/writer components in graph transformations may refer to this file by special placeholders: `${EVENT_FILE_PATH}` - path to directory which contains event source `${EVENT_FILE_NAME}` - name of event source.

Please note that previous versions used lower-case placeholders. Since version 3.3, placeholders are upper-case, however lower-case still work for backward compatibility.

i.e. if event source is: `/home/clover/data/customers.csv`, placeholders will contain:  
`EVENT_FILE_PATH` - `/home/clover/data`, `EVENT_FILE_NAME` - `customers.csv`

For "graph execution" task this works only if the graph is not pooled. Thus "keep in pool interval" must be set to 0 (default value).

---

## Chapter 13. WebDAV

Since 3.1

WebDAV API allows user to use standard WebDAV clients for managing sandboxes content.

It allows specifically:

- browsing directory structure
- editing files
- removing files/folders
- renaming files/folders
- creating files/folders
- copying files
- moving files

It is accessible on URL "http://[host]:[port]/clover/webdav".

Although common www browsers can open this URL, most of them are not rich WebDAV clients, thus you can just see list of items, but you cannot browse the directory structure with common www browsers.

---

### WebDAV clients

There are many WebDAV clients for various operating systems, some OS support WebDAV natively.

#### Linux like OS

---

Great WebDAV client working on linux systems is Konqueror. Please use different protocol in the URL: webdav://[host]:[port]/clover/webdav

#### MS windows

---

Last distributions of MS Windows (Win XP and later) have native support for WebDAV. Unfortunately, it is more or less unreliable, so it is recommended to use some free or commercial WebDAV client.

- The best WebDAV client we've tested is BitKinex: <http://www.bitkinex.com/webdavclient>
- Another option is to use Total Commander (<http://www.ghisler.com/index.htm>) with WebDAV plugin: <http://www.ghisler.com/plugins.htm#filesys>

#### Mac OS

---

Mac OS supports WebDAV natively and in this case it should be without any problems. You can use "finder" application, select "Connect to the server ..." menu item and use URL with HTTP protocol: "http://[host]:[port]/clover/webdav".

---

### WebDAV authentication/authorization

CloverETL Server WebDAV API uses the HTTP Basic Authentication by default. However it may be reconfigured to use HTTP Digest Authentication. Please see the Configuration section for details.

Digest Authentication may be useful, since some WebDAV clients can't work with HTTP Basic Authentication, only with Digest Authentication.

HTTP Digest Authentication is feature added to the version 3.1. If you upgraded your older CloverETL Server distribution, users created before the upgrade cannot use the HTTP Digest Authentication until they reset their passwords. So when they reset their passwords (or the admin does it for them), they can use Digest Authentication as well as new users.

---

## Chapter 14. Simple HTTP API

This API is intended for all HTTP clients (even for the simplest ones - like wget tool). All operations are accessible using http GET method and return plain text. Thus response can be parsed by simple tools. If global security is on (default setting), BASIC HTTP authentication is required. Use CloverETL Server user with proper permissions.

Please note, that ETL graph related operations "graph\_run", "graph\_status" and "graph\_kill" work for jobflows as well.

URL has this pattern:

```
http://[domain]:[port]/[context]/[servlet]/[operation]?[param1]=[value1]&[param2]=[value2]...
```

For wget client, you can use following command line:

```
wget --user=$USER --password=$PASS -O ./$OUTPUT_FILE $REQUEST_URL
```

- [Operation help](#) (p. 76)
- [Operation graph\\_run](#) (p. 77)
- [Operation graph\\_status](#) (p. 77)
- [Operation graph\\_kill](#) (p. 78)
- [Operation server\\_jobs](#) (p. 79)
- [Operation sandbox\\_list](#) (p. 79)
- [Operation sandbox\\_content](#) (p. 79)
- [Operation executions\\_history](#) (p. 79)
- [Operation suspend](#) (p. 81)
- [Operation resume](#) (p. 81)
- [Operation sandbox\\_create](#) (p. 82)
- [Operation sandbox\\_add\\_location](#) (p. 82)
- [Operation sandbox\\_remove\\_location](#) (p. 82)
- [Cluster status](#) (p. 83)

---

### Operation help

#### parameters

no

#### returns

list of possible operations and parameters with its descriptions

**example**

```
http://localhost:8080/clover/request_processor/help
```

## Operation graph\_run

Call this operation to start execution of the specified job. Operation is called `graph_run` for backward compatibility, however it may execute ETL graph or jobflow.

**parameters**

Table 14.1. Parameters of `graph_run`

parameter name	mandatory	default	description
graphID	yes	-	Text Id, which is unique in specified sandbox. May be file path relative to sandbox root
sandbox	yes	-	Text ID of sandbox
additional graph parameters	no		Any URL parameter with "param_" prefix is passed to executed graph and may be used in graph XML as placeholder, but without "param_" prefix. i.e. "param_FILE_NAME" specified in URL may be used in the graph as \${FILE_NAME}. These parameters are resolved only during loading of graph XML, so graph cannot be pooled.
nodeID	no	-	In cluster mode it's ID of node which should execute the job. However it's not final. If the graph is distributed, or the node is disconnected, the graph may be executed on some another node.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

**returns**

run ID: incremental number, which identifies each execution request

**example**

```
http://localhost:8080/clover/request_processor/graph_run?graphID=graph/graphDBExecute.grf&sandbox=mva
```

## Operation graph\_status

Call this operation to obtain status of specified job execution. Operation is called `graph_status` for backward compatibility, however it may return status of ETL graph or jobflow.

**parameters**

Table 14.2. Parameters of graph\_status

parameter name	mandatory	default	description
runID	yes	-	Id of each graph execution
returnType	no	STATUS	STATUS   STATUS_TEXT   DESCRIPTION   DESCRIPTION_XML
waitForStatus	no	-	Status code which we want to wait for. If it is specified, this operation will wait until graph is in required status.
waitTimeout	no	0	If waitForStatus is specified, it will wait only specified amount of milliseconds. Default 0 means forever, but it depends on application server configuration. When the specified timeout expires and graph run still isn't in required status, server returns code 408 (Request Timeout). 408 code may be also returned by application server if its HTTP request timeout expires before.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

**returns**

Status of specified graph. It may be number code, text code or complex description in dependence of optional parameter returnType. Description is returned as plain text with pipe as separator, or as XML. Schema describing XML format of the XML response is accessible on CloverETL Server URL: [http://\[host\]:\[port\]/clover/schemas/executions.xsd](http://[host]:[port]/clover/schemas/executions.xsd) In dependence on waitForStatus parameter may return result immediately or wait for specified status.

**example**

```
http://localhost:8080/clover/request_processor/graph_status ->
-> ?runID=123456&returnType=DESCRIPTION&waitForStatus=FINISHED&waitTimeout=60000
```

## Operation graph\_kill

Call this operation to abort/kill job execution. Operation is called graph\_kill for backward compatibility, however it may abort/kill ETL graph or jobflow.

**parameters**

Table 14.3. Parameters of graph\_kill

parameter name	mandatory	default	description
runID	yes	-	Id of each graph execution
returnType	no	STATUS	STATUS   STATUS_TEXT   DESCRIPTION
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

**returns**

Status of specified graph after attempt to kill it. It may be number code, text code or complex description in dependence of optional parameter.

**example**

```
http://localhost:8080/clover/request_processor/graph_kill?runID=123456&returnType=DESCRIPTION
```

## Operation server\_jobs

### parameters

no

### returns

List of runIDs currently running jobs.

### example

```
http://localhost:8080/clover/request_processor/server_jobs
```

## Operation sandbox\_list

### parameters

no

### returns

List of all sandbox text IDs. In next versions will return only accessible ones.

### example

```
http://localhost:8080/clover/request_processor/sandbox_list
```

## Operation sandbox\_content

### parameters

Table 14.4. Parameters of sandbox\_content

parameter name	mandatory	default	description
sandbox	yes	-	text ID of sandbox
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

### returns

List of all elements in specified sandbox. Each element may be specified as file path relative to sandbox root.

### example

```
http://localhost:8080/clover/request_processor/sandbox_content?sandbox=mva
```

## Operation executions\_history

### parameters

Table 14.5. Parameters of executions\_history

parameter name	mandatory	default	description
sandbox	yes	-	text ID of sandbox
from	no		Lower datetime limit. Operation will return only records after(and equal) this datetime. Format: "yyyy-MM-dd HH:mm" (must be URL encoded)
to	no		Lower datetime limit. Operation will return only records after(and equal) this datetime. Format: "yyyy-MM-dd HH:mm" (must be URL encoded) status
status	no		Current execution status. Operation will return only records with specified STATUS. Meaningful values are RUNNING   ABORTED   FINISHED_OK   ERROR
sandbox	no		Sandbox code. Operation will return only records for graphs from specified sandbox.
graphId	no		Text Id, which is unique in specified sandbox. File path relative to sandbox root
orderBy	no		Attribute for list ordering. Possible values: id   graphId   finalStatus   startTime   stopTime. There is no ordering by default.
orderDescend	no	true	Switch which specifies ascending or descending ordering. If it is true (which is default), ordering is descending.
returnType	no	IDs	Possible values are: IDs   DESCRIPTION   DESCRIPTION_XML
index	no	0	Index of the first returned records in whole record set. (starting from
records	no	infinite	Max amount of returned records.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

**returns**

List of executions according to filter criteria.

For returnType==IDs returns simple list of runIDs (with new line delimiter).

For returnType==DESCRIPTION returns complex response which describes current status of selected executions, their phases, nodes and ports.

```

execution|[runID]|[status]|[username]|[sandbox]|[graphID]|[startedDatetime]|[finishedDatetime]|[clusterNode]|[graph
phase]|[index]|[execTimeInMilis]
node|[nodeID]|[status]|[totalCpuTime]|[totalUserTime]|[cpuUsage]|[peakCpuUsage]|[userUsage]|[peakUserUsage]
port|[portType]|[index]|[avgBytes]|[avgRows]|[peakBytes]|[peakRows]|[totalBytes]|[totalRows]
```

**example of request**

```

http://localhost:8080/clover/request_processor/executions_history ->
-> ?from=&to=2008-09-16+16%3A40&status=&sandbox=def&graphID=&index=&records=&returnType=DESCRIPTION
```

**example of DESCRIPTION (plain text) response**

```

execution|13108|FINISHED_OK|clover|def|test.grf|2008-09-16 11:11:19|2008-09-16 11:11:58|nodeA|2.4
```

```

phase|0|38733
node|DATA_GENERATOR1|FINISHED_OK|0|0|0.0|0.0|0.0|0.0
port|Output|0|0|0|0|0|130|10
node|TRASH0|FINISHED_OK|0|0|0.0|0.0|0.0|0.0
port|Input|0|0|0|5|0|130|10
node|SPEED_LIMITER0|FINISHED_OK|0|0|0.0|0.0|0.0|0.0
port|Input|0|0|0|0|0|130|10
port|Output|0|0|0|5|0|130|10
execution|13107|ABORTED|clover|def|test.grf|2008-09-16 11:11:19|2008-09-16 11:11:30
phase|0|11133
node|DATA_GENERATOR1|FINISHED_OK|0|0|0.0|0.0|0.0|0.0
port|Output|0|0|0|0|0|130|10
node|TRASH0|RUNNING|0|0|0.0|0.0|0.0|0.0
port|Input|0|5|0|5|0|52|4
node|SPEED_LIMITER0|RUNNING|0|0|0.0|0.0|0.0|0.0
port|Input|0|0|0|0|0|130|10
port|Output|0|5|0|5|0|52|4

```

For `returnType==DESCRIPTION_XML` returns complex data structure describing one or more selected executions in XML format. Schema describing XML format of the XML response is accessible on CloverETL Server URL: `http://[host]:[port]/clover/schemas/executions.xsd`

## Operation suspend

Suspends server or sandbox(if specified). Suspension means, that no graphs may be executed on suspended server/sandbox.

### parameters

Table 14.6. Parameters of suspend

parameter name	mandatory	default	description
sandbox	no	-	Text ID of sandbox to suspend. If not specified, it suspends whole server.
atonce	no		If this param is set to true, running graphs from suspended server(or just from sandbox) are aborted. Otherwise it can run until it is finished in common way.

### returns

Result message

## Operation resume

### parameters

Table 14.7. Parameters of resume

parameter name	mandatory	default	description
sandbox	no	-	Text Id of sandbox to resume. If not specified, server will be resumed.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

### returns

Result message

## Operation sandbox\_create

This operation creates specified sandbox. If it's sandbox of "partitioned" or "local" type, create also locations by "sandbox\_add\_location" operation.

### parameters

Table 14.8. Parameters of sandbox create

parameter name	mandatory	default	description
sandbox	yes	-	Text Id of sandbox to be created.
path	no	-	Path to the sandbox root if server is running in standalone mode.
type	no	shared	Sandbox type: shared   partitioned   local. For standalone server may be left empty, since the default "shared" is used.
createDirs	no	true	Switch whether to create directory structure of the sandbox (only for standalone server or "shared" sandboxes in cluster environment).
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

### returns

Result message

## Operation sandbox\_add\_location

This operation adds location to specified sandbox. Only useable for sandboxes of type partitioned or local.

### parameters

Table 14.9. Parameters of sandbox add location

parameter name	mandatory	default	description
sandbox	yes	-	Sandbox which we want to add location to.
nodeId	yes	-	Location attribute - node which has direct access to the location.
path	yes	-	Location attribute - path to the location root on the specified node.
location	no	-	Location attribute - location storage ID. If it's not specified, new one will be generated.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

### returns

Result message

## Operation sandbox\_remove\_location

This operation removes location from specified sandbox. Only sandboxes of type partitioned or local can have locations associated.

**parameters***Table 14.10. Parameters of sandbox add location*

parameter name	mandatory	default	description
sandbox	yes	-	Removes specified location from its sandbox.
location	yes	-	Location storage ID. If the specified location isn't attached to the specified sandbox, sandbox won't be changed.
verbose	no	MESSAGE	MESSAGE   FULL - how verbose should possible error message be.

**returns**

Result message

---

## Cluster status

This operation displays cluster's nodes list.

**parameters**

no

**returns**

Cluster's nodes list.

---

## Chapter 15. JMX mBean

CloverETL Server JMX mBean is API, which is useful for monitoring of CloverETL Server's internal status.

MBean is registered with name:

```
com.cloveretl.server.api.jmx:name=cloverServerJmxMBean
```

---

### JMX configuration

Application's JMX MBeans aren't accessible outside of JVM by default. It needs some changes in application server configuration to make them accessible.

