Endeca® Latitude

Latitude Data Integrator Server Guide

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CloverETL Server: Reference Manual

This Reference Manual covers the Release 3.1.x of CloverETL Server.

Release 3.1

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Javlin

www.cloveretl.com

www.javlininc.com

Feedback welcome:

If you have any comments or suggestions for this documentation, please send them by email to `docs@cloveretl.com`.

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Chapter 1. What is CloverETL Server

CloverETL Server (CS) is the most recent member of CloverETL products family. It introduces powerfull tool Clover into world of enterprise applications. CloverETL Server itself is enterprise class application, thus it's shipped as `WAR` file (WAR stands for Web Archive). CS is tested and works on Apache Tomcat web container, Sun Glassfish application server or IBM Websphere application server. CloverETL Server is basically runtime environment for graphs, which brings new possibilities how to integrate Clover with your own software. Whereas CloverEngine can be integrated only as embedded library, CS implements several interfaces which can be called by another applications using common protocols like http. In addition, CS implements some optimalizations of threads and memory management.

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 11, Simple HTTP API (p. 43).)	by executing external process or by calling of java API
initialization of engine	during server startup	init is called for each graph execution
thread and memory optimalization	threads recycling, graphs cache, etc.	not implemented
scheduling	scheduling by timetable, onetime trigger, logging included	external tools (i.e. cron) can bes 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 5, Graph Event Listeners (p. 25)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 filesystem 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 2, Graphs on Server Side - Sandboxes (p. 2).	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 11, Simple HTTP API (p. 43).	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.
developement of graphs	CS supports team cooperation above one project (sandbox). CloverETL Designer will be intergated with CS in further versions.	

Chapter 2. Graphs on Server Side - Sandboxes

Sandbox is base storage unit for project. Sandbox is actually server-side analogy to CloverETL Designer project. Since CloverETL Designer has connector to CloverETL Server, designer project and 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 about configuration of connection to server.

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

In cluster mode, there are three sandbox types "shared", "local" and "partitioned". See Chapter 21, Clustering (p. 93) for details.

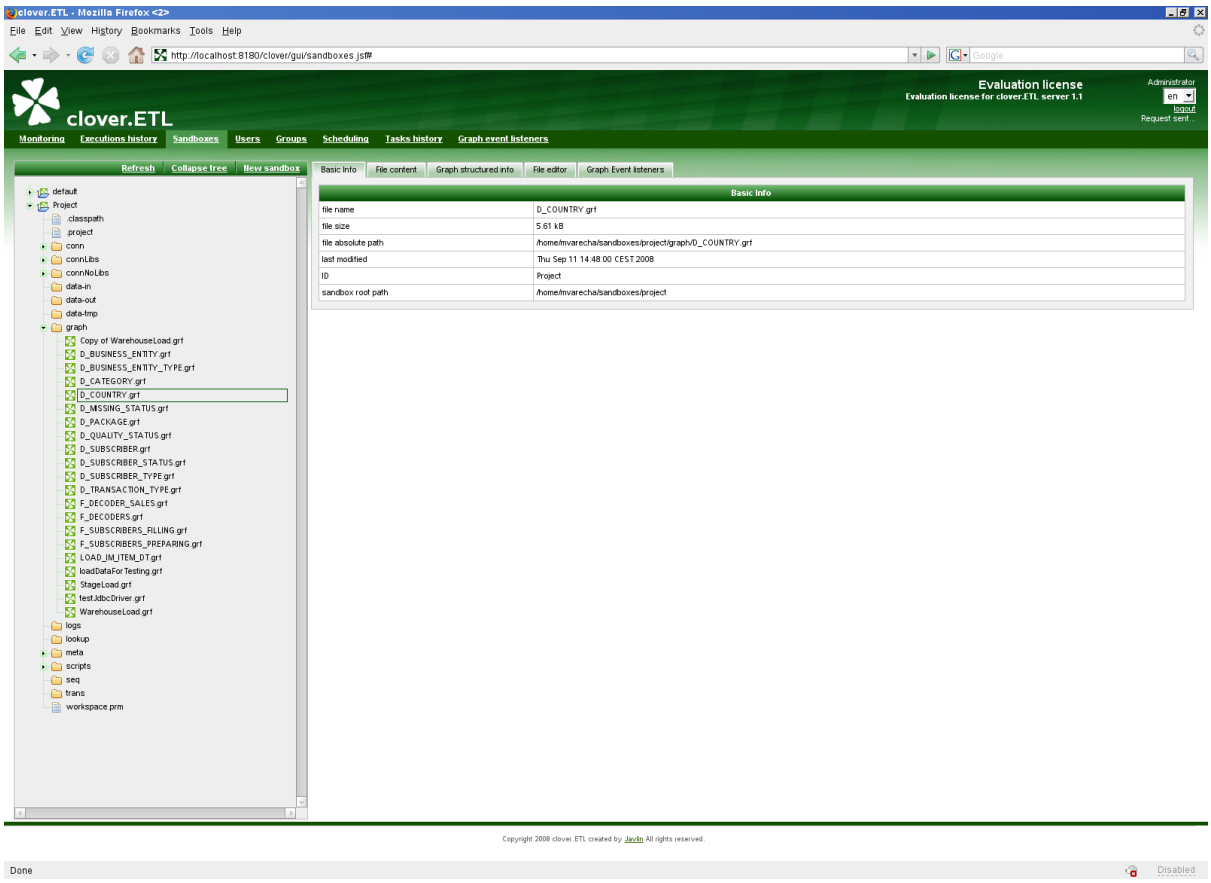


Figure 2.1. Sandboxes Section in CloverETL Server Web GUI

Each sandbox is defined by following attributes:

Table 2.1. Sandbox attributes

ID	Unique "name" of the sandbox. It's used in server APIs to identify sandbox. It must meet common rules for identifiers. It's specified by user in during sandbox creation and it can be modified later. *Note: modyfiing is not recommended, becouse it may be already used by some CS APIs clients.*
Name	Sandbox name used just for display. It's 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's specified by user during sandbox creation and it can be modified later. This attribute is used only in standalone mode. See Chapter 21, Clustering (p. 93) for details about cluster mode.
Owner	It's set automatically during sandbox creation. It may be modified later.

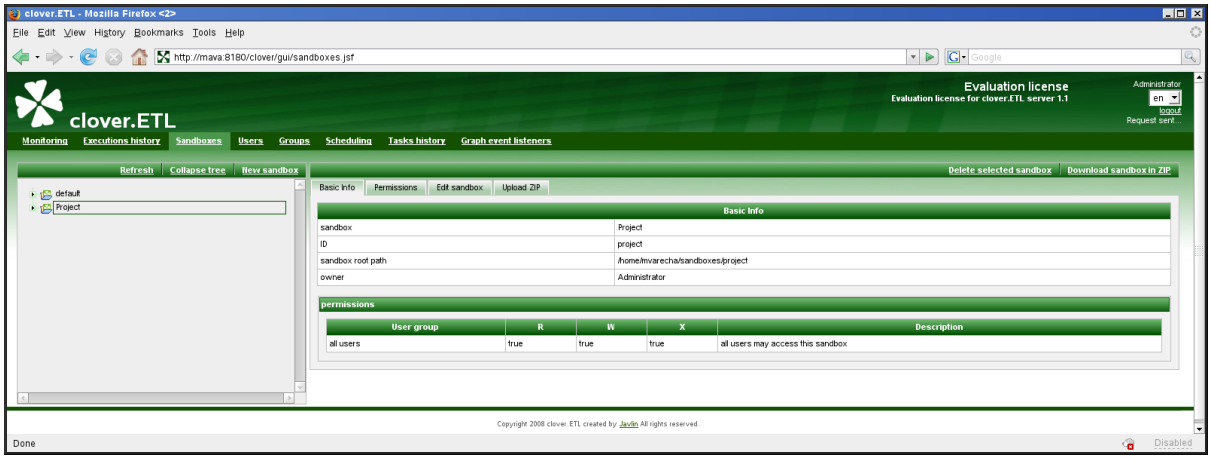


Figure 2.2. Sandbox Detail in CloverETL Server Web GUI

Referencing files from the graph

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 graph file.

- SANDBOX_* placeholders

  It's possible to use placeholders for paths to another sandboxes. Placeholder is constructed from sandbox ID with "SANDBOX_" prefix. I.e. placeholder for default sandbox is: SANDBOX_default and you can use it in graph XML like this: ${SANDBOX_default}. Placeholder is replaced by path to the sandbox's root path during graph preprocessing. These absolute local filesystem paths won't work in cluster environment! It's recommended to use sandbox URL instead.

- 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. 97) for details about the sandbox URLs.

Sandbox 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.

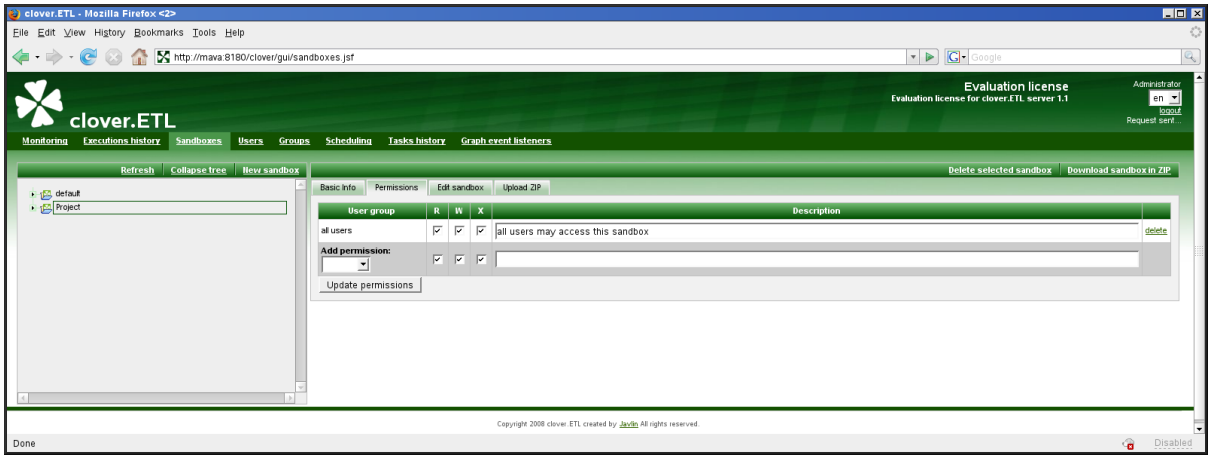


Figure 2.3. Sandbox Permissions in CloverETL Server Web GUI

Permissions to 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 2.2. Sandbox permissions

R - read	Users can see this sandbox in their sandboxes list.
W - write	Users can modify files in the sandbox throught CS APIs.
X - execution	Users can execute graphs in this sandbox. *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 4,* Scheduling *(p. 16).*

Sandbox Content

Sandbox should contain graphs, metadata, external connection and all related files. Files expecially graph files are identified by relative path from sandbox root. Thus you need two values to identify specific graph: sandbox and path in sandbox.

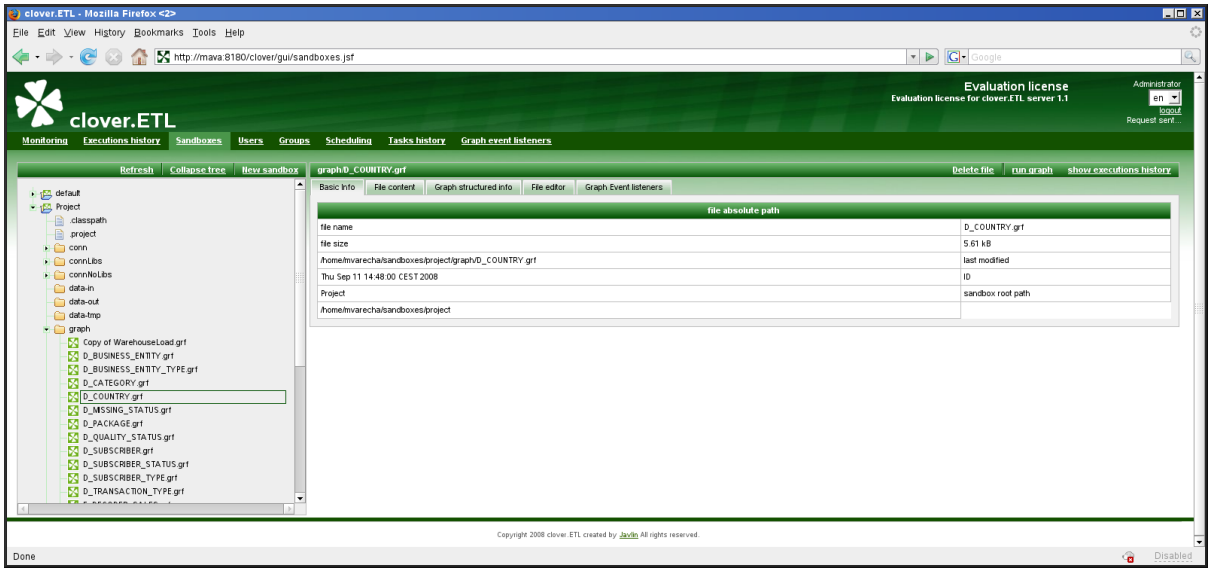


Figure 2.4. Web GUI - section "Sandboxes"

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

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.

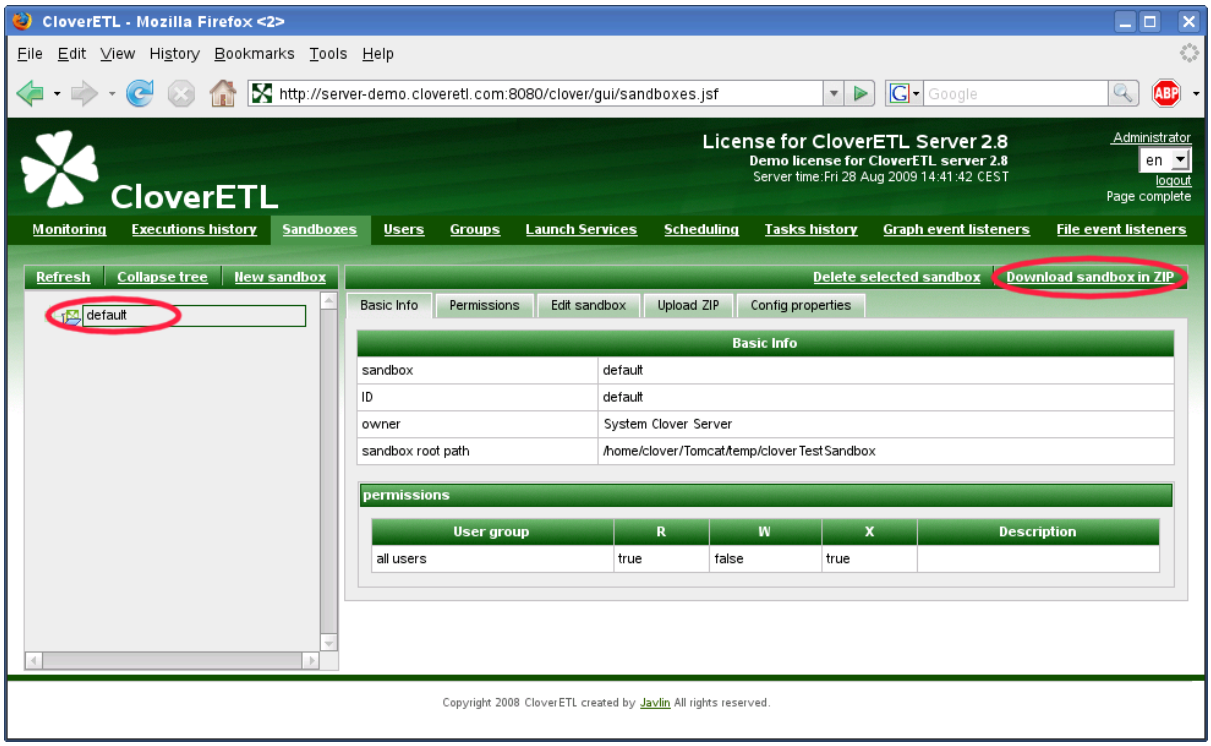


Figure 2.5. Web GUI - download sandbox in ZIP

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's immediatelly 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.

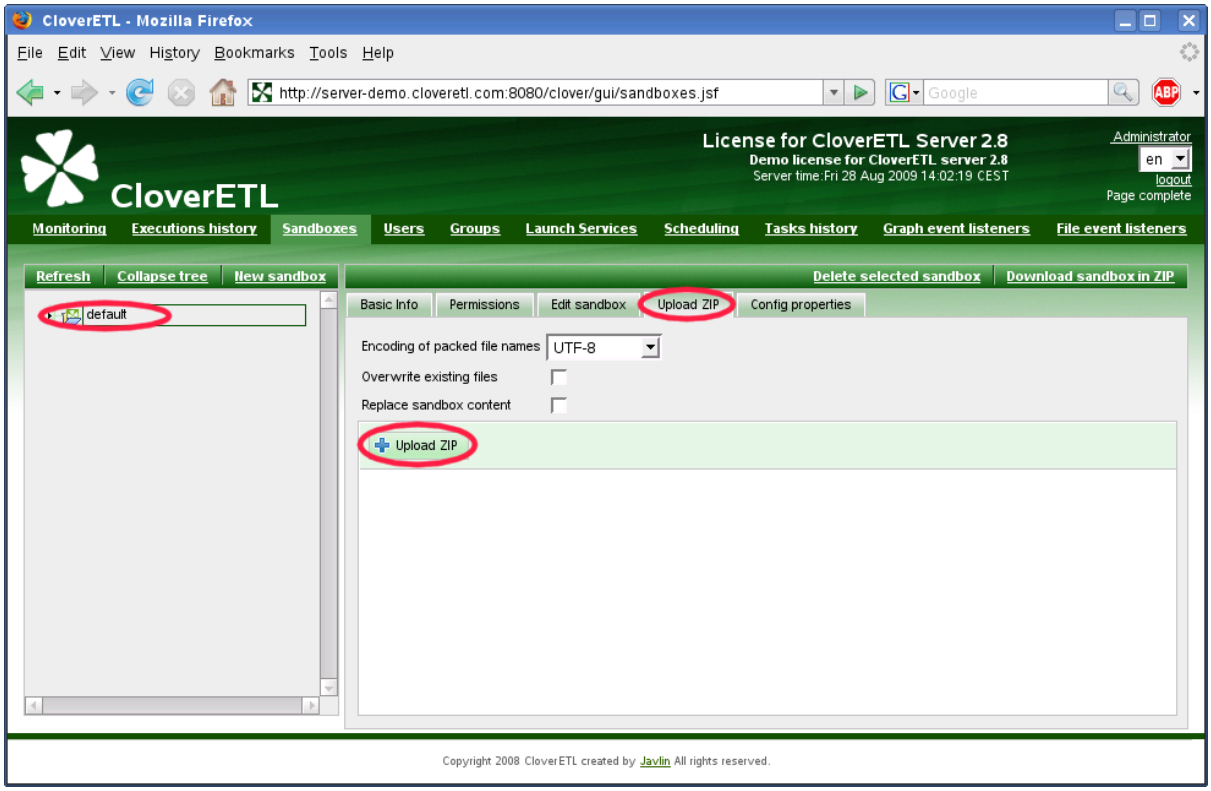


Figure 2.6. Web GUI - upload ZIP to sandbox

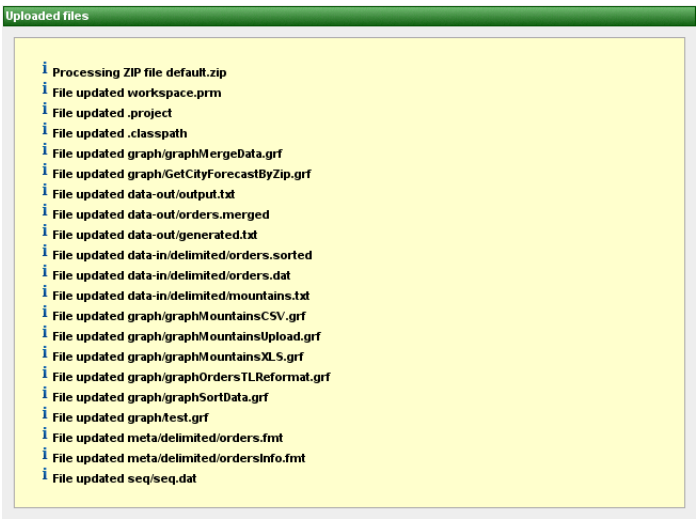


Figure 2.7. Web GUI - upload ZIP results

Table 2.3. 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 overwriten 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 file (i.e. input or output file) which cannot be displayed directly in web GUI. so user can download it.

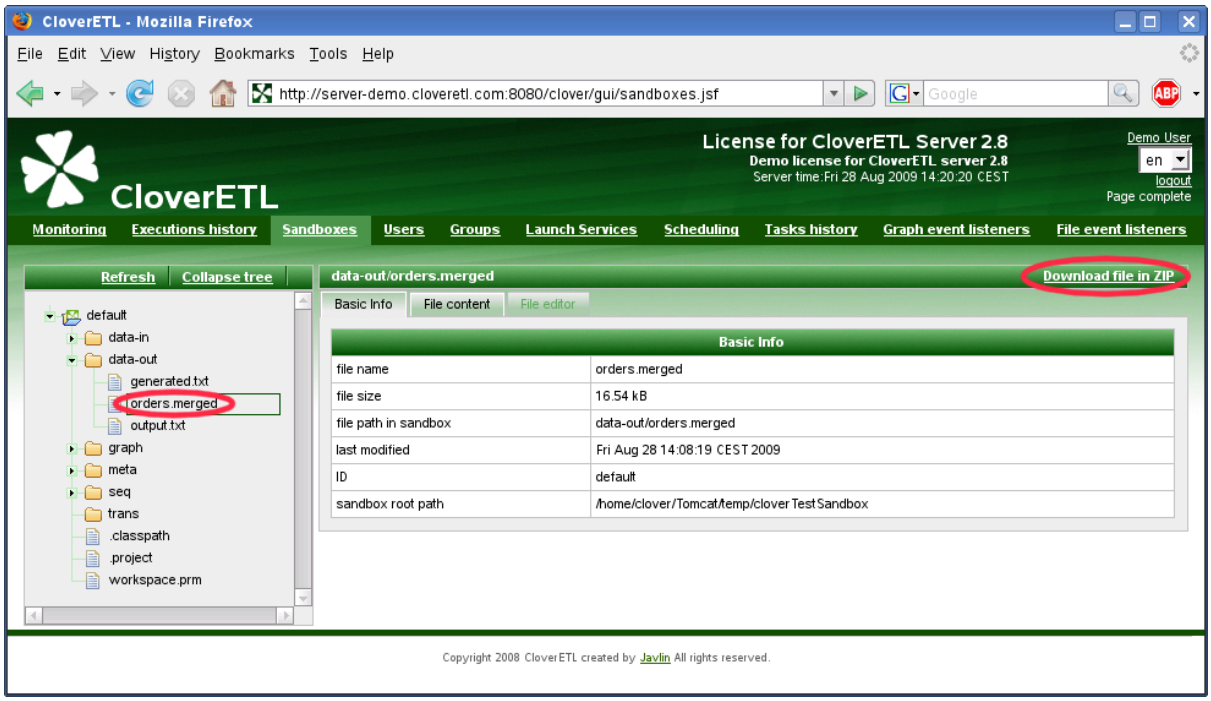


Figure 2.8. Web GUI - download file in ZIP

Download file HTTP API

It's 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's false, so response is content of the file.