This section describes how to configure JMX Connector for development and testing. Thus authentication may be disabled. For production deployment authentication should be enabled. Please refer further documentation to see how to achieve this. i.e. <http://java.sun.com/j2se/1.5.0/docs/guide/management/agent.html#auth>

Configurations and possible problems:

- [How to configure JMX on Apache Tomcat](#) (p. 84)
- [How to configure JMX on Glassfish](#) (p. 85)
- [Websphere 7](#) (p. 86)
- [Possible problems](#) (p. 87)

---

### How to configure JMX on Apache Tomcat

Tomcat's JVM must be executed with these self-explanatory parameters:

1. `-Dcom.sun.management.jmxremote=true`
2. `-Dcom.sun.management.jmxremote.port=8686`
3. `-Dcom.sun.management.jmxremote.ssl=false`
4. `-Dcom.sun.management.jmxremote.authenticate=false`

On UNIX like OS set environment variable CATALINA\_OPTS i.e. like this:

```
export CATALINA_OPTS="-Dcom.sun.management.jmxremote=true
-Dcom.sun.management.jmxremote.port=8686
-Dcom.sun.management.jmxremote.ssl=false
-Dcom.sun.management.jmxremote.authenticate=false"
```

File TOMCAT\_HOME/bin/setenv.sh (if it does not exist, you may create it) or TOMCAT\_HOME/bin/catalina.sh

On Windows it might be tricky, that each parameter must be set separately:

```
set CATALINA_OPTS=-Dcom.sun.management.jmxremote=true
set CATALINA_OPTS=%CATALINA_OPTS% -Dcom.sun.management.jmxremote.port=8686
set CATALINA_OPTS=%CATALINA_OPTS% -Dcom.sun.management.jmxremote.authenticate=false
```

```
set CATALINA_OPTS=%CATALINA_OPTS% -Dcom.sun.management.jmxremote.ssl=false
```

File TOMCAT\_HOME/bin/setenv.bat (if it does not exist, you may create it) or TOMCAT\_HOME/bin/catalina.bat

With these values, you can use URL

```
service:jmx:rmi:///jndi/rmi://localhost:8686/jmxrmi
```

for connection to JMX server of JVM. No user/password is needed

## How to configure JMX on Glassfish

Go to Glasfish admin console (by default accessible on <http://localhost:4848> with admin/adminadmin as user/password)

Go to section "Configuration" > "Admin Service" > "system" and set attributes like this:

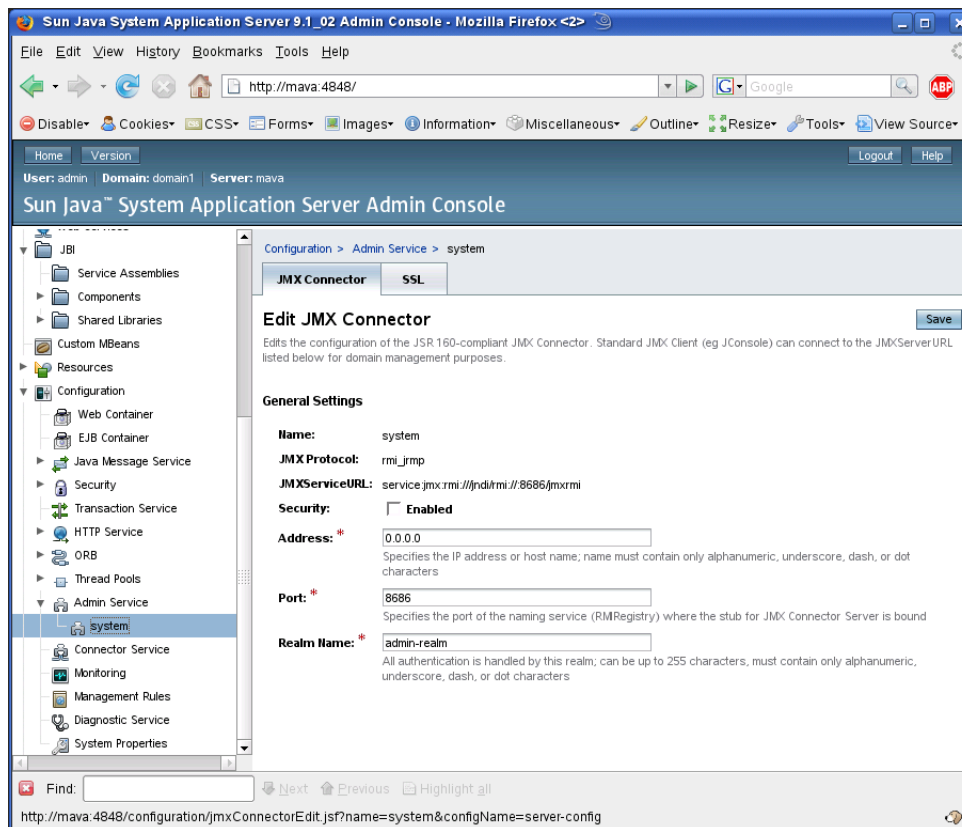


Figure 15.1. Glassfish JMX connector

With these values, you can use URL

```
service:jmx:rmi:///jndi/rmi://localhost:8686/jmxrmi
```

for connection to JMX server of JVM.

Use admin/adminadmin as user/password. (admin/adminadmin are default glassfish values)

## How to configure JMX on Websphere

Websphere does not require any special configuration, but the clover MBean is registered with the name, that depends on application server configuration:

```
com.cloveretl.server.api.jmx:cell=[cellName],name=cloverServerJmxMBean,node=[nodeName],
process=[instanceName]
```

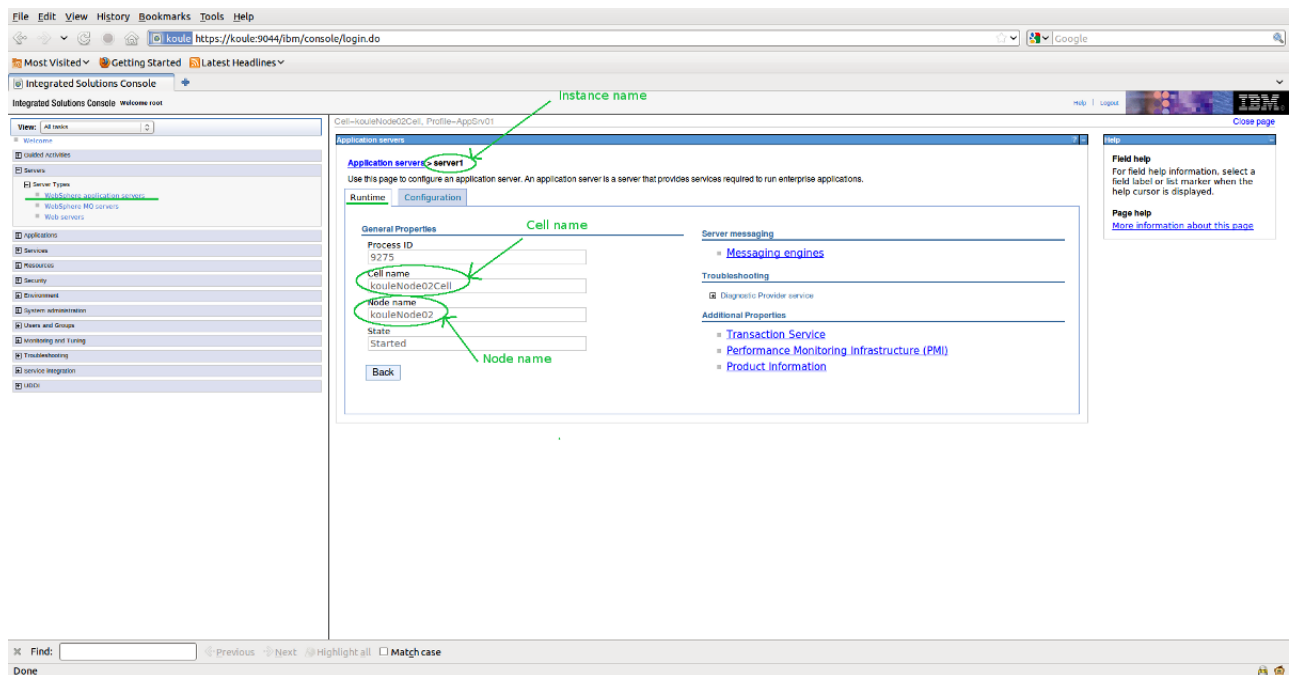


Figure 15.2. Websphere configuration

## Websphere 7

URL for connecting to JMX server is:

```
service:jmx:iiop://[host]:[port]/jndi/JMXConnector
```

where *host* is the host name you are connecting to and *port* is RMI port number. If you have a default Websphere installation, the JNDI port number will likely be 2809, 2810, ... depending on how many servers there are installed on one system and the specific one you want to connect to. To be sure, when starting Websphere, check the logs, as it will dump a line like

```
0000000a RMICConnectorC A   ADMC0026I: The RMI Connector is available at port 2810
```

## How to configure JMX on Websphere7

Websphere does not require any special configuration, but the clover MBean is registered with the name, that depends on application server configuration:

```
com.cloveretl.server.api.jmx:cell=[cellName],name=cloverServerJmxMBean,node=[nodeName],
process=[instanceName]
```

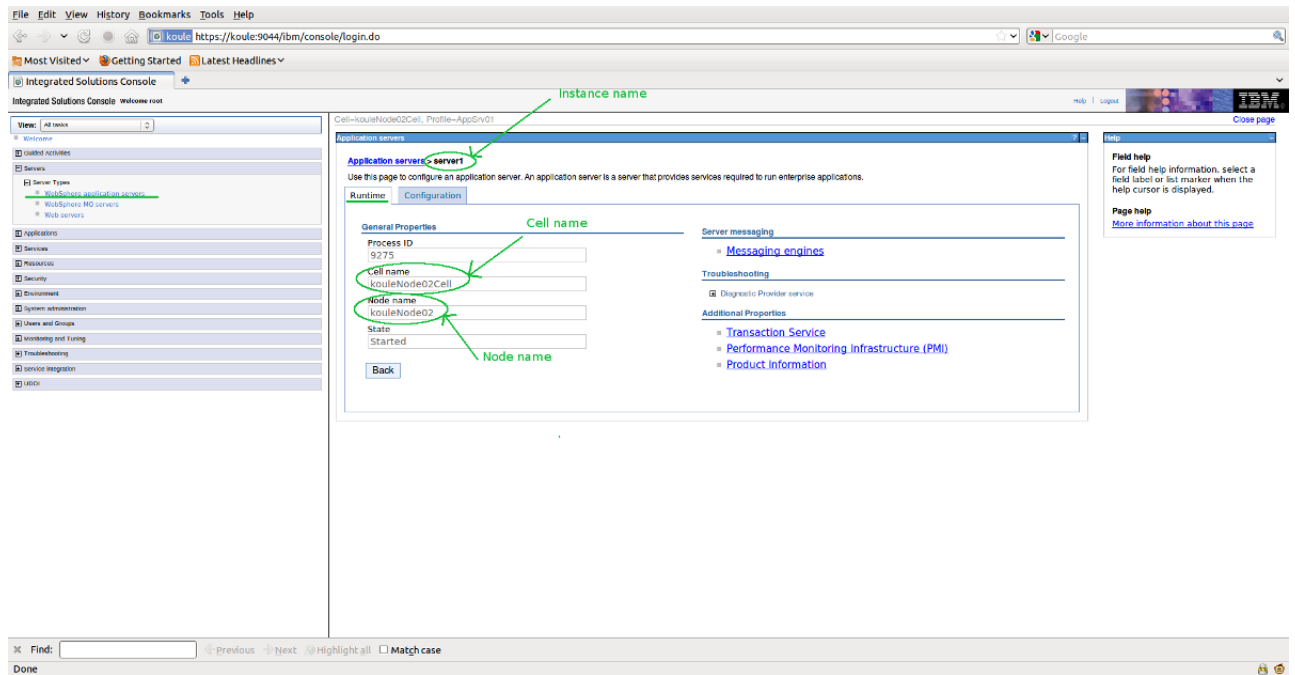


Figure 15.3. Websphere7 configuration

URL for connecting to JMX server is:

```
service:jmx:iiop://[host]:[port]/jndi/JMXConnector
```

where *host* is the host name you are connecting to and *port* is RMI port number. If you have a default Websphere installation, the JNDI port number will likely be 2809, 2810, ... depending on how many servers there are installed on one system and the specific one you want to connect to. To be sure, when starting Websphere, check the logs, as it will dump a line like

```
0000000a RMICConnectorC A   ADMC0026I: The RMI Connector is available at port 2810
```

You will also need to set on the classpath following jar files from Websphere home directory:

```
/runtimes/com.ibm.ws.admin.client_7.0.0.jar
/runtimes/com.ibm.ws.ejb.thinclient_7.0.0.jar
/runtimes/com.ibm.ws.orb_7.0.0.jar
```

## Possible problems

- Default JMX mBean server uses RMI as a transport protocol. Sometimes RMI cannot connect remotely when one of peers uses Java version 1.6. Solution is quite easy, just set these two system properties: `-Djava.rmi.server.hostname=[hostname or IP address]` - `-Djava.net.preferIPv4Stack=true`

## Operations

For details about operations please see the JavaDoc of the MBean interface:

JMX API MBean JavaDoc is accessible in the running CloverETL Server instance on URL: `http://[host]:[port]/[contextPath]/javadoc-jmx/index.html`

---

## Chapter 16. SOAP WebService API

CloverETL Server SOAP Web Service is API, which allows its clients to manipulate with content of the sandboxes, to monitor status of executed graphs and more.

Service is accessible on URL:

```
http://[host]:[port]/clover/webservice
```

Service descriptor is accessible on URL:

```
http://[host]:[port]/clover/webservice?wsdl
```

Protocol HTTP can be changed to secured HTTPS according to web server configuration.

---

### SOAP WS Client

Exposed service is implemented with the most common binding style "document/literal", which is widely supported by libraries in various programming languages.

To create client for this API, only WSDL document (see the URL above) is needed together with some development tools according to your programming language and development environments.

JavaDoc of WebService interface with all related classes is accessible in the running CloverETL Server instance on URL `http://[host]:[port]/[contextPath]/javadoc-ws/index.html`

If the web server has HTTPS connector configured, also the client must meet the security requirements according to web server configuration. i.e. client trust + key stores configured properly

---

### SOAP WS API authentication/authorization

Since exposed service is stateless, authentication "sessionToken" has to be passed as parameter to each operation. Client can obtain authentication sessionToken by calling "login" operation.

---

## Chapter 17. Launch Service

The **Launch Service** provides users with convenient way of remotely executing the CloverETL graphs or Jobflows via a simple web-based interface.

The Launch Services can be used with any HTTP client. This allows for convenient control of the job execution which can be easily tied to external tools if necessary (requests can be sent from custom applications as well).

---

### Launch Service Overview

The architecture of Launch Service is relatively simple and follows the basic design of multi-tiered applications utilizing the browser.

The Launch Service and underlying CloverETL Server jobs may work as back-end for any front-end. It may be client's web application or third party application which calls CloverETL Launch Service by HTTP request. Thus Launch Services allow full customization of the outside appearance of the web - for example, it can be a simple web form which communicates with users in the terminology they are familiar with.