Graph config properties

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

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

If neither sandbox or graph have config properties specified, defaults from main server configuration are applied. (See Chapter 16, Configuration (p. 75) for details)

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

Table 2.4. Graph config parameters

Property name	Default value	Description
tracking_interval	2000	Interval in ms for sampling nodes status in running graph.
max_running_concurrently	unlimited	Max number of concurrently running instances of this graph.
enqueue_executions	false	Boolean value. If it's true, executions above max_running_concurrently are enqueued, if it's 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 graph run log doesn't contain more detail messages then INFO event if graph config parameter "log_level" is set properly. See Chapter 19, Logging (p. 91) for details about log4j configuration.
max_graph_instance_age	0	Time interval in ms which specifies how long may graph instance last in server's cache. 0 means that graph is inited and released for each execution. Graph cannot be stored in the pool and reused in some cases (graph uses placeholders using dynamicly specified parameters)
classpath		List of paths or jar files which contain external classes used in the graph (transformations, generators, JMS processors). Separator is specified by Engine property "DEFAULT_PATH_SEPARATOR_REGEX". Path must always end with slash character "/". Server automatically adds "trans" subdirectory of graphs's sandbox.
skip_check_config	default value is taken from engine property	Switch which specifies whether check config must be performed before graph execution.
password		Password for decoding of encoded DB connection passwords.
verbose_mode	true	If true, more descriptive logs of graph runs are generated.
use_jmx	true	If true, graph executor registers jmx mBean of running graph.
debug_mode	false	If true, edges with enabled debug store data into files in debug directory. See property "graph.debug_path"

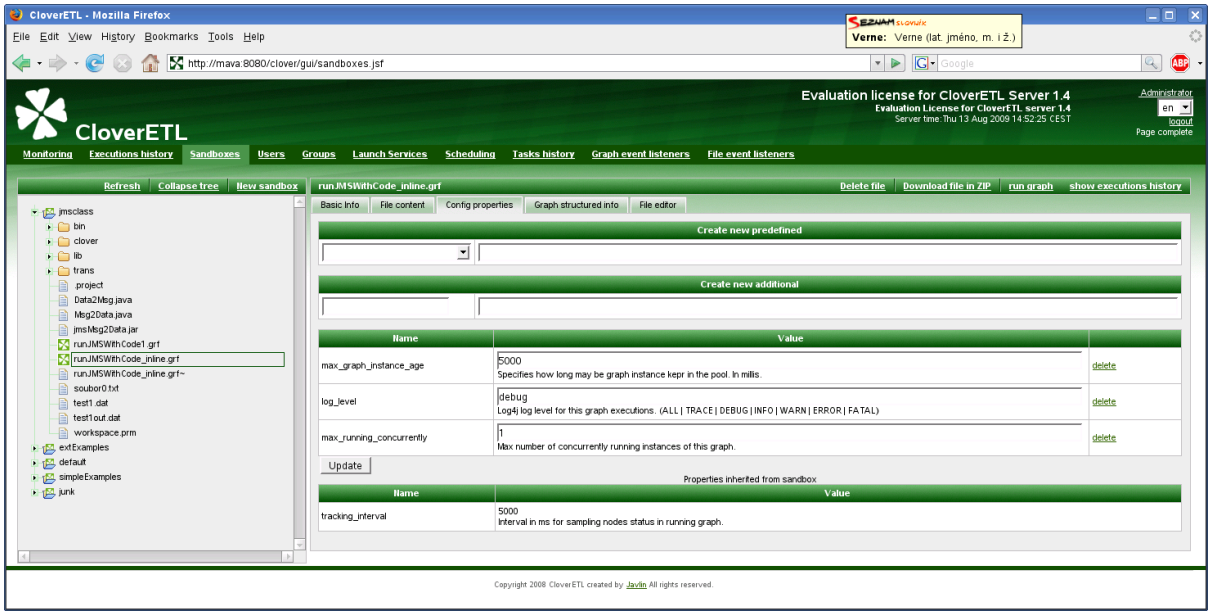


Figure 2.9. Graph config properties

Chapter 3. Users and Groups

CloverETL Server implements security module, which manages users and groups. Security module may be globally switched off (see Chapter 16, Configuration (p. 75) for details), but by default it's 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 neccessary.

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*
- *delete user*
- *assign user to groups* - Assignment to groups gives user proper permissions

Table 3.1. After default instalation 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's impossible to login as this user.

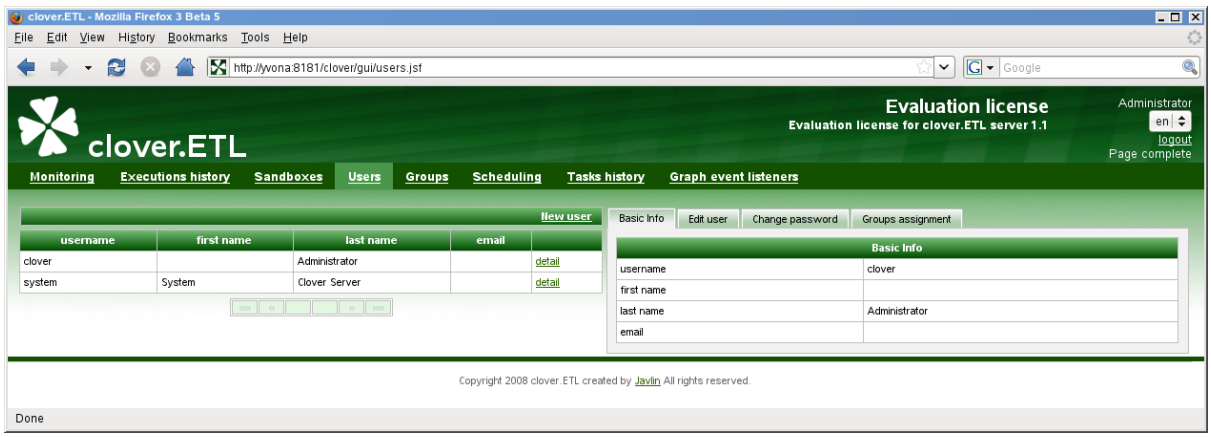


Figure 3.1. Web GUI - section "Users"

Table 3.2. 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 looses 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 Task - Send Email (p. 26) for details.

Edit user record

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

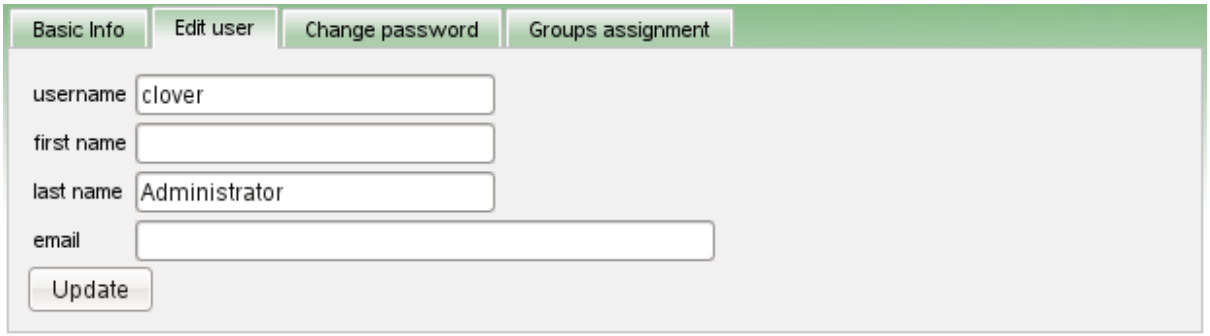


Figure 3.2. Web GUI - edit user

Change users Password

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

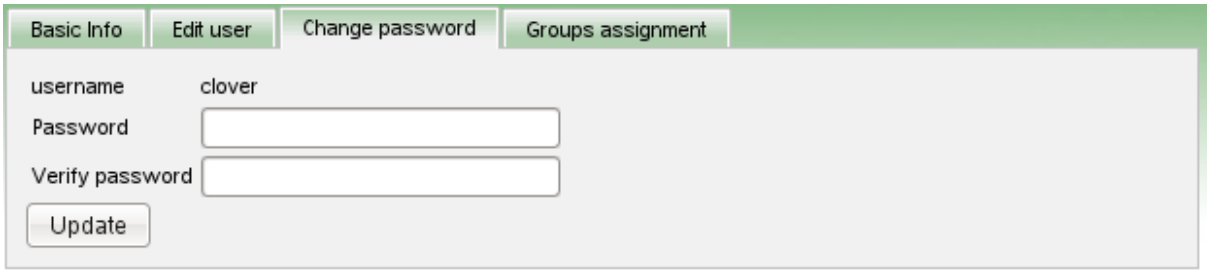


Figure 3.3. Web GUI - change password

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 Groups (p. 13) for details about permissions.

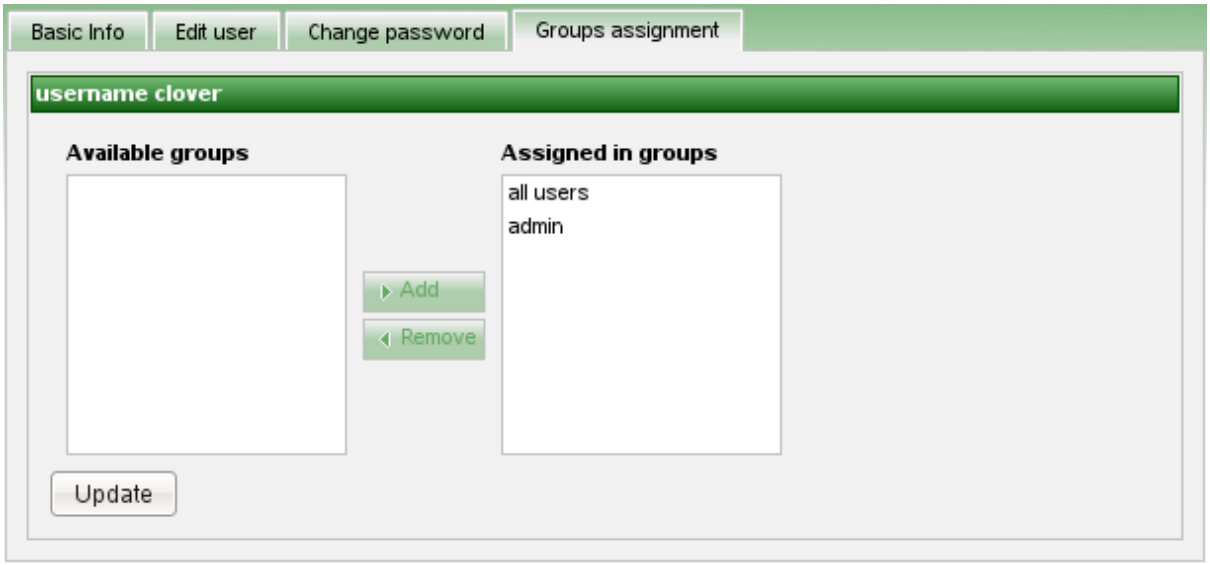


Figure 3.4. Web GUI - groups assignment

Groups

Group is abstract set of users, which gives assigned users some permissions. So it's not neccessary 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 Security and Permissions (p. 4) 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 14, Launch Service (p. 58) for details.

Table 3.3. Default groups created during instalation

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's possible to remove user from this group, but it's not 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.

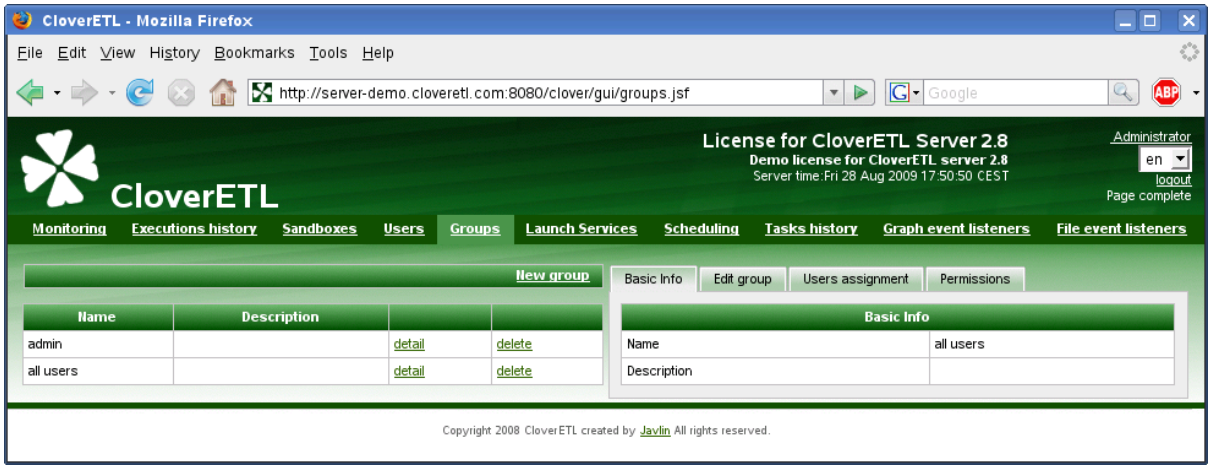


Figure 3.5. Web GUI - section "Groups"

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.

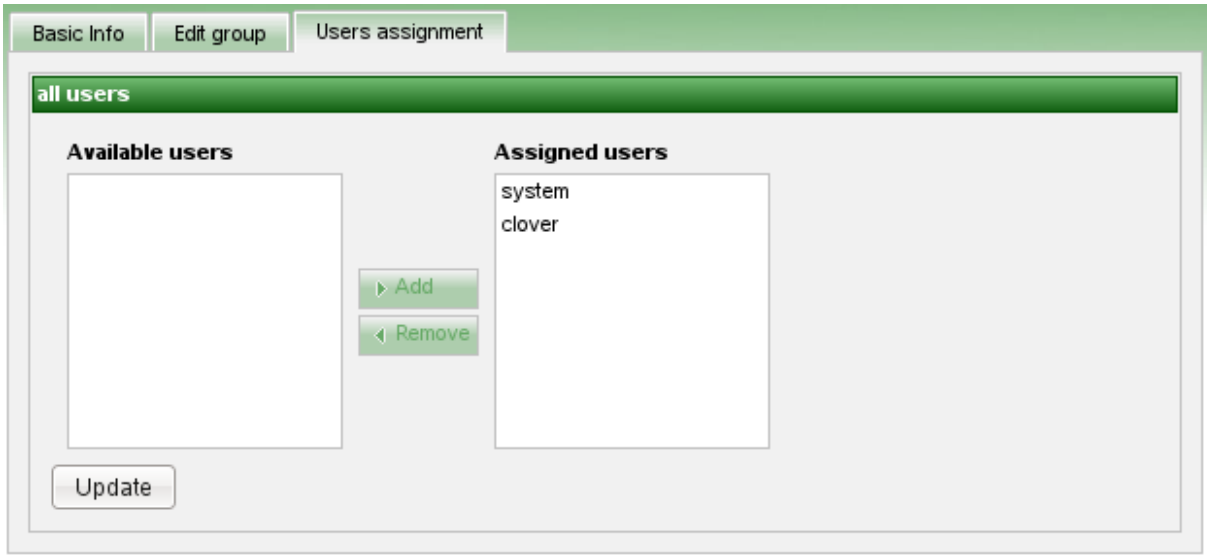


Figure 3.6. Web GUI - groups assignment

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 3.7. Tree of permissions

Chapter 4. Scheduling

Scheduling allows user to create his own timetable for operations which he doesn't want to trigger manually. Each schedule represents separated timetable and basicaly 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.

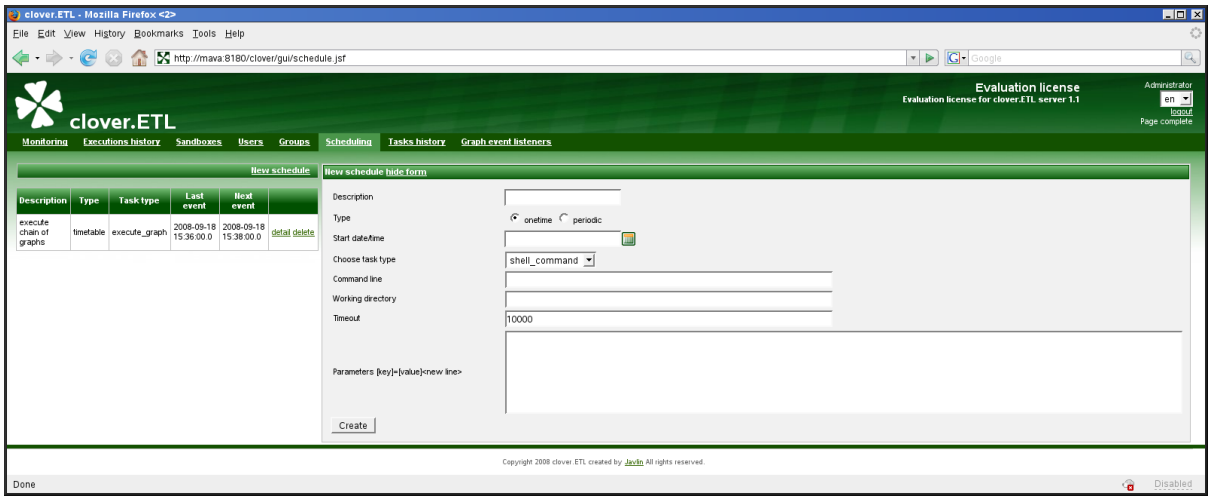


Figure 4.1. Web GUI - section "Scheduling" - create new

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. 16)
- Periodical schedule by Interval (p. 17)
- Periodical schedule by timetable (Cron Expression) (p. 18)

Onetime Schedule

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

Table 4.1. Onetime schedule attributes

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

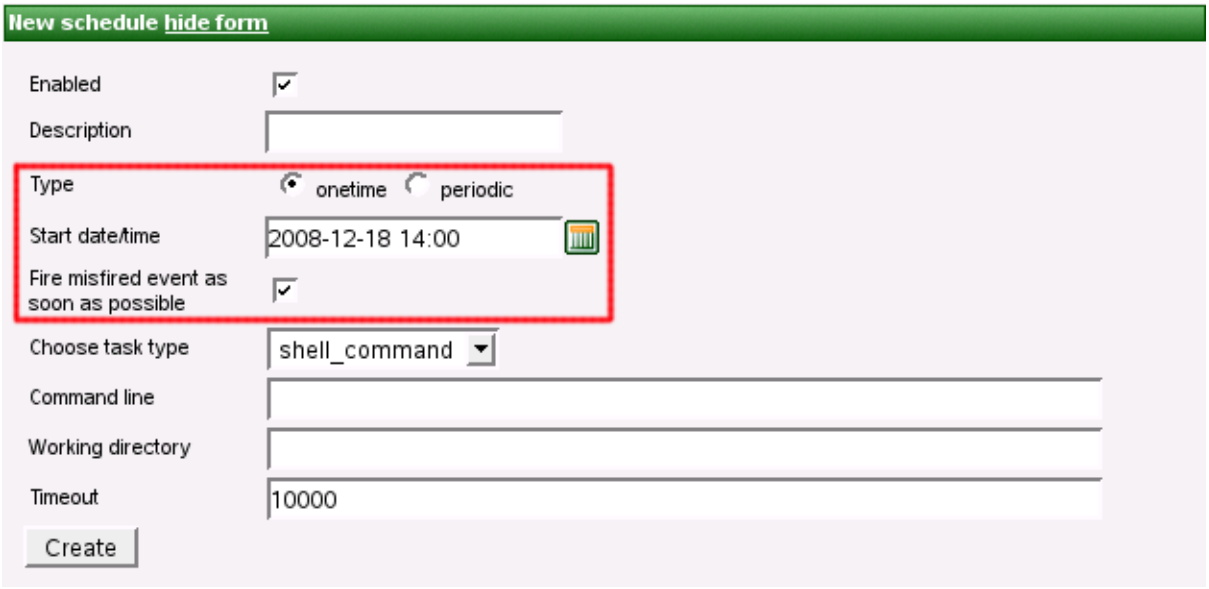


Figure 4.2. Web GUI - onetime schedule form

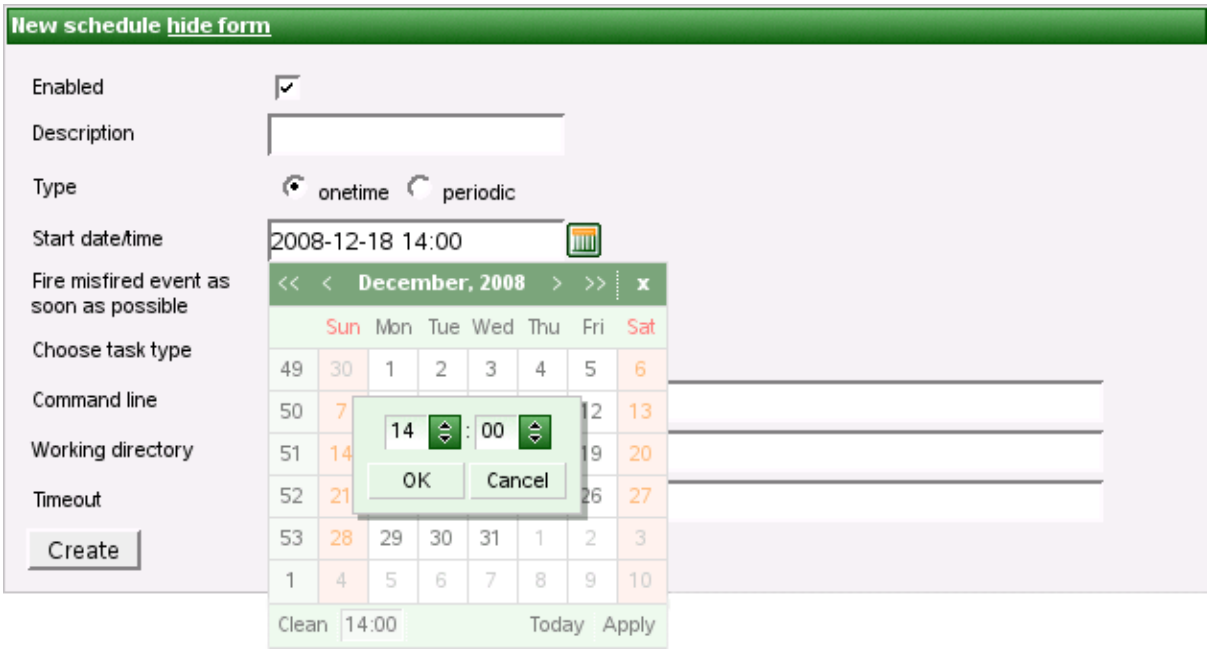


Figure 4.3. Web GUI - schedule form - calendar

Periodical schedule by Interval

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

Table 4.2. 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 immediatelly, when it's possible. Otherwise it's ignored and it will be triggered at next schedulled time.

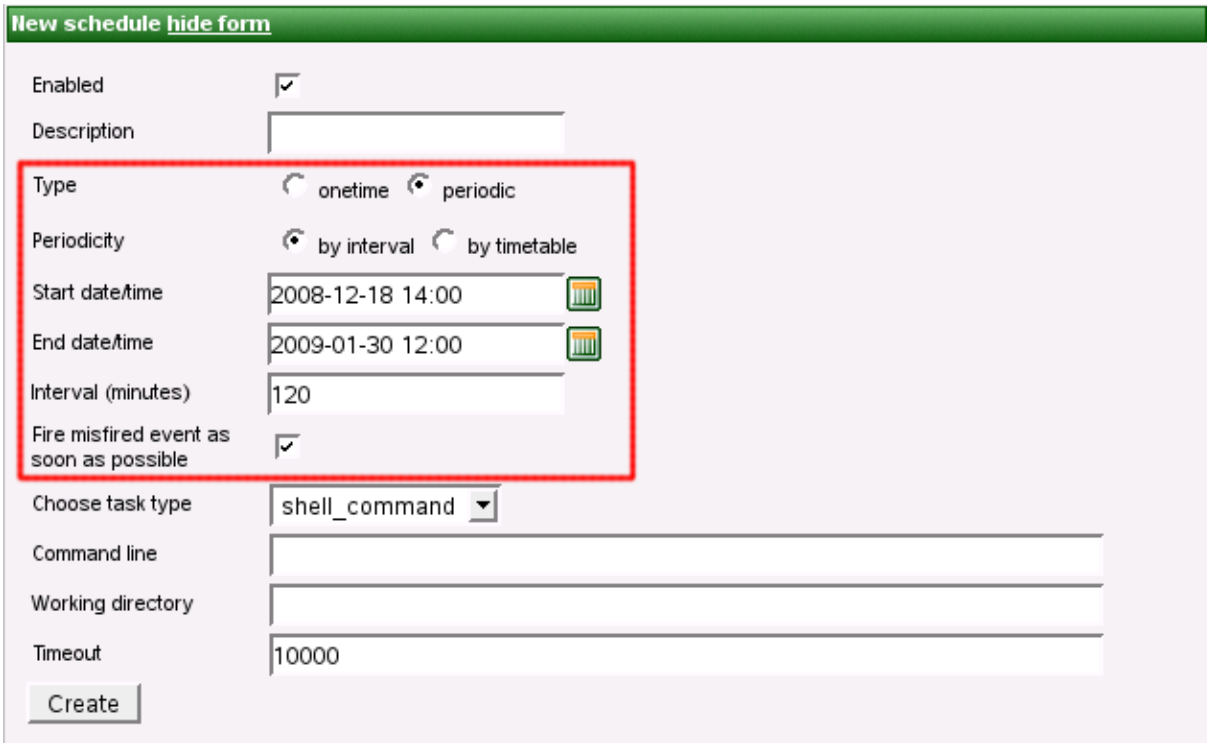


Figure 4.4. Web GUI - periodical schedule form

Periodical schedule by timetable (Cron Expression)

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

Table 4.3. 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 powerfull 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 immediatelly, when it's possible. Otherwise it's ignored and it will be triggered at next schedulled time.