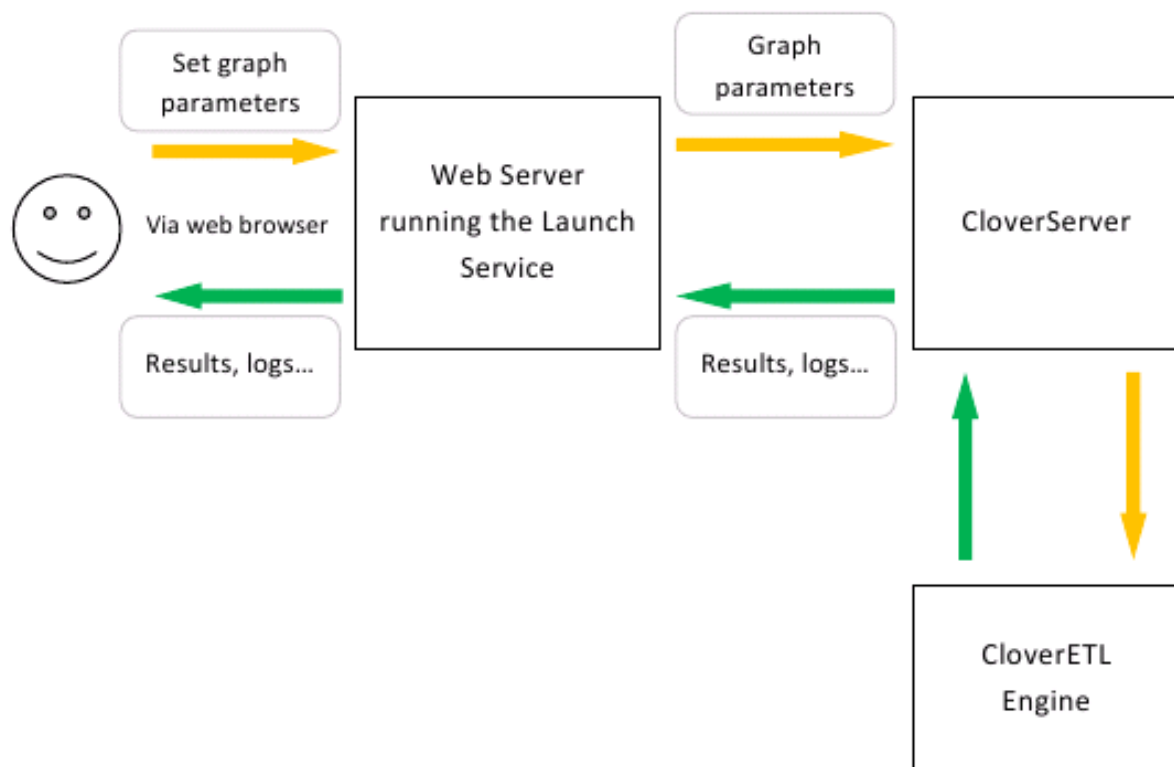


Figure 17.1. Launch Services and CloverETL Server as web application back-end

---

### Deploying Graph in Launch Service

To enable users to access the specific job via Launch Service, several steps have to be taken:

1. The job has to be designed to allow its parameters to be passed via dictionary.
2. The job has to be configured in CloverETL Server in Launch Service section.
3. The form which will submit the data to Launch Service has to be written.

Overall the deployment of the job to the Launch Service is not much more complex compared to the regular job development process. In following chapters all the steps will be described in more detail alongside some basic examples.

---

## Designing the ETL graph/Jobflow for Launch Service

To use the jobs from Launch Service, the Launch Service requires the job to use dictionary when parameters have to be passed to the job. Dictionary is a data storage associated with each run of the job in CloverETL. For more details about the dictionary see section "Dictionary" in CloverETL Designer docs.

To use the Dictionary from the Launch Service, the job author is required to specify the entries of the dictionary in job's XML source file. For more details about the Dictionary XML element see section "Dictionary" in CloverETL Designer docs.

Apart from the use of the dictionary, the Launch Service does not impose any other restriction on the jobs it should run. The jobs can therefore use all the facilities provided by the CloverETL engine.

---

## Configuring the job in CloverETL Server web GUI

To notify the Launch Service about the jobs that will be available via its interface, the Launch Service has to be properly configured via CloverETL Server GUI.

Launch Service uses launch configurations to store the details about how each job can be run. Each launch configuration contains full description of the job's parameters, how they are mapped to the parameters passed from the web interface and so on.

Each launch configuration is identified by its name, user and group restriction. Several configurations with the same name can be created as long as they differ in their user or group restrictions.

User restrictions can be used to launch different jobs for different users even though they use the same launch configuration (for example, the developers may want to use debug version of the job while the end customers will want to use the production job). The user restriction can also be used to prohibit certain users from executing the launch configuration.

Similarly, the group restriction can be used to differentiate jobs based on the group membership of the user which runs the launch configuration.

When the configuration is launched, the correct configuration is picked based on the configuration name, user specification and group specification. If multiple configuration match the current user/group and configuration name, the most specific one is picked (the user name has higher priority than the group name).

---

## Adding New Launch Configuration

New launch configurations can be added by clicking on New launch configuration link on the Launch Services tab in CloverETL Server GUI:

**CloverETL Server 3**  
Enterprise ETL Runtime Environment

**CloverETL Server**  
Server time (browser time-zone): 22. srpen 2012 13:40:22  
Node ID / Cluster group name **node01 / cloverCluster**

Administrator  
en  
logout  
Page complete

**Monitoring Executions History Sandboxes Launch Services Scheduling Tasks History Event Listeners Configuration**

**New launch configuration**

Name	Description	Group	User			
glossary				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
mountains				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
mountains			user1	<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
mountains-upload				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
ascents-everest				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
product-search				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>
product-insert				<a href="#">detail</a>	<a href="#">test</a>	<a href="#">delete</a>

**Overview Edit configuration Edit parameters**

**Overview**

Name	glossary
Description	
Group	
User	
Sandbox	default
Job file	graph/graphDeardorffGlossarySearch.grf
Save run record	true
Display error message detail	false

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Figure 17.2. Launch Services section

After the configuration has been created it will appear in the table on the left side among the other existing configuration. Before using the configuration user will have to add parameter mapping. To add parameter mappings click on the detail link for the newly created configuration. The details will be displayed on the right side of the window in a simple table:

**Overview Edit configuration Edit parameters**

**Overview**

Name	mountains
Description	
Group	
User	user1
Sandbox	default
Job file	graph/graphMountainsXLS.grf
Save run record	true
Display error message detail	true

Figure 17.3. Overview tab

The Overview tab shows the basic details about the launch configuration. These can be modified in the Edit Configuration tab:

The screenshot shows the 'Edit configuration' tab with the following fields and values:

Field	Value
Name	mountains
Description	
Group	
User	user1
Sandbox	default
Job file	graph/graphMountainsXLS.grf
Save run record	<input checked="" type="checkbox"/>
Display error message detail	<input checked="" type="checkbox"/>

An 'Update' button is located at the bottom left of the form.

Figure 17.4. Edit Configuration tab

Following fields can be modified:

- *Name* - is the name under which the configuration will be accessible from web.
- *Description* - the description of the configuration.
- *Group* - restricts the configuration to specific group of users.
- *User* - restricts the configuration to specified user.
- *Sandbox* - selects the CloverETL Sandbox in which the configuration will be launched.
- *Job file* - selects the job to run when the configuration is launched.
- *Save run record* - if checked, the details about the launch configuration will be visible in Execution History in the CloverETL Server GUI. If unchecked, the job executions will not be logged and will not be displayed in the Execution History.
- *Display error message detail* - if checked, detailed error messages will be displayed in case the launch fails. If unchecked, only simpler messages will be displayed to the user.

Finally, the tab Edit Parameters can be used to configure parameter mappings for the launch configuration. The mappings are required for the Launch Service to be able to correctly assign parameters values based on the values sent in the launch request.

The screenshot shows the 'Edit parameters' tab with a 'New property' link. Below it is a table with headers: Name, Request parameter, Parameter required, Pass to job, and Default value. Under this table is a 'Create parameter' form. The form has the following fields:

- Name: heightMin (integer) (dropdown)
- Request parameter: (text input)
- Parameter required: ☐
- Trim parameter value: ☒
- Empty parameter is null: ☒
- Parameter format: (text input)
- Parameter locale: (text input)
- Default value: (text input)
- Pass to job: ☐
- Create button

Figure 17.5. Creating new parameter

To add new parameter mapping click on the New property link. Each property required by the job has to be created (internal job properties do not need mappings).

The screenshot shows the 'Edit parameters' tab with a 'New property' link. Below it is a table with the following data:

Name	Request parameter	Parameter required	Pass to job	Default value		
heightMin		true	false		<a href="#">delete</a>	<a href="#">detail</a>

Figure 17.6. Edit Parameters tab

Following fields are available for each property:

- *Name* - the name of the property in the job's dictionary.
- *Request parameter* - the name of the parameter as specified in the launch request generated by the request page. This name can be different than the name used in job's dictionary.
- *Parameter required* - if checked the parameter is mandatory and error will be reported if it is omitted.
- *Pass to job* - if checked the parameter will be also passed to job among the additional parameters as well as in the dictionary. In such case, the parameter can also be referenced as `${ParameterName}` in the job's XML file. Since the additional parameters are resolved when the XML file is parsed, the job which use this method cannot be pooled.
- *Default value* - is the default value which will be applied in case the parameter is omitted in the launch request.

To create the new mapping, click on the Create button after all the fields have been filled. After the mapping is created, it will be displayed in the list of existing mappings. It can be later edited or deleted by clicking on appropriate links.

## Sending the Data to Launch Service

To launch the job which has been configured for use with Launch Service, the user has to send a launch request. The launch request can be sent via HTTP GET or POST methods. A launch request is simply an URL which contains the values of all parameters that should be passed to the job. The request URL is composed of several parts:

`[Clover Context]/launch/[Configuration name]?[Parameters]`

- `[Clover Context]` is the URL to the context in which the CloverETL is running. Usually this is the full URL to CloverETL Server (for example, for CloverETL Demo Server this would be <http://server-demo.cloveretl.com:8080/clover>).
- `[Configuration name]` is the name of the launch configuration which has been specified when the configuration has been created. In our example, this would be set to NewMountains (distinction between upper- and lower-case is important).
- `[Parameters]` is the list of parameters the configuration requires in the format used for example by PHP. Therefore the parameter list is a list of name-value pairs separated by "&" character. Each name-value pair is specified as `[name]=[value]` where value has to be properly encoded according to RFC 1738 to make sure URL is valid.

Based on the above, the full URL of launch request for our example with mountains may be like this: <http://server-demo.cloveretl.com:8080/clover/launch/NewMountains?heightMin=4000>. In the request above, the value of heightMin property is set to 4000.

---

## Results of the Graph Execution

After the job's run terminates, the results are sent back to the HTTP client as a content of HTTP response. The output is partially defined in the dictionary which is declared in the job's XML file. The dictionary can mark selected parameters as output parameters. All the output parameters are sent to the user after the job execution is finished.

Depending on the number of output parameters, the following output is sent to the HTTP client:

- *No output parameters* - only summary page is returned. The format of the summary page cannot be customized. The page will contain details like when the job was started, when it finished, user name and so on.
- *One output parameter* - in this case the output is sent to the HTTP client with its content type defined by the property type in the dictionary.
- *Multiple output parameters* - in this case each output parameter is sent to the HTTP client as a part of multipart HTTP response. The content type of the response is either multipart/related or multipart/x-mixed-replace depending on the HTTP client (the client detection is of course fully automatic). The multipart/related type is used for browsers based on Microsoft Internet Explorer, the multipart/x-mixed-replace is sent to browsers based on Gecko or Webkit.

Launch requests are recorded in the log files in directory specified by `launch.log.dir` property in CloverETL Server configuration. For each launch configuration one log file named `[Configuration name]#[Launch ID].log` is created. For each launch request this file will contain only one line with following tab-delimited fields:

If the property `launch.log.dir` is not specified, log files are created in temp directory `[java.io.tmpdir]/cloverlog/launch`. Where "java.io.tmpdir" is system property.

- *Launch start time*
- *Launch end time*
- *Logged-in user name*

- *Run ID*
- *Execution status* FINISHED\_OK, ERROR or ABORTED
- *IP Address* of the client
- *User agent* of the HTTP client
- *Query string* passed to the Launch Service (full list of parameters of the current launch)

In case the configuration is not valid, the same launch details are saved into the `_no_launch_config.log` file in the same directory. All unauthenticated requests are saved to the same file as well.

---

## Chapter 18. Configuration

Default installation (without any configuration) is recommended only for evaluation purposes. For production, at least DB connection and SMTP server configuration is recommended.

---

### Config Sources and Their Priorities

There are several sources of configuration properties. If property isn't set, application default is used.

Warning: Do not combine sources specified below. Configuration becomes confusing and maintenance will be much more difficult.

---

### Context Parameters (Available on Apache Tomcat)

Some application servers allow to set context parameters without modification of WAR file. This way of configuration is possible and recommended for Tomcat.

#### Example for Apache Tomcat

On Tomcat it is possible to specify context parameters in context configuration file. `[tomcat_home]/conf/Catalina/localhost/clover.xml` which is created automatically just after deployment of CloverETL Server web application.

You can specify property by adding this element:

```
<Parameter name="[propertyName]" value="[propertyValue]" override="false" />
```

---

### Environment Variables

Set environment variable with prefix `clover.`, i.e. `(clover.config.file)`

Some operating systems may not use dot character, so also underlines (`_`) may be used instead of dots (`.`). So the `clover_config_file` works as well.

---

### System Properties

Set system property with prefix `clover.`, i.e. `(clover.config.file)`

Also underlines (`_`) may be used instead of dots (`.`) so the `clover_config_file` works as well.

---

### Properties File on default Location

Source is common properties file (text file with key-value pairs):

```
[property-key]=[property-value]
```

By default CloverETL tries to find config file `[workingDir]/cloverServer.properties`.

---

### Properties File on specified Location

The same as above, but properties file is not loaded from default location, because its location is specified by environment variable or system property `clover_config_file` or `clover.config.file`. This is recommended way of configuration if context parameters cannot be set in application server.

## Modification of Context Parameters in web.xml

---

Unzip `clover.war` and modify file `WEB-INF/web.xml`, add this code:

```
<context-param>
  <param-name>[property-name]</param-name>
  <param-value>[property-value]</param-value>
</context-param>
```

This way isn't recommended, but it may be useful when none of above ways is possible.

## Priorities of config Sources

---

Configuration sources have these priorities:

1. context parameters (specified in application server or directly in `web.xml`)
2. external config file CS tries to find it in this order (only one of them is loaded):
  - path specified by context parameter `config.file`
  - path specified by system property `clover_config_file` or `clover.config.file`
  - path specified by environment variable `clover_config_file` or `clover.config.file`
  - default location (`[workingDir]/cloverServer.properties`)
3. system properties
4. environment variables
5. default values

---

## Examples of DB Connection Configuration

Configuration of DB connection is optional. Embedded Apache Derby DB is used by default and it is sufficient for evaluation. However, configuration of external DB connection is strongly recommended for production deployment. It is possible to specify common JDBC DB connection attributes (URL, username, password) or JNDI location of DB `DataSource`.