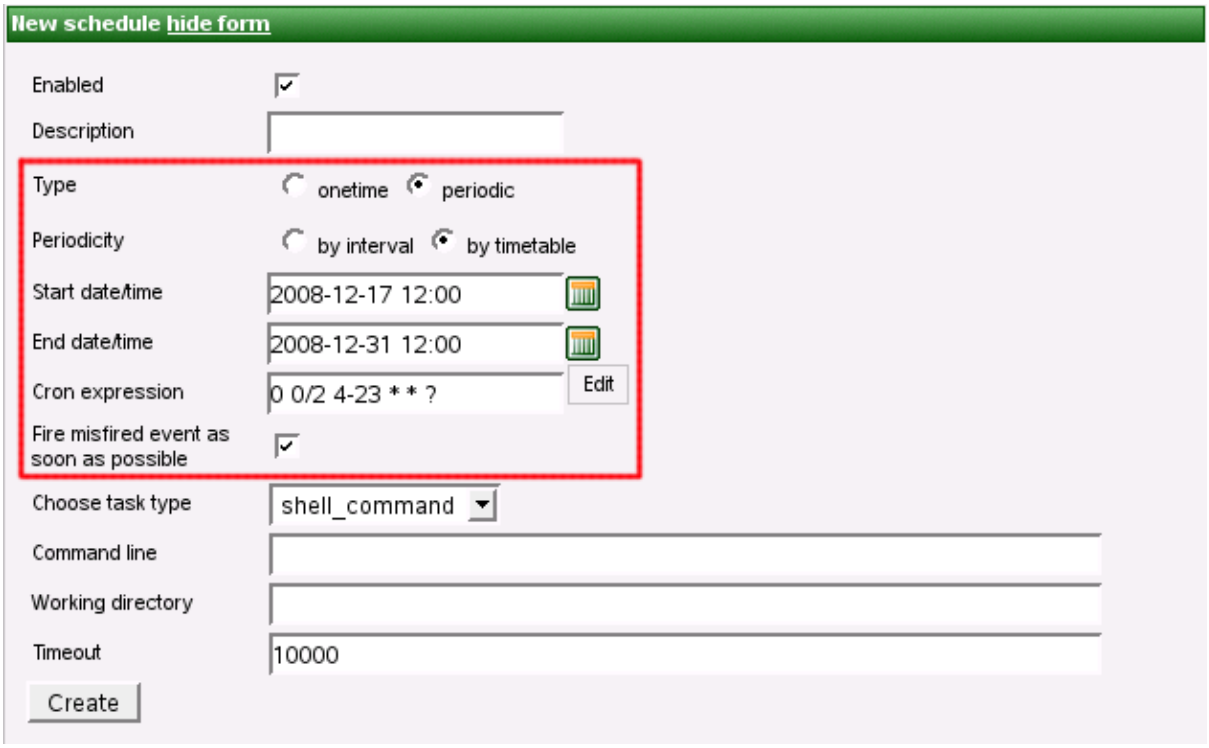


Figure 4.5. Cron periodical schedule form

Tasks

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

- Task - Execution of Graph (p. 20)
- Task - Kill Graph (p. 20)
- Task - Execution of Shell Command (p. 21)
- Task - Send Email (p. 22)
- Task - Execute Groovy Code (p. 22)
- Task - Archive Records (p. 23)

We expect, that some more task implementation will be needed, i.e. task type "Execution of java code", etc.

Task - Execution of Graph

Table 4.4. 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 accessible in selected sandbox.

Parameters	Key-value pairs which are passed to the executed graph as parameters. Besides, if this task is triggered by "graph event", you can specify parameters from the graph which is "graph event" source. These parameters are passed to executed graph. i.e. event source graph has these parameters: paramName2 with value "val2", paramName3 with value "val3", paramNameX. Task "graph execution" has "Parameters" attribute set like this:
	
	`paramName1=paramValue1`
	`paramName2=`
	`paramName3`
	`paramName4`
	
	So executed graph gets these parameters and values: paramName1 with value "paramValue1" (specified by task) paramName2 with value "" (empty string specified by task overrides event source parameters) paramName3 with value "val3" (value is taken from event source graph) These parameters aren't passed: paramName4 isn't passed, since it doesn't have any value in event source graph. paramNameX isn't passed, since it's not specified among the parameters to pass in the task
	
	Event parameters like "event_run_result", "event_run_id" etc. are passed to the graph without limitations.

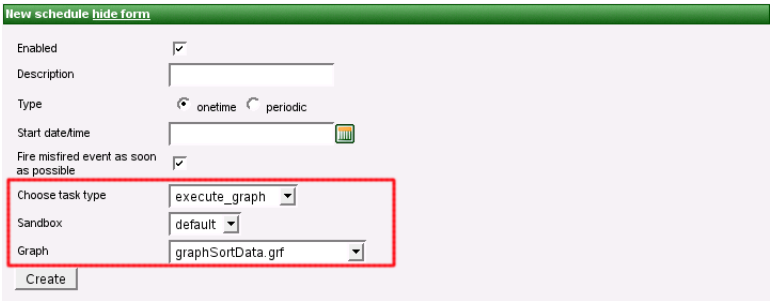


Figure 4.6. Web GUI - Graph execution task

Task - Kill Graph

This task, when activated kills/aborts specified graph, if it's currently running.

Table 4.5. Attributes of "Kill graph" task

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

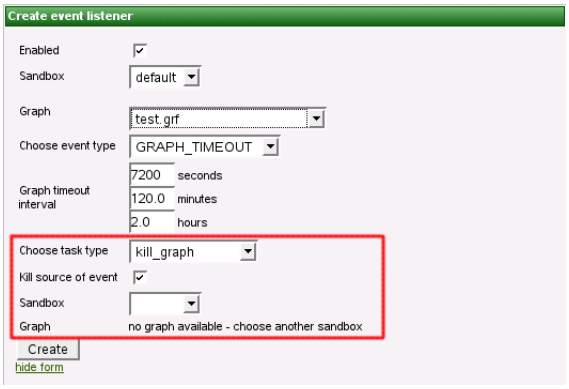


Figure 4.7. Web GUI - "Kill graph"

Task - Execution of Shell Command

Table 4.6. 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.

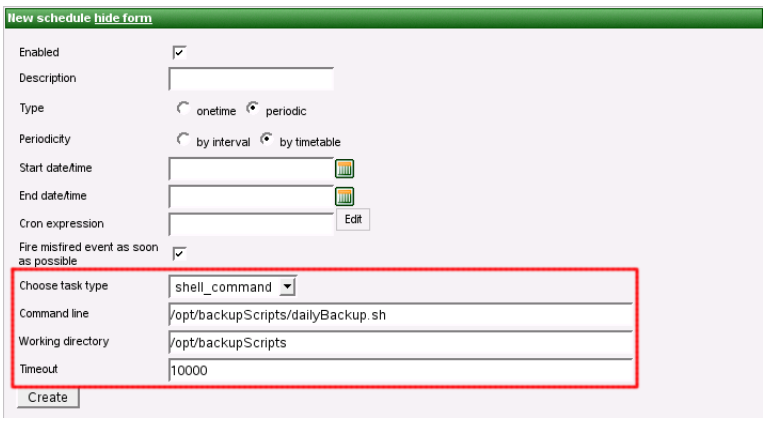


Figure 4.8. Web GUI - shell command

Task - Send Email

This task is very usefull, but for now only as response for graph events. This feature is very powerfull for monitoring. (see Chapter 5, Graph Event Listeners (p. 25) 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 4.7. List of variables available in Groovy code

variable	class	description	availability
event	com.cloveretl.server.events.AbstractServerEvent		everytime
task	com.cloveretl.server.persistent.Task		everytime
now	java.util.Date	current time	everytime
parameters	java.util.Properties	Properties of task	everytime
user	com.cloveretl.server.persistent.User	Same as event.getUser()	everytime
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		everytime
cloverConfiguration	com.cloveretl.server.spring.CloverConfiguration	Configuration values for CloverETL Server	everytime
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's accessible on URL: http://host:port/clover/javadoc/index.html	everytime
sessionToken	String	Valid session token of the user who owns the event. It's useful for authorisation to the facade interface.	everytime

Variables run, tracking and sanbox 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 4.8. 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 specified interval are included in archivation.
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's usefull i.e. If you want to delete records for sucessfully finished graphs, but you are interested in failed graphs.
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.

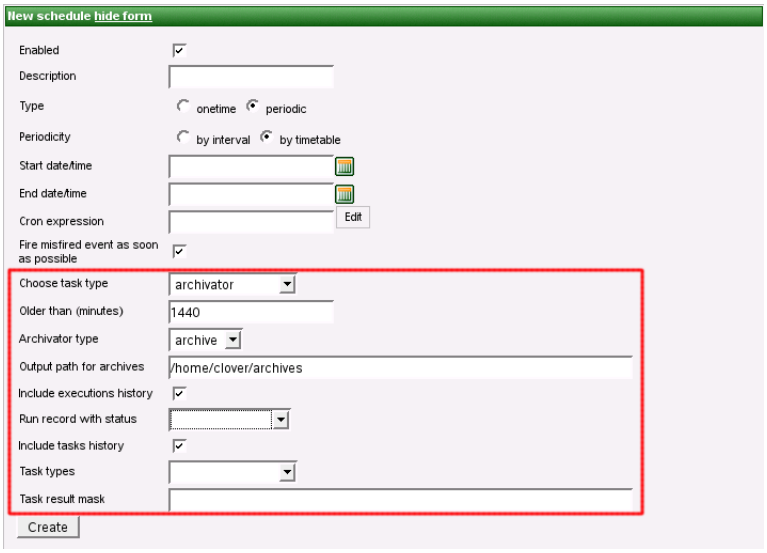


Figure 4.9. Web GUI - archive records

Chapter 5. Graph Event Listeners

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

In cluster environment, event exists only on cluster node, which runs graph thus task is triggered on the same node.

Graph Events

Each event carries properties of graph, which is source of event. If there is a 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 overriden by last graph.

For now, there are these types of graph events:

graph started

Event of this type is created, when graph is successfully executed. It means, that threads of graph nodes and watchdog are running.

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 can't be executed from any reason, or when any node of graph fails.

graph aborted

Since 1.2.1

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 "Graph timeout interval" attribute for each listener of graph timeout event. You can specify this interval in seconds or in minutes or in hours.

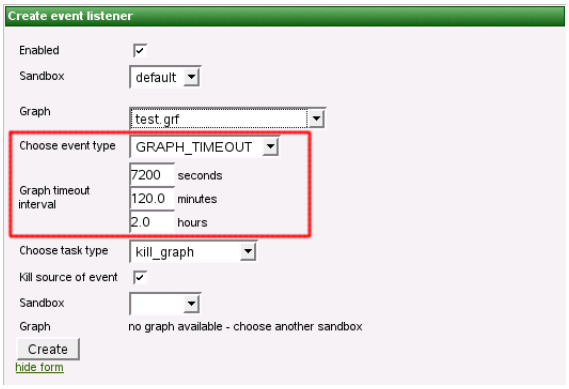


Figure 5.1. Web GUI - graph timeout event

graph status unknown

Since 1.3.

Event of this type is created, when server starts and there is graph 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's 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 usefull expecially with graph event listeners, thus it's described here. It's 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. 26)
- Task - JMS Message (p. 29)

Task - Send Email

This type of task is usefull 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 5.1. 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's possible to specify more addresses separated by comma. It's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
Cc	Cc stands for 'carbon copy'. Copy of email will be delivered to these addresses. It's possible to specify more addresses separated by comma. It's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
BCc	Bcc: stands for 'Blind carbon copy'. It's 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's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
Subject	Email subject. It's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
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 don't display HTML. It's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
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 don't display HTML. It's also possible to use placeholders. *See* Placeholders *(p. 28) for details.*
Log file as attachment	If this switch is checked, email will have an attachment with packed log file of related graph execution.

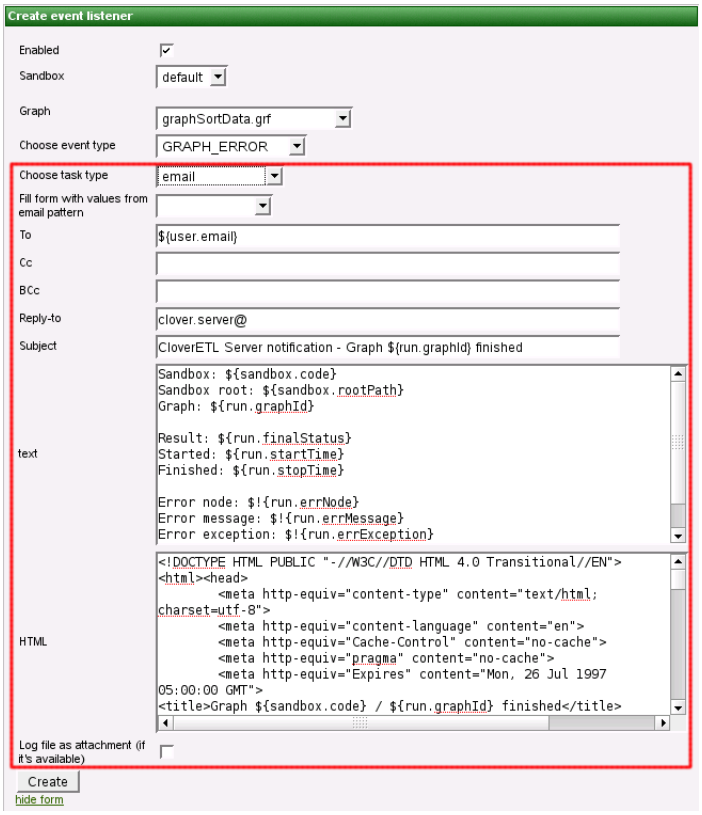


Figure 5.2. Web GUI - send email

Note: Don't forget to configure connection to SMTP server (See Chapter 16, Configuration (p. 75) for details).

Placeholders

Place holder may be used in some fields of tasks. They are expecially usefull 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 preproced 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 5.2. 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. ${user.email}) 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. ${run.graphId}) graphId, finalStatus, startTime, stopTime, errNode, errMessage, errException, logLocation

tracking	Data structure describing status of components in graph execution. Contains sub-properties, which are accessible using Velocity syntax for loops and conditions.
	`#if (${tracking})`
	`<table border="1" cellpadding="2" cellspacing="0">`
	`#foreach ($phase in $tracking.trackingPhases)`
	`<tr><td>phase: ${phase.phaseNumber}</td>`
	`<td>${phase.execTime} ms</td>`
	`<td></td><td></td><td></td></tr>`
	`#foreach ($node in $phase.trackingNodes)`
	`<tr><td>${node.nodeName}</td>`
	`<td>${node.result}</td>`
	`<td></td><td></td><td></td></tr>`
	`#foreach ($port in $node.trackingPorts)`
	`<tr><td></td><td></td>`
	`<td>${port.portType}:${port.index}</td>`
	`<td>${port.totalBytes} B</td>`
	`<td>${port.totalRows} rows</td></tr>`
	`#end`
	`#end`
	`#end`
	`</table>`
	`#end`
	`}`

sandbox	Data structure describing sandbox containing executed graph. Contains sub-properties, which are accessible using dot notation (i.e. ${sandbox.name}) name, code, rootPath
schedule	Data structure describing schedule which triggered this task. Contains sub-properties, which are accessible using dot notation (i.e. ${schedule.description}) description, startTime, endTime, lastEvent, nextEvent, fireMisfired

Task - JMS Message

This type of task is usefull 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 don't.

Table 5.3. 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's "org.apache.activemq.jndi.ActiveMQInitialContextFactory". If it's 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's also possible to use placeholders. *See* Placeholders *(p. 28) of send email task* *for details.*

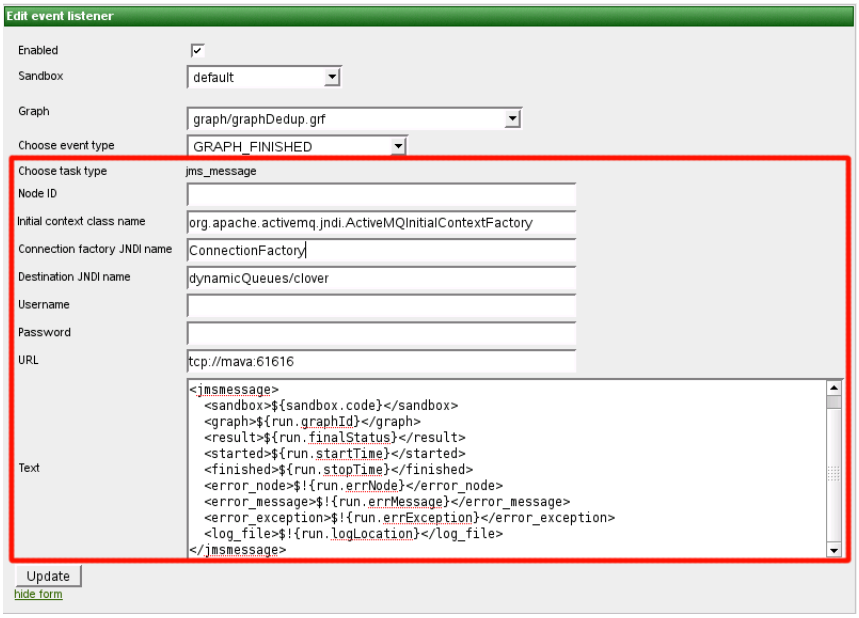


Figure 5.3. Web GUI - Task JMS message editor

Use cases

Possible use cases are the following:

- Execute graphs in chain (p. 31)
- Email notification about graph failure (p. 31)
- Email notification about graph success (p. 32)
- Backup of data processed by graph (p. 32)

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 behavior 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's 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 5.4. Event source graph isn't specified, thus listener works for all graphs in specified sandbox

Email notification about graph failure

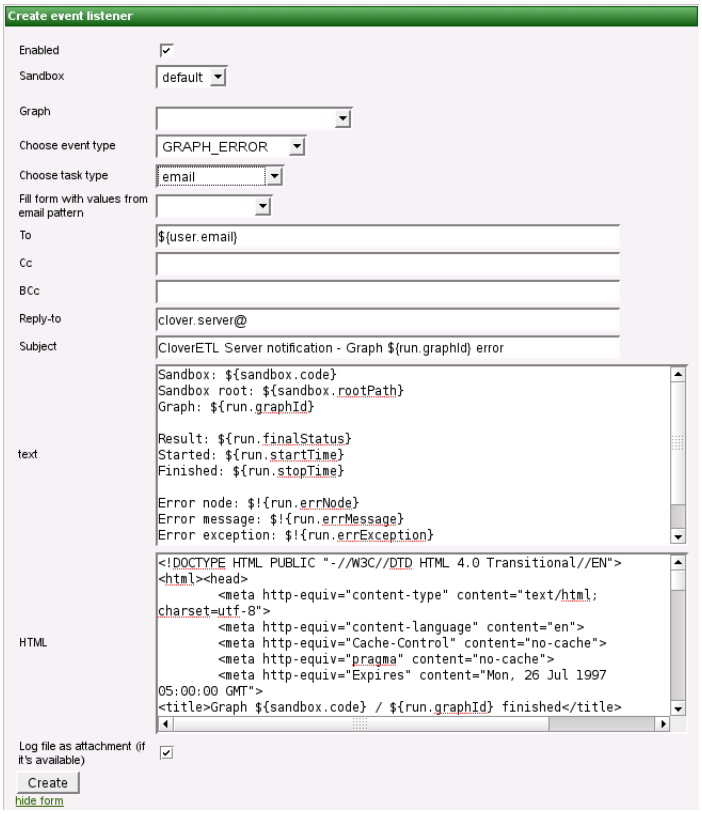


Figure 5.5. Web GUI - email notification about graph failure

Email notification about graph success

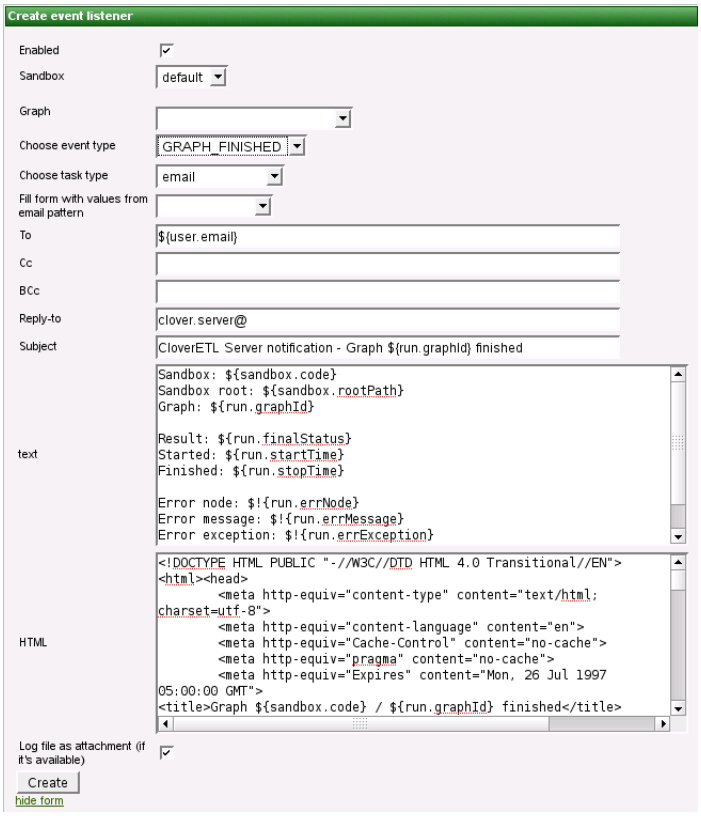


Figure 5.6. Web GUI - email notification about graph success

Backup of data processed by graph

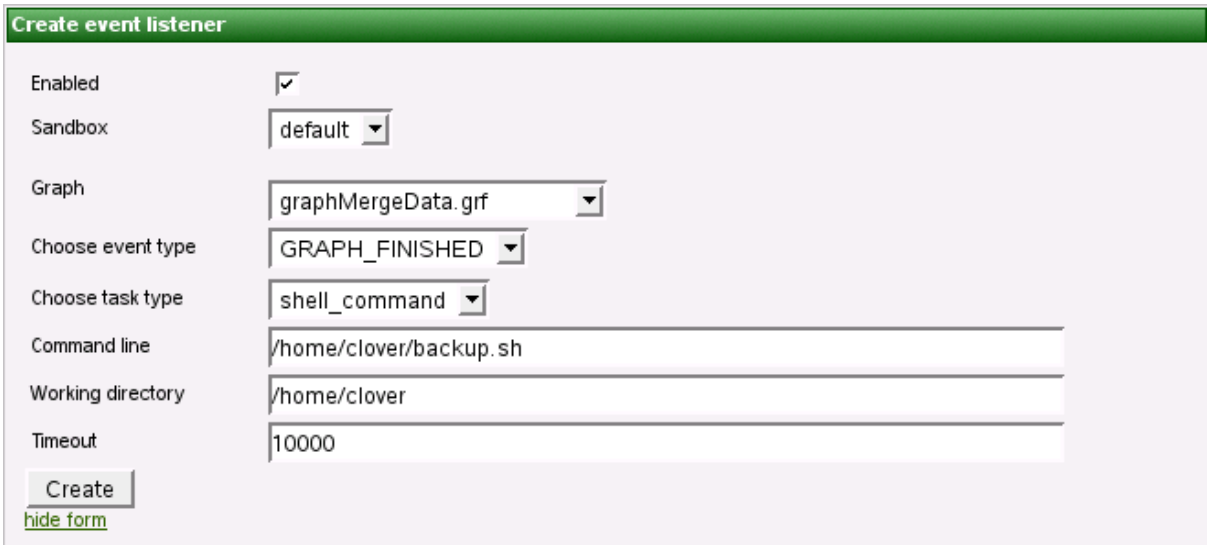


Figure 5.7. Web GUI - backup of data processed by graph

Chapter 6. JMS messages listeners

Since 2.10

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 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 6.1. Attributes of JMS message task

Attribute	Description
Node ID to handle the event	This attribute makes sense only in cluster environment. It's node ID where the listener should be initialized. If it's 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's "org.apache.activemq.jndi.ActiveMQInitialContextFactory". If it's empty, server uses default initial context. Specified class must be on web-app classpath or application-server classpath. It's 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)	If it's 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's 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" ant it must be re-initialized. So during these intervals the message in the Topic may get lost if the consumer doesn't have durable subscription. 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's set as URL parameter tcp://localhost:1244?jms.clientID=TestClientID
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: http://java.sun.com/j2ee/1.4/docs/api/javax/jms/Message.html It has different behaviour depending on type of consumer (queue/topic) Queue: If a its 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's 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 6.2. Variables accessible in groovy code

type	key	description
javax.jms.Message	msg	instance of JMS message
java.util.Properties	properties	See below for details. Contains values (String or converted to String) read from message and it's 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	See below for details. Contains values (Object, Stream, ..) read or proxied from the message instance and it's passed to the task which may use them somehow. I.e. task "execute graph" passes it to the executed graph as "dictionary entries".
javax.servlet.ServletContext	servletContext	instance of ServletContext
javax.jms.Message	msg	instance of JMS message
com.cloveretl.server.api.ServerFacade	serverFacade	instance of serverFacade usable for calling CloverETL Server core features.
String	sessionToken	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 6.3. "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 instanceof 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_destionation	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's number or text.