Configurations and their changes may be as follows:

- [Embedded Apache Derby](#) (p. 97)
- [MySQL](#) (p. 98)
- [DB2](#) (p. 98)
- [Oracle](#) (p. 100)
- [MS SQL](#) (p. 101)
- [Postgre SQL](#) (p. 101)
- [JNDI DB DataSource](#) (p. 101)

## Embedded Apache Derby

---

Apache Derby embedded DB is used with default CloverETL Server installation. It uses working directory as storage directory for data persistence by default. This may be problem on some systems. In case of any problems

with connecting to Derby DB, we recommend you configure connection to external DB or at least specify Derby home directory:

Set system property `derby.system.home` to set path which is accessible for application server. You can specify this system property by this JVM execution parameter:

```
-Dderby.system.home=[derby_DB_files_root]
```

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=org.apache.derby.jdbc.EmbeddedDriver
jdbc.url=jdbc:derby:databases/cloverDb;create=true
jdbc.username=
jdbc.password=
jdbc.dialect=org.hibernate.dialect.DerbyDialect
```

Take a closer look at the `jdbc.url` parameter. Part `databases/cloverDb` means a subdirectory for DB data. This subdirectory will be created in the directory which is set as `derby.system.home` (or in the working directory if `derby.system.home` is not set). Value `databases/cloverDb` is a default value, you may change it.

## MySQL

---

CloverETL Server requires MySql 5.x

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=com.mysql.jdbc.Driver
jdbc.url=jdbc:mysql://127.0.0.1:3306/clover?useUnicode=true&characterEncoding=utf8
jdbc.username=root
jdbc.password=
jdbc.dialect=org.hibernate.dialect.MySQLDialect
```

Since 3.0 JDBC driver is not included in CloverETL Server web archive, thus it must be added to the application server classpath.

Create DB with proper charset, like this:

```
CREATE DATABASE IF NOT EXISTS clover DEFAULT CHARACTER SET 'utf8';
```

## DB2

---

### DB2 on Linux/Windows

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=com.ibm.db2.jcc.DB2Driver
jdbc.url=jdbc:db2://localhost:50000/clover
jdbc.username=usr
jdbc.password=pwd
jdbc.dialect=org.hibernate.dialect.DB2Dialect
```

## Possible problems

### Wrong pagesize

Database *clover* has to be created with suitable `PAGESIZE`. DB2 has several possible values for this property: 4096, 8192, 16384 or 32768.

CloverETL Server should work on DB with `PAGESIZE` set to 16384 or 32768. If `PAGESIZE` value is not set properly, there should be error message in the log file after failed CloverETL Server startup:

```
ERROR:
DB2 SQL Error: SQLCODE=-286, SQLSTATE=42727, SQLERRMC=16384;
ROOT, DRIVER=3.50.152
```

`SQLERRMC` contains suitable value for `PAGESIZE`.

You can create database with proper `PAGESIZE` like this:

```
CREATE DB clover PAGESIZE 32768;
```

### The table is in the reorg pending state

After some `ALTER TABLE` commands, some tables may be in "reorg pending state". This behaviour is specific for DB2. `ALTER TABLE` DDL commands are executed only during the first start of new CloverETL Server version.

Error message for this issue may look like this:

```
Operation not allowed for reason code "7" on table "DB2INST2.RUN_RECORD"..
SQLCODE=-668, SQLSTATE=57016
```

or like this

```
DB2 SQL Error: SQLCODE=-668, SQLSTATE=57016, SQLERRMC=7;DB2INST2.RUN_RECORD, DRIVER=3.50.152
```

In this case "RUN\_RECORD" is table name which is in "reorg pending state" and "DB2INST2" is DB instance name.

To solve this, go to DB2 console and execute command (for table `run_record`):

```
reorg table run_record
```

DB2 console output should look like this:

```
db2 => connect to clover1
Database Connection Information

Database server          = DB2/LINUX 9.7.0
SQL authorization ID     = DB2INST2
Local database alias     = CLOVER1

db2 => reorg table run_record
DB20000I  The REORG command completed successfully.
db2 => disconnect clover1
DB20000I  The SQL DISCONNECT command completed successfully.
```

"clover1" is DB name

### DB2 does not allow `ALTER TABLE` which trims DB column length.

This problem depends on DB2 configuration and we've experienced this only on some AS400s so far. CloverETL Server applies set of DP patches during the first installation after application upgrade. Some of these patches

may apply column modifications which trims length of the text columns. These changes never truncate any data, however DB2 does not allow this since it "may" truncate some data. DB2 refuses these changes even in DB table which is empty. Solution is, to disable the DB2 warning for data truncation, restart CloverETL Server which applies patches, then enable DB2 warning again.

## DB2 on AS/400

The connection on AS/400 might be slightly different.

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=com.ibm.as400.access.AS400JDBCDriver
jdbc.username=javlin
jdbc.password=clover
jdbc.url=jdbc:as400://host/cloversrv;libraries=cloversrv;date format=iso
jdbc.dialect=org.hibernate.dialect.DB2400Dialect
```

Use credentials of your OS user for `jdbc.username` and `jdbc.password`.

`cloversrv` in `jdbc.url` above is the name of the DB schema.

You can create schema in AS/400 console:

- execute command STRSQL (**SQL console**)
- execute `CREATE COLLECTION cloversrv IN ASP 1`
- `cloversrv` is the name of the DB schema and it may be at most 10 characters long

Proper JDBC driver must be in the application server classpath.

I use JDBC driver `jt400ntv.jar`, which I've found in `/QIBM/ProdData/Java400` on the server.

Use `jt400ntv.jar` JDBC driver.

Do not forget to add jar with JDBC driver to the Tomcat classpath.

## Oracle

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=oracle.jdbc.OracleDriver
jdbc.url=jdbc:oracle:thin:@host:1521:db
jdbc.username=user
jdbc.password=pass
jdbc.dialect=org.hibernate.dialect.Oracle9Dialect
```

Do not forget to add jar with JDBC driver to the application server classpath.

Since CloverETL Server version 1.2.1, dialect `org.hibernate.dialect.Oracle10gDialect` is no longer available. Please use `org.hibernate.dialect.Oracle9Dialect` instead.

These are privileges which have to be granted to schema used by CloverETL Server:

```
CONNECT
CREATE SESSION
CREATE/ALTER/DROP TABLE
CREATE/ALTER/DROP SEQUENCE
```

```
QUOTA UNLIMITED ON <user_tablespace>;
QUOTA UNLIMITED ON <temp_tablespace>;
```

## MS SQL

Ms SQL requires configuration of DB server.

- Allowing of TCP/IP connection:
- execute tool **SQL Server Configuration Manager**
- go to **Client protocols**
- switch on TCP/IP (default port is 1433)
- execute tool **SQL Server Management Studio**
- go to **Databases** and create DB *clover*
- go to **Security/Logins** and create user and assign this user as owner of DB *clover*
- go to **Security** and check **SQL server and Windows authentication mode**

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=com.microsoft.sqlserver.jdbc.SQLServerDriver
jdbc.url=jdbc:sqlserver://localhost:1433;databaseName=clover
jdbc.username=user
jdbc.password=pass
jdbc.dialect=org.hibernate.dialect.SybaseDialect
```

Do not forget to add jar with JDBC driver to the Tomcat classpath.

## Postgre SQL

If you use properties file for configuration, specify these parameters: `jdbc.driverClassName`, `jdbc.url`, `jdbc.username`, `jdbc.password`, `jdbc.dialect`. For example:

```
jdbc.driverClassName=com.microsoft.sqlserver.jdbc.SQLServerDriver
jdbc.url=jdbc:postgresql://localhost/clover?charSet=UTF-8
jdbc.username=postgres
jdbc.password=
jdbc.dialect=org.hibernate.dialect.PostgreSQLDialect
```

Do not forget to add jar with JDBC driver to the Tomcat classpath.

## JNDI DB DataSource

Server can connect to JNDI DB DataSource, which is configured in application server or container. However there are some CloverETL parameters which must be set, otherwise the behaviour may be unpredictable:

```
datasource.type=JNDI # type of datasource; must be set, because default value is JDBC
datasource.jndiName=# JNDI location of DB DataSource; default value is java:comp/env/jdbc/clover_server #
jdbc.dialect=# Set dialect according to DB which DataSource is connected to.
The same dialect as in sections above. #
```

The parameters above may be set in the same ways as other params (in properties file or Tomcat context file)

Example of DataSource configuration in Apache Tomcat. Add following code to context file.

```
<Resource name="jdbc/clover_server" auth="Container"
  type="javax.sql.DataSource" driverClassName="com.mysql.jdbc.Driver"
  url="jdbc:mysql://192.168.1.100:3306/clover?useUnicode=true&characterEncoding=utf8"
  username="root" password="" maxActive="20" maxIdle="10" maxWait="-1"/>
```



## Note

Special characters you type in the context file have to be specified as XML entities. E.g. ampersand "&" as "&#38;" etc.

## List of Properties

Table 18.1. General configuration

key	description	default
config.file	location of CloverETL Server configuration file	[working_dir]/cloverServer.properties
license.file	location of CloverETL Server licence file (license.dat)	
engine.config.file	location of CloverETL engine configuration properties file	properties file packed with CloverETL
private.properties	List of server properties which are used only by CloverETL Server code. So these properties are not accessible outside of the ServerFacade. By default there are all properties which may contain password in the list. Basically it means, that their values are not visible for web GUI users. Values are replaced by single star "*". Changes in this list may cause unexpected behavior of some server API.	jdbc.password, executor.password, security.ldap.password, clover.smtp.password
engine.plugins.src	This property may contain absolute path to some "source" of additional CloverETL engine plugins. These plugins are not a substitute for plugins packed in WAR. "Source" may be directory or zip file. Both directory and zip must contain subdirectory for each plugin. Changes in the directory or the ZIP file apply only when the server is restarted. For details see section "Extensibility - engine plugins".	empty
datasource.type	Set this explicitly to JNDI if you need CloverETL Server to connect to DB using JNDI datasource. In such case, parameters "datasource.jndiName" and "jdbc.dialect" must be set properly. Possible values: JNDI   JDBC	JDBC
datasource.jndiName	JNDI location of DB DataSource. It is applied only if "datasource.type" is set to "JNDI".	java:comp/env/jdbc/clover_server
jdbc.driverClassName	class name for jdbc driver name	
jdbc.url	jdbc url used by CloverETL Server to store data	
jdbc.username	jdbc database user name	
jdbc.password	jdbc database user name	
jdbc.dialect	hibernate dialect to use in ORM	
quartz.driverDelegateClass	SQL dialect for quartz. Value is automatically derived from "jdbc.dialect" property value.	

key	description	default
security_enabled	true   false If it is set to false, then no authentication is required and anyone has admin privileges.	true
security.default_domain	Domain which all new users are included in. Stored in user's record in the database. Shouldn't be changed unless the "clover" must be white-labelled.	clover
security.basic_authentication.features_list	Semi-colon separated list of features which are accessible using HTTP and which should be protected by Basic HTTP Authentication. Each feature is specified by its servlet path.	/request_processor;/simpleHttpApi;/launch;/launchIt;/downloadStorage;/downloadFile;/uploadSandboxFile;/downloadLog
security.basic_authentication.realm	Realm string for HTTP Basic Authentication.	CloverETL Server
security.digest_authentication.features_list	Semi-colon separated list of features which are accessible using HTTP and which should be protected by HTTP Digest Authentication. Each feature is specified by its servlet path. Please keep in mind, that HTTP Digest Authentication is feature added to the version 3.1. If you upgraded your older CloverETL Server distribution, users created before the upgrade cannot use the HTTP Digest Authentication until they reset their passwords. So when they reset their passwords (or the admin does it for them), they can use Digest Authentication as well as new users.	/webdav
security.digest_authentication.realm	Realm string for HTTP Digest Authentication. If it is changed, all users have to reset their passwords, otherwise they won't be able to access to the server features protected by HTTP digest Authentication.	CloverETL Server
security.digest_authentication.nonce_validity	Interval of validity for HTTP Digest Authentication specified in seconds. When the interval passes, server requires new authentication from the client. Most of the HTTP clients do it automatically.	300
clover.event.fileCheckMinInterval	Interval of file checks (in milliseconds) See Chapter 12, <a href="#">File event listeners</a> (p. 71) for details.	1000
clover.smtp.host	SMTP server hostname or IP address	
clover.smtp.port	SMTP server port	
clover.smtp.authentication	true/false If it is false, username and password are ignored	
clover.smtp.username	SMTP server username	
clover.smtp.password	SMTP server password	
logging.project_name	used in log messages where it is necessary to name the product name	CloverETL
logging.default_subdir	name of default subdirectory for all server logs; it is relative to the path specified by system property "java.io.tmpdir". Don't specify absolute path, use properties which are intended for absolute path.	cloverlogs

key	description	default
launch.log.dir	Location, where server should store launch requests logs. See Launch Services section for details.	<code>\${java.io.tmpdir}/[logging.default_subdir]/launch</code> where <code>\${java.io.tmpdir}</code> is system property
graph.logs_path	Location, where server should store Graph run logs. See Logging section for details.	<code>\${java.io.tmpdir}/[logging.default_subdir]/graph</code> where <code>\${java.io.tmpdir}</code> is system property
temp.default_subdir	Name of default subdirectory for server tmp files; it is relative to the path specified by system property "java.io.tmpdir".	clovertmp
graph.debug_path	Location, where server should store Graph debug info.	<code>\${java.io.tmpdir}/[temp.default_subdir]/debug</code> where <code>\${java.io.tmpdir}</code> is system property
graph.dictionary_path	Location, where server should store graph dictionary temporary files.	<code>\${java.io.tmpdir}/[temp.default_subdir]/dictionary</code> where <code>\${java.io.tmpdir}</code> is system property
graph.pass_event_params_to_graph_in_old_style	Since 3.0. It is switch for backwards compatibility of passing parameters to the graph executed by graph event. In version prior to 3.0 all params has been passed to executed graph. Since 3.0 just specified parameters are passed. Please see <a href="#">Task - Execution of Graph</a> (p. 48) for details.	false
threadManager.pool.corePoolSize	Number of threads which are always active (running or idling). Related to thread pool for processing server events.	4
threadManager.pool.queueCapacity	Max size of the queue(FIFO) which contains tasks waiting for thread. Related to thread pool for processing server events. It means, that there won't be more then "queueCapacity" waiting tasks. i.e. queueCapacity=0 - no waiting tasks, each task is immediately executed in available thread or in new thread. queueCapacity=1024 - up to 1024 tasks may be waiting in the queue for available thread from "corePoolSize".	12
threadManager.pool.maxPoolSize	Max number of active threads. If no thread from core pool is available and queue capacity is exceeded, pool creates new threads up to "maxPoolSize" threads. If there are more concurrent tasks then maxPoolSize, thread manager refuses to execute it. Thus keep queueCapacity or maxPoolSize big enough.	1024
task.archivator.batch_size	Max number of records deleted in one batch. It is used for deleting of archived run records.	50
launch.http_header_prefix	Prefix of HTTP headers added by launch services to the HTTP response.	X-cloveretl

key	description	default
task.archivator.archive_file_prefix	Prefix of archive files created by archivator.	cloverArchive_
license.context_names	Comma separated list of web-app contexts which may contain license. Each of them has to start with slash! Works only on Apache Tomcat.	/clover-license/ clover_license
license.display_header	Switch which specifies whether display license header in server web GUI or not.	false

Table 18.2. Defaults for job execution configuration - see section Job config properties for details

key	description	default
executor.tracking_interval	Interval in milliseconds for scanning current status of running graph. The shorter interval, the bigger log file.	2000
executor.log_level	Log level of graph runs. TRACE   DEBUG   INFO   WARN   ERROR	INFO
executor.max_running_concurrently	Amount of graph instances which may exist(or run) concurrently. 0 means no limits	0
executor.max_graph_instance_age	Interval in milliseconds. Specifies how long graph instance can be idling before it is released from memory. 0 means no limits. This property has been renamed since 2.8. Original name was executor.maxGraphInstanceAge	0
executor.classpath	Classpath for transformation/processor classes used in the graph. Directory [sandbox_root]/trans/ does not have to be listed here, since it is automatically added to graph run classpath.	
executor.skip_check_config	Disables check of graph configuration. Increases performance of graph execution, however may be useful during graph development.	true
executor.password	Password for decoding of encoded DB connection passwords.	
executor.verbose_mode	If true, more descriptive logs of graph runs are generated.	true
executor.use_jmx	If true, graph executor registers jmx mBean of running graph.	true
executor.debug_mode	If true, edges with enabled debug store data into files in debug directory. See property "graph.debug_path"	false

See "Clustering" section for more properties.

---

## Chapter 19. Graph parameters

CloverETL Server passes set of parameters for each graph execution. Please keep in mind, that placeholders `${paramName}` are resolved only during loading of graph XML, so if you need placeholders resolving for each graph execution, graph cannot be pooled. However current parameter values are always accessible by inline java code like this:

```
String runId = getGraph().getGraphProperties().getProperty("RUN_ID");
```

Properties may be added or replaced like this:

```
getGraph().getGraphProperties().setProperty("new_property", value );
```

This is set of parameters which are always set by CloverETL Server:

*Table 19.1. Defaults for graph execution configuration - see section Graph config properties for details*

key	description
SANDBOX_CODE	Code of sandbox which contains executed graph.
JOB_FILE	Path to the file, relative to sandbox root path.
SANDBOX_ROOT	Absolute path sandbox root.
RUN_ID	ID of the graph execution. In standalone mode or in cluster mode, it is always unique. It may be lower then 0 value, if the run record isn't persistent. See "Launch Services" for details.

---

### Another sets of parameters according the type of execution

There are some more parameters in dependence of way, how the graph is executed.

#### executed from Web GUI

---

no more parameters

#### executed by Launch Service invocation

---

Service parameters which have attribute **Pass to graph** enabled are passed to the graph not only as "dictionary" input data, but also as graph parameter.

#### executed by HTTP API run graph operation invocation

---

Any URL parameter with "param\_" prefix is passed to executed graph but without "param\_" prefix. i.e. "param\_FILE\_NAME" specified in URL is passed to the graph as property named "FILE\_NAME".

#### executed by RunGraph component

---

Since 3.0 only parameters specified by "paramsToPass" attribute are passed from the "parent" graph to the executed graph. However common properties (RUN\_ID, PROJECT\_DIR, etc.) are overwritten by new values.

## executed by WS API method executeGraph invocation

Parameters with values may be passed to the graph with the request for execution.

## executed by task "graph execution" by scheduler

Table 19.2. passed parameters

key	description
EVENT_SCHEDULE_EVENT_TYPE	Type of schedule SCHEDULE_PERIODIC   SCHEDULE_ONETIME
EVENT_SCHEDULE_LAST_EVENT	Date/time of previous event
EVENT_SCHEDULE_DESCRIPTION	Schedule description, which is displayed in web GUI
EVENT_USERNAME	User who "owns" the event. For schedule it is the user who created the schedule
EVENT_SCHEDULE_ID	ID of schedule which triggered the graph

## executed from JMS listener

There are many graph parameters and dictionary entries passed, depending on the type of incoming message. See details in Chapter 9, [JMS messages listeners](#) (p. 65).

## executed by task "graph execution" by graph event listener

Since 3.0 only specified properties from "source" graph are passed to executed graph by default. There is server config property "graph.pass\_event\_params\_to\_graph\_in\_old\_style" which can change this behavior so that ALL parameters from "source" graph are passed to the executed graph. This switch is implemented for backwards compatibility. Regarding the default behaviour: You can specify list of parameters to pass in the editor of graph event listener. Please see the section "Task - Execution of Graph" for details.

However following parameters with current values are always passed to the target graph

Table 19.3. passed parameters

key	description
EVENT_RUN_SANDBOX	Sandbox with graph, which is source of the event
EVENT_GRAPH_EVENT_TYPE	GRAPH_STARTED   GRAPH_FINISHED   GRAPH_ERROR   GRAPH_ABORTED   GRAPH_TIMEOUT   GRAPH_STATUS_UNKNOWN
EVENT_RUN_GRAPH	graphId of the graph, which is source of the event
EVENT_RUN_ID	ID of the graph execution, which is source of the event.
EVENT_TIMEOUT	Number of milliseconds which specifies interval of timeout. Makes sense only for "timeout" graph event.
EVENT_RUN_RESULT	Result (or current status) of the execution, which is source of the event.
EVENT_USERNAME	User who "owns" the event. For graph events it is the user who created the graph event listener

---

## executed by task "graph execution" by file event listener

---

Table 19.4. passed parameters

key	description
EVENT_FILE_PATH	Path to file, which is source of the event. Does not contain file name. Does not end with file separator.
EVENT_FILE_NAME	Filename of the file which is source of the event.
EVENT_FILE_EVENT_TYPE	SIZE   CHANGE_TIME   APPEARANCE   DISAPPEARANCE
EVENT_FILE_PATTERN	Pattern specified in file event listener
EVENT_FILE_LISTENER_ID	
EVENT_USERNAME	User who "owns" the event. For file events it is the user who created the file event listener

---

## How to add another graph parameters

### Additional "Graph Config Parameters"

---

It is possible to add so-called additional parameters in Web GUI - section **Sandboxes** for the selected graph or for all graphs in the selected sandbox. See details in the section called "[Job config properties](#)" (p. 32).

### Task "execute\_graph" parameters

---

The "execute graph" task may be triggered by schedule, graph event listener or file event listener. Task editor allows you to specify key=value pairs which are passed to executed graph.

---

## Chapter 20. Recommendations for transformations developers

---

### Add external libraries to app-server classpath

i.e. connections (JDBC/JMS) may require third party libraries. It is strongly recommended to add these libraries to app-server classpath.

CloverETL allows you to specify these libraries directly in graph definition so CloverETL may load these libraries dynamically, but external libraries may cause memory leak resulting with "java.lang.OutOfMemoryError: PermGen space" in this case.

In addition, app-servers should have the JMS API on their classpath and the third-party libraries often bundle this API as well. So it may result in classloading conflicts if these libraries are not loaded by the same classloader.

---

### Another graphs executed by RunGraph component may be executed only in the same JVM instance

In server environment, all graphs are executed in the same VM instance. Attribute "same instance" of RunGraph component cannot be set to false.

---

## Chapter 21. Logging

---

### Main logs

CloverETL Server uses log4j library for logging. WAR file contains default log4j configuration.

By default, log files are produced in directory specified by system property "java.io.tmpdir" in "cloverlogs" subdirectory.

"java.io.tmpdir" usually contains common system temp dir i.e. "/tmp". On tomcat, it is usually "[TOMCAT\_HOME]/temp"

Default logging configuration may be overridden by system property "log4j.configuration", which should contain URL to log4j config file.

```
log4j.configuration=file:/home/clover/config/log4j.xml
```

Since such configuration overrides default configuration, it may have influence over Graph run logs. So your own log config has to contain following fragment to preserve Graph run logs

```
<logger name="Tracking" additivity="false">
  <level value="debug"/>
</logger>
```

These system properties allow logging of HTTP requests/responses to stdout:

client side:

```
com.sun.xml.ws.transport.http.client.HttpTransportPipe.dump=true (for more
information consult CloverETL Designer Users's Guide - chapter Integrating CloverETL Designer with
CloverETL Server)
```

server side:

```
com.sun.xml.ws.transport.http.HttpAdapter.dump=tru
```

---

### Graph run logs

Each graph run has its own log file, which is accessible i.e. in web GUI, section "executions history".

By default these log files are produced in subdirectory cloverLogs/graph in the directory specified by "java.io.tmpdir" system property.

It is possible to specify different location for these logs by CloverETL property "graph.logs\_path". This property does not have any influence over main server logs.

---

## Chapter 22. Extensibility (Embedded OSGi framework)

CloverETL Server implements extensibility of its APIs, so the server may expose its fetures with custom API.

For now, there are two possibilities: Groovy code API and OSGi plugin.

---

### Groovy Code API

Since 3.3

CloverETL Server Groovy Code API allows clients to execute groovy code stored on the server by HTTP request. Executed code has access to the serverFacade, instance HTTP request and HTTP response, so it's possible to implement custom CloverServer API in the Groovy code.

To execute the code call URL:

```
http://[host]:[port]/clover/groovy/[sandboxCode]/[pathToGroovyCodeFile]
```

Protocol HTTP can be changed to secured HTTPS according to web server configuration.

Server uses Basic or Digest authentication according to the configuration. so the user must be authorized and must have permission to execute in the specified sandbox and permission to call "Groovy Code API".

Please note, that permission to call "Groovy Code API" (and edit them) is wery strong permission, since the Groovy Code can basically do the same as Java code and it's running as the same system process as whole application container.

---

### Variables accessible in the Groovy code

By default, there are some variables accessible in the groovy code

*Table 22.1. Variables accessible in groovy code*

type	key	description
javax.servlet.http.HttpServletRequest	request	Instance of HTTP request, which triggered the code.
javax.servlet.http.HttpServletResponse	response	Instance of HTTP response, which will be sent to the client when the script finishes.
javax.servlet.http.HttpSession	session	Instance of HTTP session.
javax.servlet.ServletConfig	servletConfig	instance of ServletConfig
javax.servlet.ServletContext	servletContext	instance of ServletContext
com.cloveretl.server.api.ServerFacade	serverFacade	Instance of serverFacade usable for calling CloverETL Server core features.  WAR file contains JavaDoc of facade API and it is accessible on URL: <a href="http://host:port/clover/javadoc/index.html">http://host:port/clover/javadoc/index.html</a>
String	sessionToken	sessionToken, needed for calling serverFacade methods

## Code examples

---

Code may return string which will be returned as a content of HTTP response, or it may itself construct the output to the output Writer

Following script writes its own output and doesn't return anything, so the underlying servlet doesn't modify the output at all. Advantage of this approach is, that output may be constructed on the fly and sent to the client continuously. However when the output stream(or writer) is opened, servlet won't send any error description in case of any error during the script processing.

```
response.getWriter().write("write anything to the output");
```

Following script returns String, so the underlying servlet puts the string to the output. Advantage of this approach is, that in case of any error during code processing, servlet returns full stacktrace, so the script may be fixed. However the constructed output may consume some amount of memory.

```
String output = "write anything to the output";  
return output;
```

Following script is little bit more complex. It returns XML with list of all configured schedules. User must have permission to list the schedules.

```
// uses variables: response, sessionToken, serverFacade  
import java.io.*;  
import java.util.*;  
import javax.xml.bind.*;  
import com.cloveretl.server.facade.api.*;  
import com.cloveretl.server.persistent.*;  
import com.cloveretl.server.persistent.jaxb.*;  
  
JAXBContext jc = JAXBContext.newInstance( "com.cloveretl.server.persistent:com.cloveretl.server.persistent.jaxb" );  
Marshaller m = jc.createMarshaller();  
m.setProperty(Marshaller.JAXB_ENCODING, "UTF-8");  
m.setProperty(Marshaller.JAXB_FORMATTED_OUTPUT, Boolean.TRUE);  
m.setProperty(Marshaller.JAXB_SCHEMA_LOCATION, "/clover/schemas/csc.xsd");  
  
Response<List<Schedule>> list = serverFacade.findScheduleList(sessionToken, null);  
SchedulesList xmlList = new SchedulesList();  
xmlList.setSchedulesList(list.getBean());  
m.marshal(xmlList, response.getWriter());
```

---

## Embedded OSGi framework

Since 3.0

CloverETL Server includes embedded OSGi framework which allows implementation of "plugin" (OSGi bundle) which works as new API (or even GUI) of the server and it is independent of released clover.war.

## Plugin possibilities

---

Basically the plugin may work as new server API similarly as Launch Services, HTTP API, WebServices API. It may be just simple JSP, HttpServlet or complex SOAP Web Services. So if the plugin contains some HTTP service, it is registered to listen on specified URL during the startup and incoming HTTP requests are "bridged"

from the web container to the plugin. Plugin itself has access to the internal CloverETL Server interface called "ServerFacade". ServerFacade offers methods for execution graphs, obtaining of graph status and executions history, manipulation with scheduling, listeners, configuration and many more. So the API may be customized according to the needs of specific deployment.

## Deploying an OSGi bundle

---

There are 2 CloverETL Server configuration properties related to the OSGi framework.

- `plugins.path` - Absolute path to the directory containing all your plugins (jar files).
- `plugins.autostart` - It is comma separated plugin names list. These plugins will be started during server startup. Theoretically OSGi framework can start the OSGi bundle on demand, however it is unreliable when the servlet bridge to the servlet container is used, so it is strongly recommended to name all your plugins.

So do deploy your plugin: set two config properties, copy plugin to the directory specified by "`plugins.path`" and restart the server.

---

## Chapter 23. Extensibility CloverETL engine plugins

Since 3.1.2

CloverETL Server may use external engine plugins loaded from specified source. Source is specified by config property "engine.plugins.src"

See details about possibilities of CloverETL configuration in *Chapter 18, [Configuration](#)* (p. 96)

This property must be absolute path to the directory or zip file with additional CloverETL engine plugins. Both directory and zip must contain subdirectory for each plugin. These plugins are not a substitute for plugins packed in WAR. Changes in the directory or the ZIP file apply only when the server is restarted.

Each plugin has its own class-loader which uses parent-first strategy by default. Parent of plugins' classloaders is web-app classloader (content of [WAR]/WEB-INF/lib). If the plugin uses any third-party libraries, there may be some conflict with libraries on parent-classloaders classpath. These are common exceptions/errors suggesting, that there is something wrong with classloading:

- java.lang.ClassCastException
- java.lang.ClassNotFoundException
- java.lang.NoClassDefFoundError
- java.lang.LinkageError

There are couple of ways how to get rid of such conflicts:

- Remove your conflicting third-party libraries and use libraries on parent classloaders (web-app or app-server classloaders)
- Use different class-loading strategy for your plugin.
  - in the plugin descriptor plugin.xml, set attribute greedyClassLoader="true" in the element "plugin"
  - it means, that plugin classloader will use self-first strategy
- Set inverse class-loading strategy for selected java packages.
  - In the plugin descriptor plugin.xml, set attribute "excludedPackages" in the element "plugin".
  - It's comma separated list of package prefixes. E.g. like this: excludedPackages="some.java.package,some.another.package"
  - In previous example all classes from "some.java.package", "some.another.package" and all their sub-packages would be loaded with the inverse loading strategy then the rest of classes on the plugins classpath.

Of course, the suggestions above may be combined. It's not easy to find the best solution for these conflicts and it may depend on the libraries on app-server classpath.

For more convenient debugging it is useful to set TRACE log level for related class-loaders.

```
<logger name="org.jetel.util.classloader.GreedyURLClassLoader">
  <level value="trace"/>
</logger>
<logger name="org.jetel.plugin.PluginClassLoader">
  <level value="trace"/>
</logger>
```

See "Logging" section for details about overriding server log4j configuration.

---

## Chapter 24. Clustering

CloverETL Server only works in the cluster if the user's license allows it.

There are two common cluster features, high availability and scalability. Both of them are implemented by CloverETL Server on various levels. This section should clarify the basics of CloverETL Clustering.

---

### High Availability

Since version 3.0, CloverETL Server does not recognize any differences between cluster nodes. Thus, there are no "master" or "slave" nodes meaning all nodes can be virtually equal. There is no single point of failure(SPOF) in the CloverETL cluster itself, however SPOFs may be in the input data or some other external element.

Clustering offers high availability(HA) for all features accessible through HTTP. This includes sandbox browsing, modification of services configuration (scheduling, launch services, listeners) and primarily graph executions. Any cluster node may accept incoming HTTP requests and process them itself or delegate it to another node.

Since all nodes are equal, almost all requests may be processed by any cluster node:

- All graph files, metadata files, etc. are located in shared sandboxes. Thus all nodes have access to them. A shared filesystem may be a SPOF, thus it is recommended to use a replicated filesystem instead.
- The database is shared by all cluster nodes. Again, a shared DB might be a SPOF, however it may be clustered as well.

But there is still a possibility, that a node cannot process a request by itself. In such cases, it completely and transparently delegates the request to a node which can process the request.

These are the requests which are limited to one (or more) node(s):

- a request for the content of a partitioned or local sandbox. These sandboxes aren't shared among all cluster nodes. Please note that this request may come to any cluster node which then delegates it to a target node, however, this target node must be up and running.
- A graph is configured to use a partitioned or local sandbox. These graphs need nodes which have a physical access to the required sandboxes.

Thus an inaccessible partitioned or local sandbox may cause a failure from the request, however...

1. it is still possible to configure redundant sandboxes stored on other cluster nodes.
2. these types of sandboxes are used only for scalability on the data level(described below), which is a different approach to using a CloverETL cluster.

CloverETL itself implements a load balancer for executing graphs. So a graph which isn't configured for some specific node(s) may be executed anywhere in the cluster and the CloverETL load balancer decides, according to the current load, which node will process the graph. All this is done transparently.

To achieve HA, it is recommended to use an independent HTTP load balancer. Independent HTTP load balancers allow transparent fail-overs for HTTP requests. They send requests to the nodes which are running.

---

### Scalability

There are two independent levels of scalability implemented. Scalability of transformation requests(and any HTTP requests) and data scalability (parallel data processing).

Both of these "scalability levels" are "horizontal". Horizontal scalability means adding nodes to the cluster, whereas vertical scalability means adding resources to a single node. Vertical scalability is supported natively by the CloverETL engine and it is not described here.

## Transformation Requests

---

Basically, the more nodes we have in the cluster, the more transformation requests (or HTTP requests in general) we can process at one time. This type of scalability is the CloverETL server's ability to support a growing number of clients. This feature is closely related to the use of an HTTP load balancer which is mentioned in the previous section.

## Parallel Data Processing

---

When a transformation is processed in parallel, the whole graph (or its parts) runs in parallel on multiple cluster nodes having each node process just a part of the data.

So the more nodes we have in the cluster, the more data can be processed in the specified time.

The data may be split(partitioned) before the graph execution or by the graph itself on the fly. The resulting data may be stored in partitions or gathered and stored as one group of data.

The curve of scalability may differ according to the type of transformation. It may be almost linear, which is almost always ideal, except when there is a single data source which cannot be read by multiple readers in parallel limiting the speed of further data transformation. In such cases it is not beneficial to have parallel data processing since it would actually wait for input data.

## Node Allocation

Node allocation is the specification of which cluster nodes will run the graph and which parts of the graph they will run. Allocation is basically specified by the *partitioned sandboxes* used in the graph phase. Each phase may have its own (just one) allocation. Basically, each partitioned sandbox has a list of locations. When some part of the graph runs in parallel, there is one worker for each partitioned sandbox location. See "Partitioned sandbox" in [Partitioned and Local Sandboxes](#) (p. 118) for details.

Allocation is specified in the graph either by:

- sandbox resources pointing to a partitioned sandbox, if workers read/write some partitioned data to/from their own location of this partitioned sandbox, or by
- the node attribute "node allocation", if workers do not read/write their partitioned data, however there must be an allocation specified.

If there is a conflict, execution fails and an error message appears containing the description of the conflict. A single conflict may be caused by using two different allocations in a single phase.

## Partitioning/gathering Data

As mentioned before, data may be partitioned and gathered in multiple ways. It may be prepared before the graph is executed or it may be partitioned on the fly.

### Partitioning/gathering "on the fly"

There are two special components to consider: ClusterPartitioner and ClusterGather. Both work similarly, but in the opposite way.

**ClusterPartitioner** works like a common partitioner, but *node allocation* is applied simultaneously behind the ClusterPartitioner component. All components preceding the ClusterPartitioner run on just one node (so called the *primary worker* - see below) whereas components behind the ClusterPartitioner run in parallel according to node allocation. Thus, these nodes work with just part of the data. There are more partitioning types: "round-robin" (default), "by record key", and "by load".

**ClusterGather** works in the opposite way. Components preceding the gather run in parallel while components behind the gather run on just one node (primary worker). The cluster gather component gathers records in the same way as SimpleGather and its attributes are the same. By default it does not sort input records in any way. It just gathers them in the order they come.

***Primary worker node** - some parts of the graph designed to run in parallel may run on a single node anyway. i.e. the part where the graph reads/writes data from/to a single resource. It may be the part preceding ClusterPartitioner or the part behind ClusterGatherer respectively. It also may be on all components in the phase which do not have **node allocation** specified at all. Each phase may have its own primary worker. All graph primary workers are chosen during graph execution primarily according to the **local sandbox** datasources used in the phases. Basically, the node which has direct(local) access to a sandbox datasource(s) used in the phase is selected as the primary worker. Of course, there may be multiple different local sandbox datasources, or even no local sandbox datasources used in the phase. In such cases, the server uses some minor parameters to choose the primary worker.*

Both components may be combined in a single phase in any way, but there must be just one node allocation and just one primary worker in each single phase.

This example shows how data would be processed in 2 different node allocations, on 2 different primary workers.

- phase 1 starts
  - processing data on primary worker (nodeA)
  - cluster partitioner component
  - processing data in parallel (nodeA, nodeB, nodeC)
  - cluster gatherer component
  - processing data on primary worker (nodeA)
- phase 1 ends
- phase 2 starts
  - processing data on primary worker (nodeA)
  - cluster partitioner component
  - processing data in parallel (nodeB, nodeD)
- phase 2 ends
- phase 3 starts
  - processing data in parallel (nodeB, nodeD)
  - cluster gatherer component
  - processing data on primary worker (nodeD)
- phase 3 ends

Results are stored on a different node (nodeD) then the node that read (nodeA) and data is actually *repartitioned* (from nodeA, nodeB, nodeC to nodeB, nodeD).

### **Partitioning/gathering data by external tools**

Partitioning data on the fly may in some cases be an unnecessary bottleneck. Splitting data using low-level tools can be much better for scalability. The optimal case being, that each running worker reads data from an independent

data source. Thus there does not have to be a ClusterPartitioner component in the first phase and the graph runs in parallel from the beginning.

- phase 1 starts
  - processing data in parallel (nodeA, nodeB, nodeC)
  - cluster gatherer component
  - processing data on primary worker (nodeA)
- phase 1 ends

Or the whole graph may run in parallel, however the results would be partitioned.

- phase 1 starts
  - processing data in parallel (nodeA, nodeB, nodeC)
- phase 1 ends

## Partitioned and Local Sandboxes

Partitioned and local sandboxes were mentioned in previous sections. These new sandbox types were introduced in version 3.0 and they are vital for parallel data processing.

Together with shared sandboxes, we have three sandbox types in total.

### Shared sandbox

This type of sandbox must be used for all data which is supposed to be accessible on all cluster nodes. This includes all graphs, metadata, connections, classes and input/output data for graphs which should support HA, as described above.

**Create new sandbox** hide form

ID

Name

Distribution type shared ▾

Root file system path Server is configured as clustered. Sandbox cannot have its own "Root path". Each sandbox is sub-directory in one shared directory. Please refer to "cluster.shared\_sandboxes\_path" config property. It is set to /home/mvarecha/sandboxes on this node (nodeA).

Create sandbox root path and sub directories ☒

*Figure 24.1. Dialog form for creating new shared sandbox*

As you can see in the screenshot above, you cannot specify any root path on the filesystem. Shared sandboxes are stored in the directory specified by "cluster.shared\_sandboxes\_path". Each shared sandbox has its own subdirectory in it, which is named by sandbox ID.

### Local sandbox

This sandbox type is intended for data, which is accessible only by certain cluster nodes. It may include massive input/output files. The purpose being, that any cluster node may access content of this type of sandbox, but only one has local(fast) access and this node must be up and running to provide data. The graph may use resources from multiple sandboxes which are physically stored on different nodes since cluster nodes are able to create network streams transparently as if the resource was a local file. See [Using a Sandbox Resource as a Component Data Source](#) (p. 119) for details.

Do not use local sandbox for common project data (graphs, metadata, connections, lookups, properties files, etc.). It would cause odd behaviour. Use shared sandboxes instead.

Figure 24.2. Dialog form for creating new local sandbox

### Partitioned sandbox

This type of sandbox is actually an abstract wrapper for a couple of physical locations existing typically on different cluster nodes. However, there may be multiple locations on the same node. A partitioned sandbox has two purposes which are both closely related to parallel data processing.

1. **node allocation** specification - locations of a partitioned sandbox define the workers which will run the graph or its parts. So each physical location will cause a single worker to run. This worker does not have to actually store any data to "its" location. It is just a way to tell the CloverETL Server: "execute this graph/phase in parallel on these nodes"
2. **storage for part of the data** during parallel data processing. Each physical location contains only part of the data. In a typical use, we have input data split in more input files, so we put each file into a different location and each worker processes its own file.

As you can see on the screenshot above, for a partitioned sandbox, you can specify one or more physical locations on different cluster nodes.

Do not use partitioned sandbox for common project data (graphs, metadata, connections, lookups, properties files, etc.). It would cause odd behavior. Use shared sandboxes instead.

### Using a Sandbox Resource as a Component Data Source

A sandbox resource, whether it is a shared, local or partitioned sandbox (or ordinary sandbox on standalone server), is specified in the graph under the fileURL attributes as a so called sandbox URL like this:

```
sandbox://data/path/to/file/file.dat
```

where "data" is a code for sandbox and "path/to/file/file.dat" is the path to the resource from the sandbox root. URL is evaluated by CloverETL Server during graph execution and a component (reader or writer) obtains the opened stream from the server. This may be a stream to a local file or to some other remote resource. Thus, a graph does not have to run on the node which has local access to the resource. There may be more sandbox resources used in the graph and each of them may be on a different node. In such cases, CloverETL Server would choose the node with the most local resources to minimize remote streams.

The sandbox URL has a specific use for parallel data processing. When the sandbox URL with the resource in a *partitioned sandbox* is used, that part of the graph/phase runs in parallel, according to the node allocation specified by the list of partitioned sandbox locations. Thus, each worker has its own local sandbox resource. CloverETL Server evaluates the sandbox URL on each worker and provides an open stream to a local resource to the component.

The sandbox URL may be used on standalone server as well. It is excellent choice when graph references some resources from different sandboxes. It may be metadata, lookup definition or input/output data. Of course, referenced sandbox must be accessible for the user who executes the graph.

## Recommendations for Cluster Deployment

1. All nodes in the cluster should have a synchronized system date-time.
2. All nodes share sandboxes stored on a shared or replicated filesystem. The filesystem shared among all nodes is single point of failure. Thus, the use of a replicated filesystem is strongly recommended.
3. All nodes share a DB, thus it must support transactions. I.e. The MySQL table engine, MyISAM, may cause strange behaviour because it is not transactional.
4. All nodes share a DB, which is a single point of failure. Use of a clustered DB is strongly recommended.
5. Configure the license as "license.file" for this property on Tomcat. Do not use `clover_license.war`. Tomcat loads web-apps in an unpredictable order and for the cluster, the license must be loaded before CloverETL Server itself.

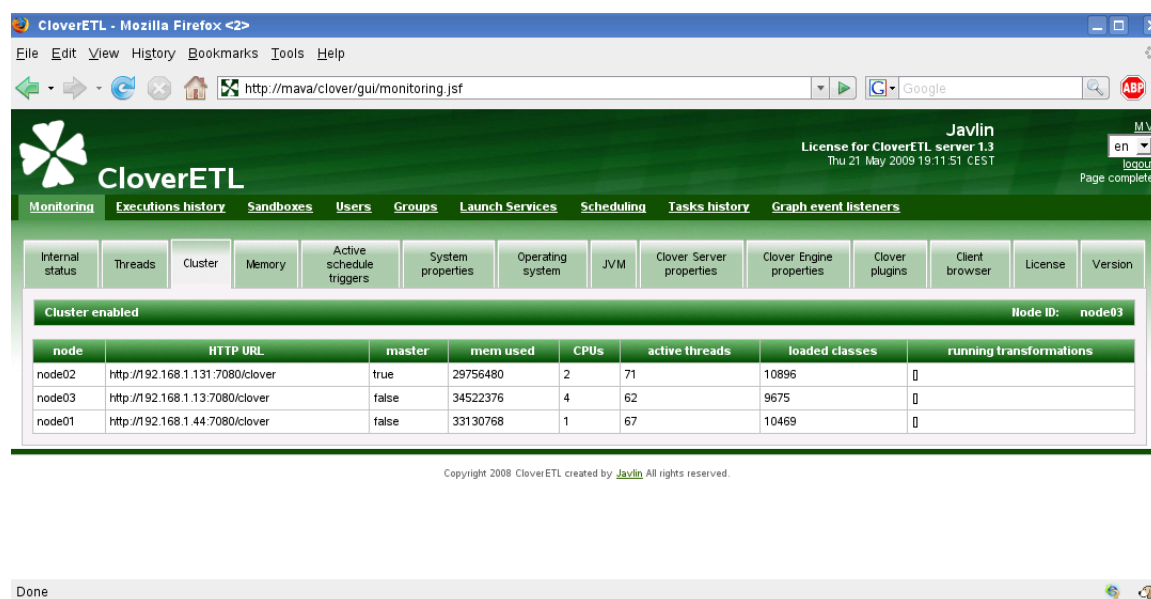
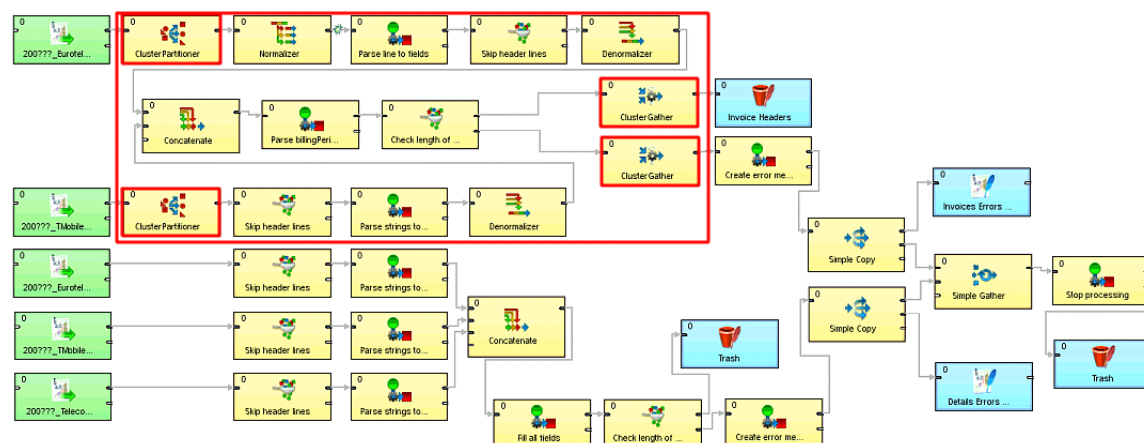


Figure 24.3. List of nodes joined to the cluster

## Example of Distributed Execution

The following diagram shows a transformation graph used for parsing invoices generated by a few cell phone network providers in Czech Republic.



The size of these input files may be up to a few gigabytes, so it is very beneficial to design the graph to work in the cluster environment.

## Details of the Example Transformation Design

Please note there is only one phase and there are four cluster components in the graph (highlighted by red border). These components define a point of change "node allocation", so the part of the graph demarcated by these components is highlighted by the red rectangle. This part of the graph performs data processing in parallel. This means that the components inside the dotted rectangle run on cluster nodes according to the "node allocation" of that part of the graph.

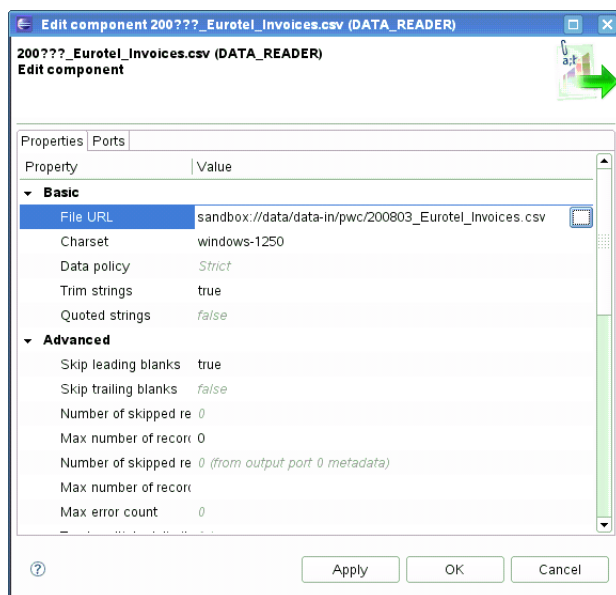
The rest of the graph runs just on one node called "primary worker".

## Specification of "node allocation"

Since there is only one phase, the whole graph has just one primary worker and only one node allocation.

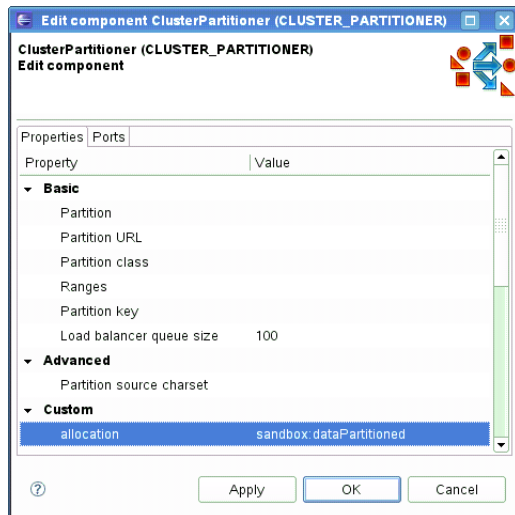
- node allocation is applied for groups of components running in parallel (demarcated by the four cluster components)
- the outer part of the graph run on a single node - primary worker.

The primary worker is specified by the sandbox code used in the URLs of input data. The following dialog shows the File URL value: "sandbox://data/path-to-csv-file", where "data" is the ID of the server sandbox containing the specified file. And it is the "data" *local* sandbox which defines the primary worker in the graph.



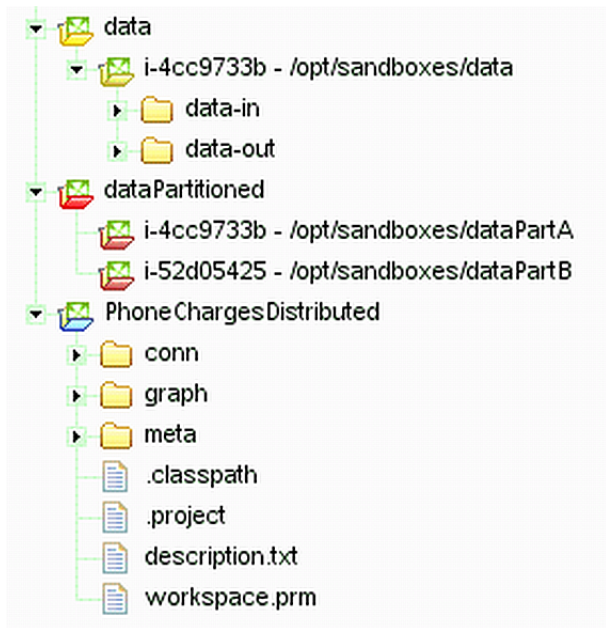
The part of the graph demarcated by the four cluster components may have specified its allocation by the file URL attribute as well, but this part does not work with files at all, so there is no file URL. Thus, we will use the "allocation" attribute. Since all components in this part must have the same allocation, it is sufficient to set it only for one component.

Again, "dataPartitioned" in the following dialog is the sandbox ID.



Let's investigate our sandboxes. This project requires 3 sandboxes: "data", "dataPartitioned" and "PhoneChargesDistributed".

- data
  - contains input and output data
  - local sandbox (yellow folder), so it has only one physical location
  - accessible only on node "i-4cc9733b" in the specified path
- dataPartitioned
  - partitioned sandbox (red folder), so it has a list of physical locations on different nodes
  - does not contain any data and since the graph does not read or write to this sandbox, it is used only for the definition of "nodes allocation"
  - on the following figure, allocation is configured for two cluster nodes
- PhoneChargesDistributed
  - common sandbox containing the graph file, metadata, and connections
  - shared sandbox (blue folder), so all cluster nodes have access to the same files



If the graph was executed with the sandbox configuration of the previous figure, the node allocation would be:

- components which run only on primary worker, will run only on the "i-4cc9733b" node according to the "data" sandbox location.
- components with allocation according to the "dataPartitioned" sandbox will run on nodes "i-4cc9733b" and "i-52d05425".

## Scalability of the Example Transformation

The example transformation has been tested in the Amazon Cloud environment with the following conditions for all executions:

- the same master node
- the same input data: 1,2 GB of input data, 27 million records
- three executions for each "node allocation"
- "node allocation" changed between every 2 executions
- all nodes has been of "c1.medium" type

We tested "node allocation" from 1 single node, all the way up to 8 nodes.

The following figure shows the functional dependence of run-time on the number of nodes in the cluster:

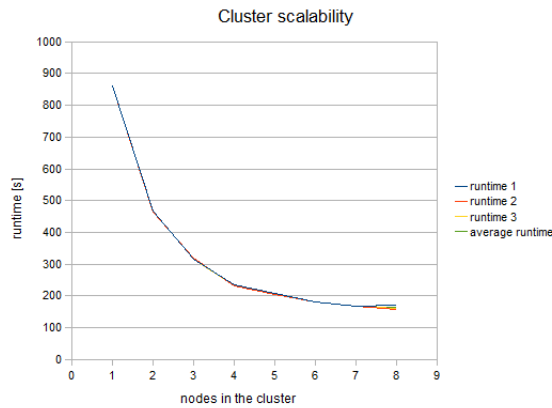


Figure 24.4. Cluster Scalability

The following figure shows the dependency of "speedup factor" on the number of nodes in the cluster. The speedup factor is the ratio of the average runtime with one cluster node and the average runtime with x cluster nodes. Thus:

$$\text{speedupFactor} = \text{avgRuntime}(1 \text{ node}) / \text{avgRuntime}(x \text{ nodes})$$

We can see, that the results are favourable up to 4 nodes. Each additional node still improves cluster performance, however the effect of the improvement decreases. Nine or more nodes in the cluster may even have a negative effect because their benefit for performance may be lost in the overhead with the management of these nodes.

These results are specific for each transformation, there may be a transformation with much a better or possibly worse function curve.

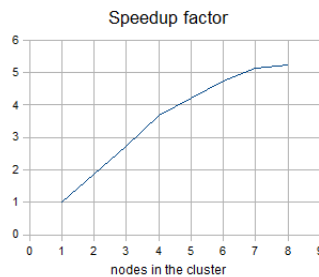


Figure 24.5. Speedup factor

Table of measured runtimes:

nodes	runtime 1 [s]	runtime 2 [s]	runtime 3 [s]	average runtime [s]	speedup factor
1	861	861	861	861	1
2	467	465	466	466	1.85
3	317	319	314	316.67	2.72
4	236	233	233	234	3.68
5	208	204	204	205.33	4.19
6	181	182	182	181.67	4.74
7	168	168	168	168	5.13
8	172	159	162	164.33	5.24

## Cluster configuration

Cluster can work properly only if each node is properly configured. Clustering must be enabled, nodeID must be unique on each node, all nodes must have access to shared DB and shared sandboxes, and all properties for inter-node cooperation must be set according to network environment.

Properties and possible configuration are the following:

- [Mandatory properties](#) (p. 125)
- [Optional properties](#) (p. 126)
- [Example of 2 node cluster configuration](#) (p. 126)
- [Load balancing properties](#) (p. 127)

## Mandatory properties

Besides mandatory cluster properties, you need to set license.file, database connection and other necessary properties which are not specifically related to the cluster environment.

*Table 24.1. Mandatory properties - these properties must be properly set on each node of the cluster*

property	type	default
cluster.enabled	boolean	false
<i>description:</i>	switch whether server is connected to the cluster or not	
cluster.node.id	String	node01
<i>description:</i>	each cluster node must have unique ID	
cluster.shared_sandboxes_path	String, path	
<i>description:</i>	Path, where all shared sandboxes are stored on this node. If cluster is enabled, all sandboxes are shared, thus "rootPath" attribute of the sandbox is ignored. Path to the root directory of the sandbox is constructed like this: [shared_sandboxes_path]/[sandboxID]	
cluster.jgroups.bind_address	String, IP address	127.0.0.1
<i>description:</i>	IP address of ethernet interface, which is used for communication with another cluster nodes. Necessary for inter-node messaging.	
cluster.jgroups.start_port	int, port	7800
<i>description:</i>	Port where jGroups server listens for inter-node messages.	
cluster.jgroups.tcping.initial_hosts	String, in format: "IPAddress1[port1],IPAddress2[port2]"	127.0.0.1[7800]
<i>description:</i>	List of IP addresses(with ports) where we expect running and listening nodes. It is related to another nodes "bind_address" and "start_port" properties. I.e. like this: bind_address1[start_port1],bind_address2[start_port2],... It is not necessary to list all nodes of the cluster, but at least one of listed host:port must be running. Necessary for inter-node messaging.	
cluster.http.url	String, URL	http://localhost:8080/clover
<i>description:</i>	URL to the root of web application of configured node. Necessary for inter-node cooperation. This value will be sent to all other nodes in the cluster to let them know how to connect to this node.	

## Optional properties

*Table 24.2. Optional properties - these properties aren't vital for cluster configuration - default values are sufficient*

property	type	default	description
cluster.node.sendinfo.interval	int	5000	time interval in ms; each node sends info about itself to another nodes; this interval specified how often the info is sent
cluster.node.remove.interval	int	15000	time interval in ms; if no node info comes in this interval, node is considered as lost and it is removed from the cluster
cluster.max_allowed_time_shift_between_nodes	int	2000	Max allowed time shift between nodes. If time shift exceeds this, node will be selected as invalid.
cluster.group.name	String	cloverCluster	Each cluster has its unique group name. If you need 2 clusters in the same network environment, each of them would have its own group name.
cluster.max_allowed_time_shift_between_nodes	int	2000	How many milliseconds is maximum allowed time shift between nodes in the cluster. All nodes must have system time synchronized. Otherwise cluster may not work properly. So if this threshold is exceeded, node will be set as invalid.

## Example of 2 node cluster configuration

This section contain example of CloverETL cluster nodes configuration. In addition it is necessary to configure:

- sharing or replication of directory /home/clover/nfs\_shared/sandboxes
- connection to the same database from both nodes
- HTTP load balancer

Configuration of node on 192.168.1.131

```
jdbc.dialect=org.hibernate.dialect.MySQLDialect
datasource.type=JNDI
datasource.jndiName=java:comp/env/jdbc/clover_server

cluster.enabled=true
cluster.node.id=node01
cluster.shared_sandboxes_path=/home/clover/nfs_shared/sandboxes

license.file=/home/clover/license/license.dat
```

```
cluster.group.name=cloverCluster
cluster.jgroups.bind_address=192.168.1.131
cluster.jgroups.start_port=7800
cluster.jgroups.tcpping.initial_hosts=192.168.1.13[7800]

cluster.http.url=http://192.168.1.131:8080/clover
```

### Configuration of node on 192.168.1.13

```
jdbc.dialect=org.hibernate.dialect.MySQLDialect
datasource.type=JNDI
datasource.jndiName=java:comp/env/jdbc/clover_server

cluster.enabled=true
cluster.node.id=node02
cluster.shared_sandboxes_path=/home/clover/nfs_shared/sandboxes

license.file=/home/clover/license/license.dat

cluster.group.name=cloverCluster
cluster.jgroups.bind_address=192.168.1.13
cluster.jgroups.start_port=7800
cluster.jgroups.tcpping.initial_hosts=192.168.1.131[7800]

cluster.http.url=http://192.168.1.13:8080/clover
```

## Load balancing properties

---

Multiplicators of load balancing criteria. Load balancer decides which cluster node executes graph. It means, that any node may process request for execution, but graph may be executed on the same or on different node according to current load of the nodes and according to these multiplicators.

The higher number, the higher relevance for decision. All multiplicators must be greater then 0.

Each node of the cluster may have different load balancing properties. Any node may process incomming requests for transformation execution and each may apply criteria for loadbalancing in a different way according to its own configuration.

These properties aren't vital for cluster configuration - default values are sufficient

Table 24.3. Load balancing properties

property	type	default	description
cluster.lb.balance.running_graphs	float	3	Specify importance of running graphs for load balancing.
cluster.lb.balance.memused	float	0.5	Specify importance of used memory for load balancing.
cluster.lb.balance.cpus	float	1.5	Specify importance of number of CPUs for load balancing.
cluster.lb.balance.master_bonus	float	1	Specify importance of the fact, that the node is master. Usually it does not affect anything, thus value 1 says to load balancer: "consider master node the same as any other node"
cluster.lb.balance.this_node	float	2	Specify importance of the fact, that the node is the same which processes request for execution. The same node, which decides where to execute graph. If you specify this multiplier great enough, it will cause, that graph will be always executed on the same node, which processes request for execution.

## Chapter 25. Temp Space Management

Many of the components available in the CloverETL require temporary files or directories in order to work properly. *Temp space* is a physical location on local file system where these files or directories are created and maintained.

### Overview

The overview of temp spaces defined in CloverETL Server is available under *Configuration > Temp space management > Overview*

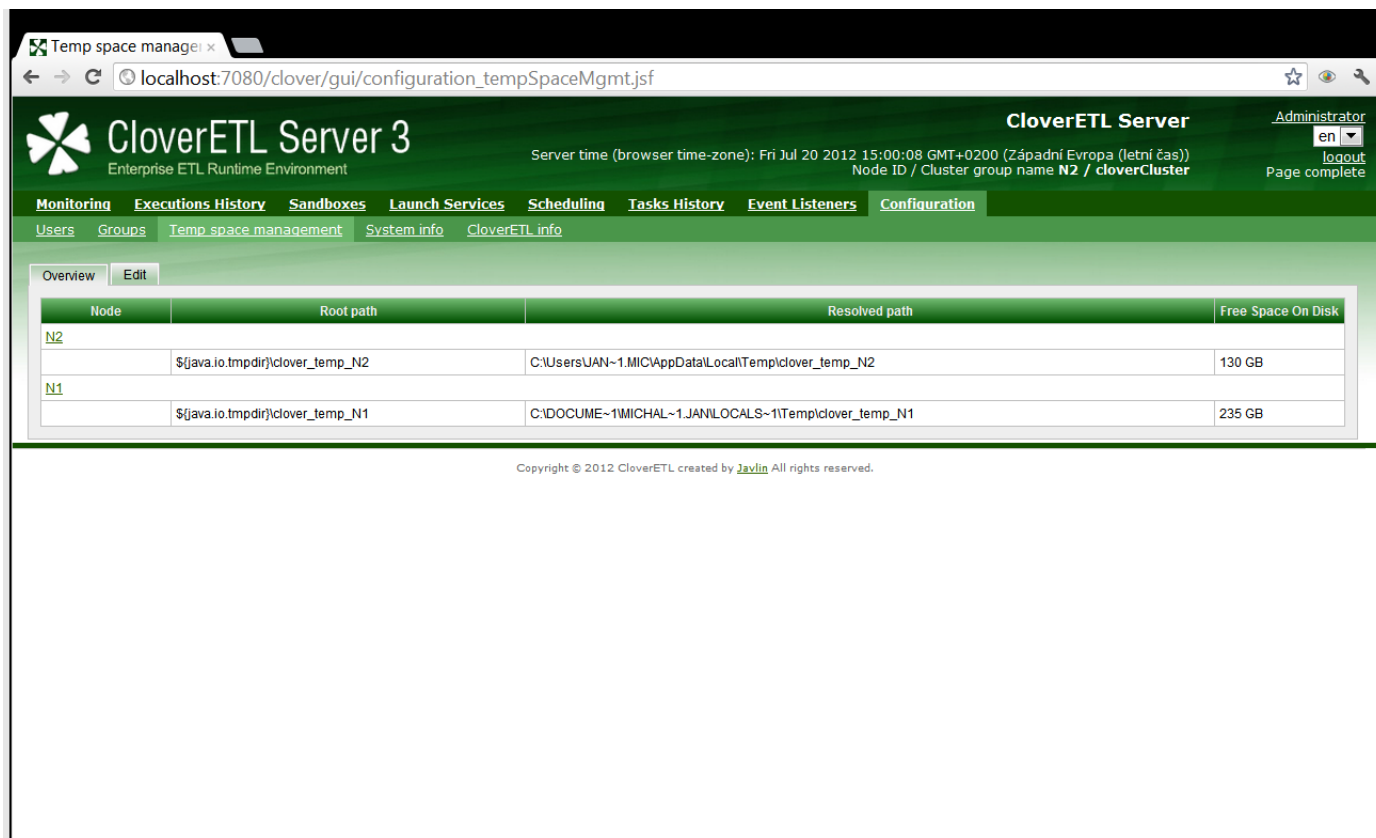


Figure 25.1. Configured temp spaces overview - one default temp space on each cluster node

### Setup

Temp space management offers an interface to add, suspend, resume and delete a temp space. It is accessible under *Configuration > Temp space management > Edit*.

The screen is divided in two drop-down areas: Global Configuration and Per Node Configuration. The *Global configuration* manages temp spaces of standalone server or in case of a server cluster temp spaces on all its nodes. The *Per Node Configuration* allows to maintain temp spaces separately on each node.

#### Initialization

When CloverETL Server is started the system checks temp space configuration: in case no temp space is configured a new default temp space is created in the directory where `java.io.tmpdir` system property points. The directory are named as follows:

- `${java.io.tmpdir}\clover_temp` in case of a standalone server

- `${java.io.tmpdir}/clover_temp_<node_id>` in case of server cluster

## Adding Temp Space

In order to define new temp space enter its path into text field under last row in the table and click the "Add" link. Note that environment variables and system properties may be used in the path, e.g.: `${VARIABLE_NAME} / temp_space`. If the directory entered does not exist, it will be created.



### Note

The environment variables have higher priority than system properties of the same name. The path with variables are resolved after system has added new temp space and while the server is starting. In case the variable value has been changed it is necessary to restart the server to such change take effect.



### Tip

The main point of adding additional temp spaces is to enable higher system throughput - therefore the paths entered should point to directories residing on different physical devices to achieve maximal I/O performance.

The screenshot shows the CloverETL Server Configuration page. At the top, there's a navigation bar with tabs like Monitoring, Executions History, Sandboxes, Launch Services, Scheduling, Tasks History, Event Listeners, and Configuration. The Configuration tab is active, and the Temp space management sub-tab is selected. A yellow message box at the top says "Temp space created successfully". Below this, there are two main sections: Global Configuration and Per Node Configuration.

**Global Configuration:**

Root path	Operations
<code>\${CLOVER_TEMP}</code>	<a href="#">Suspend</a>
<input type="text"/>	<a href="#">Add</a>

**Per Node Configuration:**

Node	Root path	Resolved path	Free Space On Disk	Operations
N2	<code>\${java.io.tmpdir}/clover_temp_N2</code>	C:\Users\UAN~1\MIC\AppData\Local\Temp\clover_temp_N2	130 GB	<a href="#">Suspend</a>
	<code>\${CLOVER_TEMP}</code>	C:\var\data/temp	130 GB	<a href="#">Suspend</a>
	<input type="text"/>	<input type="text"/>		<a href="#">Add</a>
N1	<code>\${java.io.tmpdir}/clover_temp_N1</code>	C:\DOCUME~1\MICHA~1\JAN\LOCALS~1\Temp\clover_temp_N1	235 GB	<a href="#">Suspend</a>
	<code>\${CLOVER_TEMP}</code>	C:\data/temp	235 GB	<a href="#">Suspend</a>
	<input type="text"/>	<input type="text"/>		<a href="#">Add</a>

Figure 25.2. Newly added global temp space using environment property set on both nodes.

## Suspending Temp Space

To suspend a temp space click on "Suspend" link in the panel. In case there are files left from previous or current graph executions a notification is displayed. Once the temp space has been suspended, no new temporary files will be created in it, but the files already created may be still used by running jobs.



### Note

The system ensures that at least one active (i.e. not suspended) temp space is available.

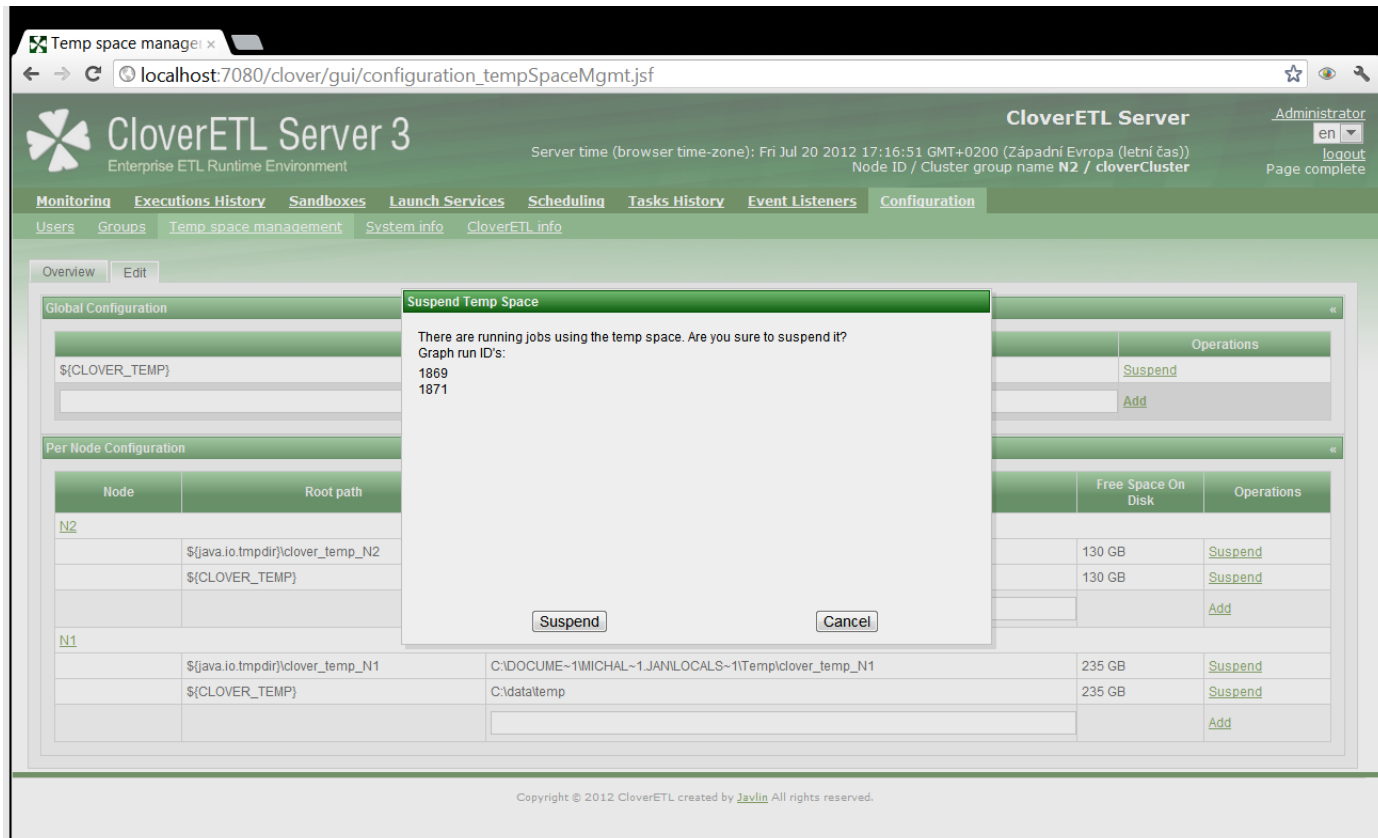


Figure 25.3. Suspend operation asks for confirmation in case there are data present from running jobs.

## Resuming Temp Space

To resume a temp space click on "Resume" link in the panel. Resumed temp space is active, i.e. available for temporal files and directories creation.

## Removing Temp Space

To remove a temp space click on "Remove" link in the panel. Only suspended temp space may be removed. Should be there any running jobs using the temp space, system will not allow its removal. In case there are some files left in the the temp space directory, it is possible to remove them in the displayed notification panel. The available options are:

- *Remove* - remove temp space from system, but keep its content
- *Remove and delete* - remove the temp space from system and its content too
- *Cancel* - do not proceed with operation

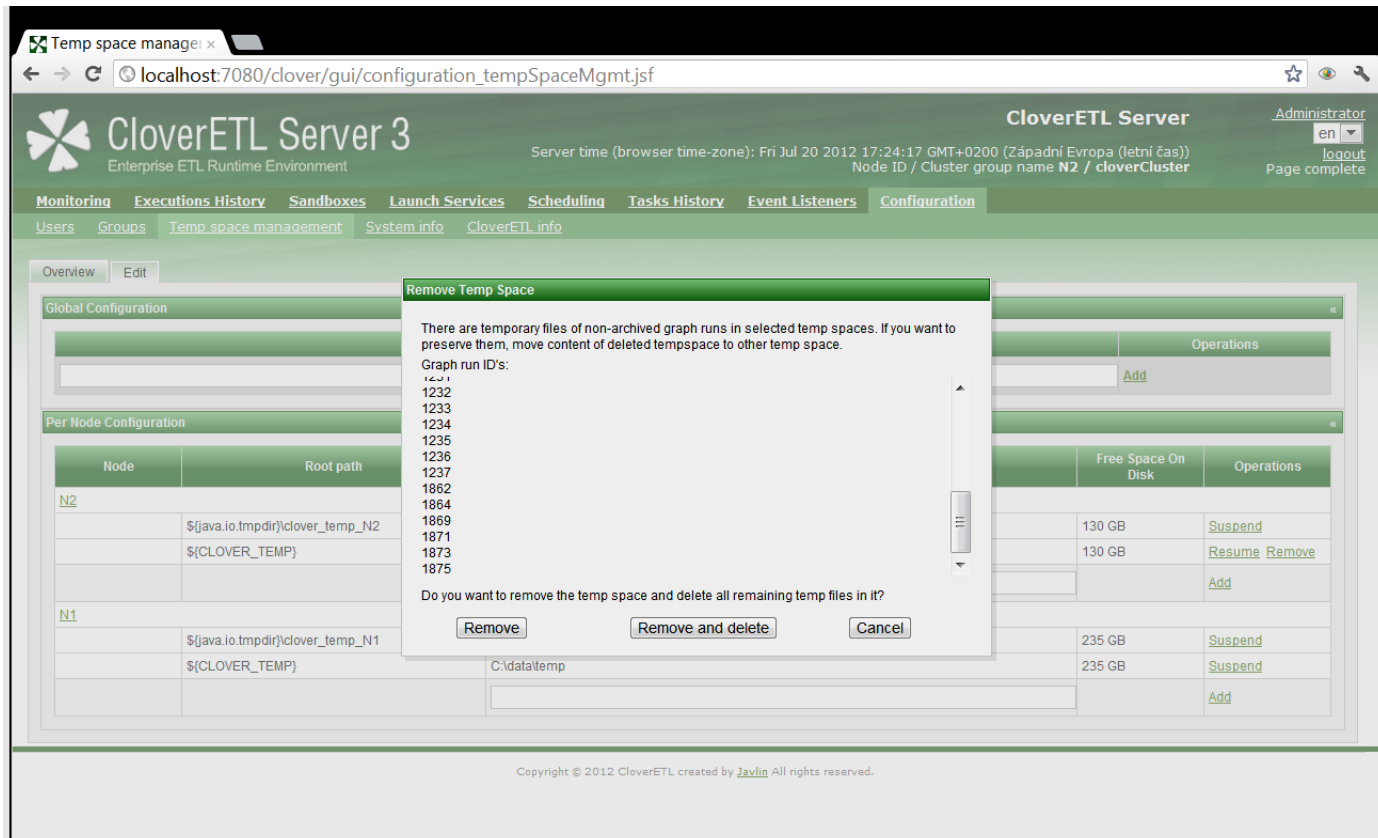


Figure 25.4. Remove operation asks for confirmation in case there are data present in the temp space.

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