Table 6.4. "data" elements

key	description
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's 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 incomming JMS message using this proxy stream.

Chapter 7. Universal event listeners

Since 2.10

This feature allows you to specify Groovy code, which decides when the event is created. Subsequntly 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 7.1. Attributes of Universal message task

Attribute	Description
Node ID to handle the event	This attribute makes sense only in cluster environment. It's node ID where the listener should be initialized. If it's 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 decesion 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, mothing happens. If groovy code throws an exception, it's considered as coding error and event is NOT created because of it. So if it's neccessary, the exceptions must be handled in groovy code.

Table 7.2. 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's 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's 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's 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 8. 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"

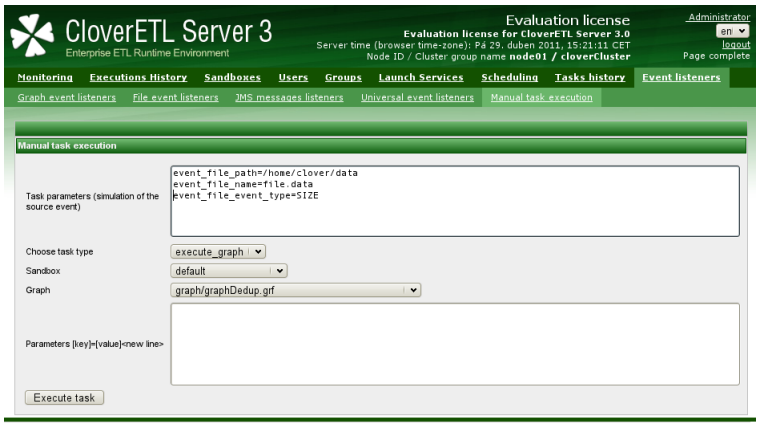


Figure 8.1. Web GUI - "Manual task execution" section

Chapter 9. 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 checkes it's local filesystem. In "standalone" environment, "node ID" attribute is ignored.

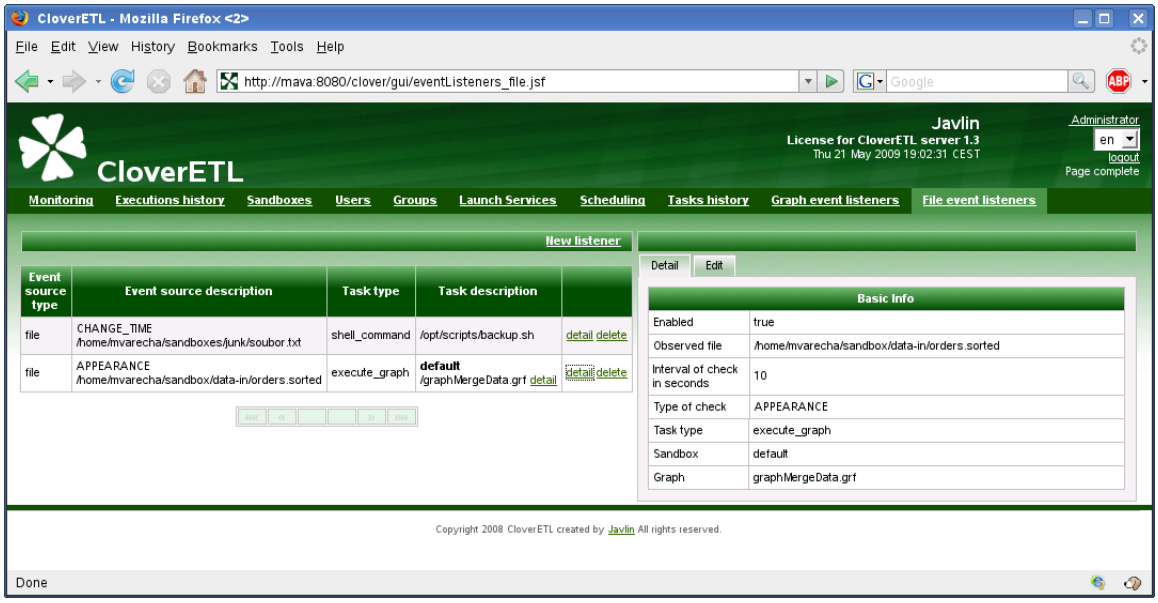


Figure 9.1. Web GUI - "File event listeners" section

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. 38)
- Wildcards (p. 38)
- Regullar expression (p. 39)

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 doesn't match input_9.csv

Regullar expression

Examples

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

Notes

- It's strongly recommended to use absolute paths. It's 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. 39)
- file DISAPPEARANCE (p. 39)
- file SIZE (p. 40)
- file CHANGE_TIME (p. 40)

file APPEARANCE

Event of this type occures, when 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's 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's complete, move/rename to observed location where CloverETL Server may detect it. File moving/renaming should be atomic operation.

file DISAPPEARANCE

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

file SIZE

Event of this type occures, when size 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.

file CHANGE_TIME

Event of this type occures, 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's specified in seconds.
- Each listener defines task, which will be processed as the reaction for file event. All task types and theirs 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.

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 10. 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's 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 can't 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. Unfortunatelly, it's more or less unreliable, so it's recommended to use some free or commercial WebDAV client. The best WebDAV client we've tested is BitKinex: http://www.bitkinex.com/webdavclient

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

Whereas most of WebDAV clients can work with HTTP Digest Authentication, some of them can't use HTTP Basic Authentication. So the CloverETL Server WebDAV API uses the Digest Authentication by default. However it may be reconfigured to use HTTP Basic Authentication. Please see the Configuration section for details.

HTTP Digest Authentication is feature added to the version 3.1. If you upgraded your older CloverETL Server distribution, users created before the upgrade can't 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 11. Simple HTTP API

This API is intended for all HTTP clients (even for the most simple 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.

URL has this pattern:

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


Operation help

parameters

no

returns

list of possible operations and parameters

example

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

Operation graph_run

parameters

Table 11.1. 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
runtime config	no	default	Text ID of runtime config for this execution. If not specified, default will be used.
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.

returns

run ID: incremental number, which identifies each execution request

example

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

Operation graph_status

parameters

Table 11.2. 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's 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. After timeout returns error response.

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 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

parameters

Table 11.3. Parameters of graph_kill

parameter name	mandatory	default	description
runID	yes	-	Id of each graph execution
returnType	no	STATUS	STATUS | STATUS_TEXT | DESCRIPTION

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 runID which are currently running.

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 11.4. Parameters of sandbox_content

parameter name	mandatory	default	description
sandbox	yes	-	text ID of sandbox

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 11.5. 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. Meaningfull 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's 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.

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]|[grap
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 me executed on suspended server/sandbox.

parameters

Table 11.6. Parameters of suspend

parameter name	mandatory	default	description
sandbox	no	-	Text ID of sandbox to suspend. If not specified, it supends 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's finished in common way.

returns

Result message

Operation resume

parameters

Table 11.7. Parameters of resume

parameter name	mandatory	default	description
sandbox	no	-	Text Id of sandbox to resume. If not specified, server will be resumed.

returns

Result message

Chapter 12. 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. 49)
- How to configure JMX on Glassfish (p. 50)
- Websphere 7 (p. 51)
- Possible problems (p. 53)

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 doesn't 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 doesn't 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:

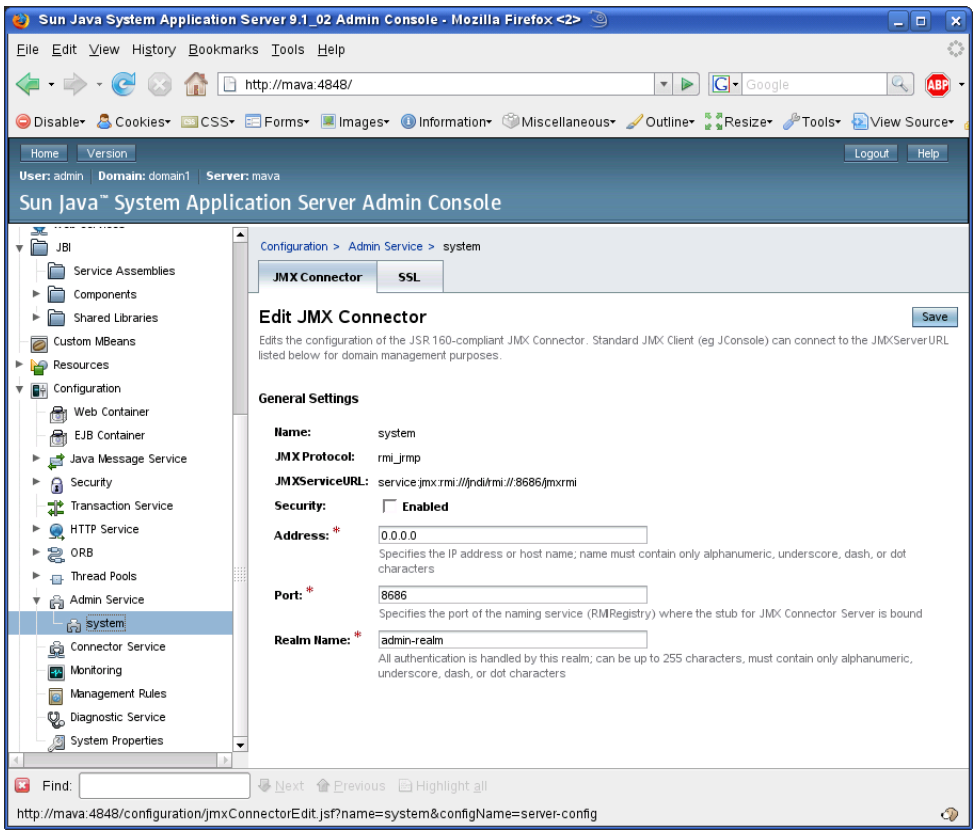


Figure 12.1. Glassfish JMX connector

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 doesn't 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]
```

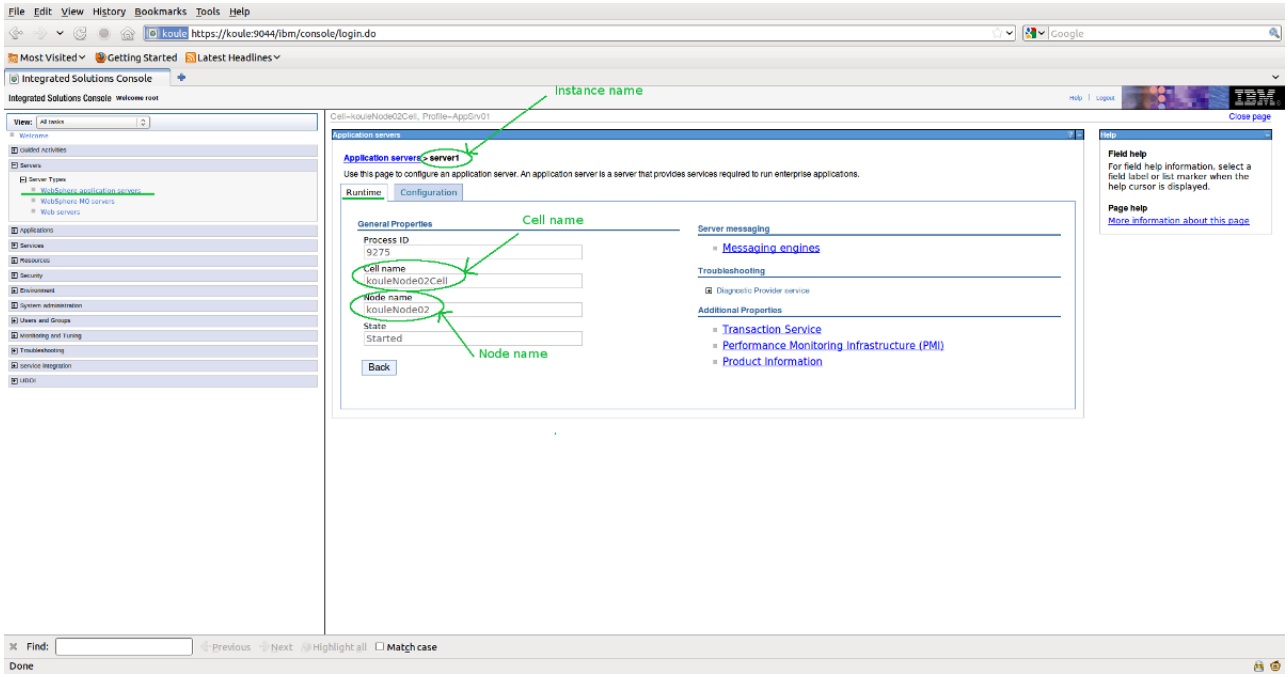


Figure 12.2. Websphere configuration

Websphere 6

URL for connecting to JMX server is:

```
service:jmx:rmi:///jndi/JMXConnector
```

Following system properties need to be set:

org.omg.CORBA.ORBClass=com.ibm.CORBA.iiop.ORB
java.naming.provider.url=corbaloc:iiop:[host]:[port]/WsnAdminNameService where *host* is the host name you are connectiong 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 RMIConnectorC 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_6.1.0.jar
/runtimes/runtimes/com.ibm.ws.webservices.thinclient_6.1.0.jar
/java/jre/lib/ibmorb.jar

Websphere 7

URL for connecting to JMX server is:

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

where *host* is the host name you are connectiong 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 RMIConnectorC A   ADMC0026I: The RMI Connector is available at port 2810
```

How to configure JMX on Websphere7

Websphere doesn't 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]
```

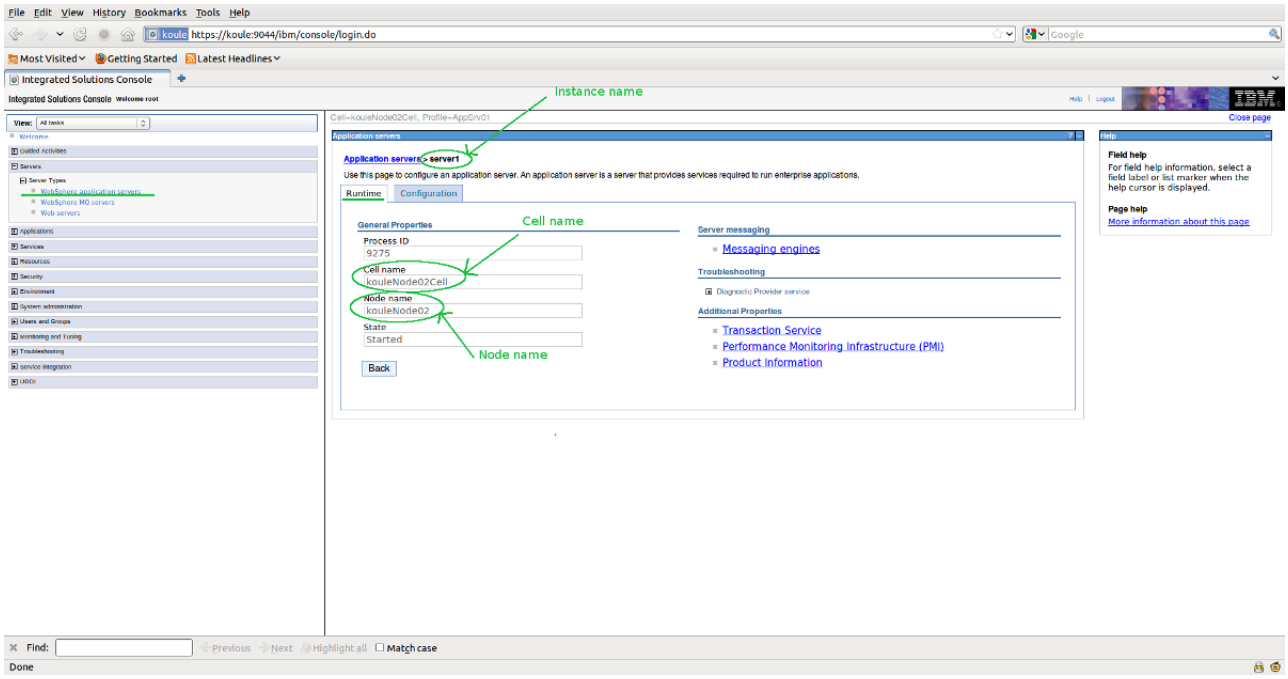


Figure 12.3. Websphere7 configuration

URL for connecting to JMX server is:

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

where *host* is the host name you are connectiong 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 RMIConnectorC 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 protokol. Sometimes RMI cannot connect remotelly 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

Because JMX is stateless communication, all operations have at least two parameters: user and password.

List of operations is the following:

Operation getServerJobs

parameters

Table 12.1. Parameters of getServerJobs

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	

returns

IDs of running jobs(graphs). IDs may be used as parameters of another operations.

Operation executeGraph

Since: 1.2.1

Executes specified graph. Only user, which has permission to execute the graph may call operation executeGraph(). Otherwise CloverSecurityException is thrown.

parameters

Table 12.2. Parameters of executeGraph

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
sandbox	yes	String	Text ID of sandbox which contains graph to execute.
graphId	yes	String	Text ID of graph. It's path to graph file relative to sandbox root. Only forward slashes may be used.

returns

Result runID of execution or throws an exception.

Operation killGraph

Kill running graph. Only user, which has permission to execute the graph may call operation killGraph() to kill it. Otherwise CloverSecurityException is thrown.

parameters

Table 12.3. Parameters of killGraph

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
runID	yes	long	Run ID, which may be obtained i.e. by getRunningJobs() operation.

returns

Result status of killed graph. If it's sucessfully killed, status should be ABORTED.

Operation graphStatus

Since: 1.2.1

Returns current status of specified execution.

parameters

Table 12.4. Parameters of graphStatus

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
runID	yes	long	Run ID, which is returned by executeGraph method or which may be obtained i.e. by getRunningJobs() operation.

returns

Result status of specified graph execution. Possible values are: FINISHED_OK | RUNNING | N_A | ERROR | ABORTED | READY

Operation suspendServer

Suspends server. Suspended server means that no graph may be executed. All attempts to execute graph will fail. See resumeServer operation. Only administrator can call this operation. Otherwise CloverSecurityException is thrown.

parameters

Table 12.5. Parameters of suspendServer

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
atOnce	yes	boolean	If this param is set to true, running graphs from suspended server are aborted. Otherwise it can run until it's finished in common way.

returns

void

Operation resumeServer

Resumes suspended server. Only administrator can call this operation. Otherwise CloverSecurityException is thrown. See suspendServer() operation.

parameters

Table 12.6. Parameters of resumeServer

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	

returns

void

Operation suspendServerSandbox

Suspends specified sandbox. Suspended sandbox means that no graph from sandbox may be executed. All attempts to execute graph will fail. See resumeServerSandbox operation. Only administrator can call this operation. Otherwise CloverSecurityException is thrown.

parameters

Table 12.7. Parameters of suspendServerSandbox

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
sandbox	yes	String	Text ID of sandbox to suspend
atOnce	yes	boolean	If this param is set to true, running graphs from suspended sandbox are aborted. Otherwise it can run until it's finished in common way.

returns

void

Operation resumeServerSandbox

Resumes suspended sandbox. Only administrator can call this operation. Otherwise CloverSecurityException is thrown. See suspendServerSandbox() operation.

parameters

Table 12.8. Parameters of resumeServerSandbox

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
sandbox	yes	String	Text ID of sandbox to suspend

returns

void

Operation getGraphExecutionMBeanName

Returns MBean name of running graph. It may be used for direct monitoring of the transformation. However in cluster environment, MBean is accessible only on the node, which runs graph.

parameters

Table 12.9. Parameters of getGraphExecutionMBeanName

parameter name	mandatory	type	description
user	yes	String	
password	yes	String	
runID	yes	long	Run ID, which may be obtained i.e. by getRunningJobs() operation.

returns

MBean name

Chapter 13. 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 acording to your programming language and development environments.

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 14. Launch Service

The **Launch Service** provides users with convenient way of remotely executing the CloverETL graphs via a simple web-based interface which can be customized to fit the needs of the users.

The Launch Services can be used with any browser and therefore do not require users to install any software. This allows for convenient control of the graph 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.

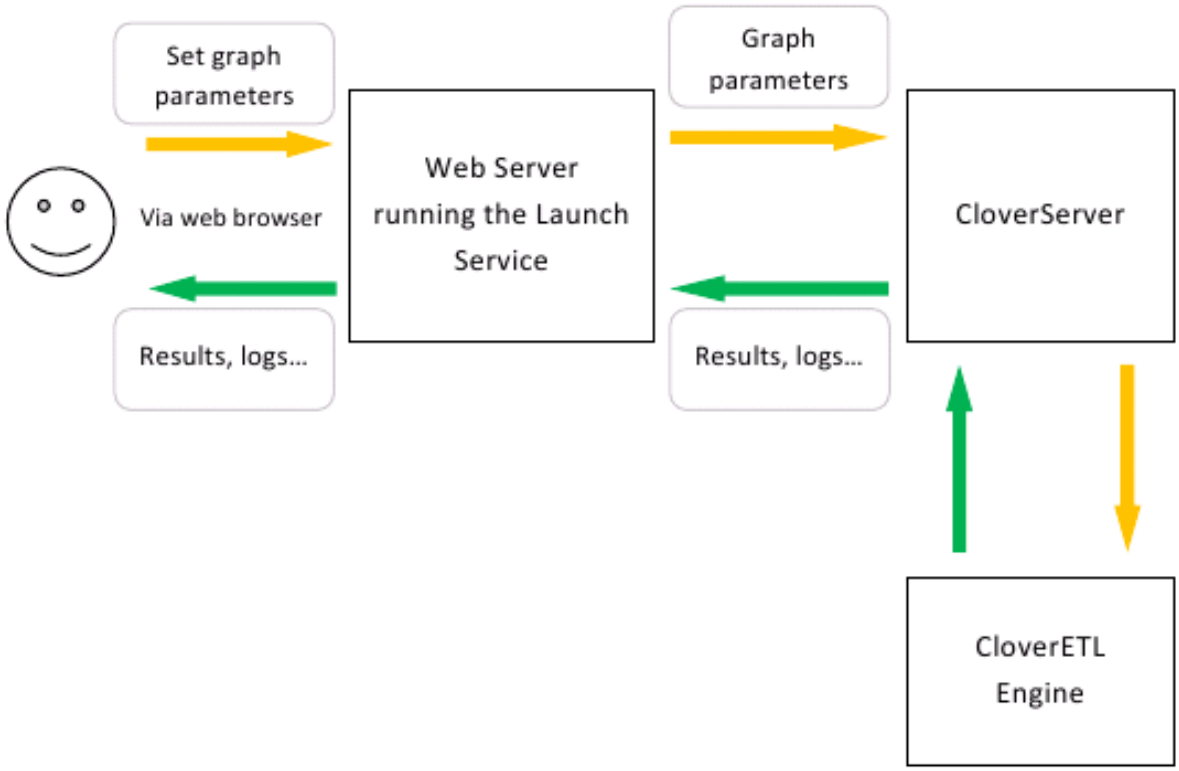


Figure 14.1. Launch Service Overview

The basic usage scenario of client form page is simple:

1. User opens the Launch Service web page in his browser
2. User enters the parameters of the graph (if required)
3. The data is submitted to the CloverETL Server. This is the moment the service is actually called.
4. All the results (including error messages or logs) are sent back to the user and displayed in the browser. The logs are also available for inspection via CloverETL Server GUI.

The Launch Service web pages which are presented to users can be fully replaced by client's web application or by third party application which calls CloverETL Launch Service by HTTP request. This allows 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.

Deploying Graph in Launch Service

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

1. The graph has to be designed to allow its parameters to be passed via dictionary.

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

Designing the Graphs for Launch Service

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

To use the Dictionary from the Launch Service, the graph author is required to specify the entries of the dictionary in graph'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 graphs it should run. The graphs can therefore use all the facilities provided by the CloverETL engine.

Configuring the Graph in CloverETL Server web GUI

To notify the Launch Service about the graphs 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 graph can be run. Each launch configuration contains full description of the graph'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.

Use restrictions can be used to launch different graphs for different users even though they use the same launch configuration (for example, the developers may want to use debug version of the graph while the end customers will want to use the production graph). 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 graphs 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:

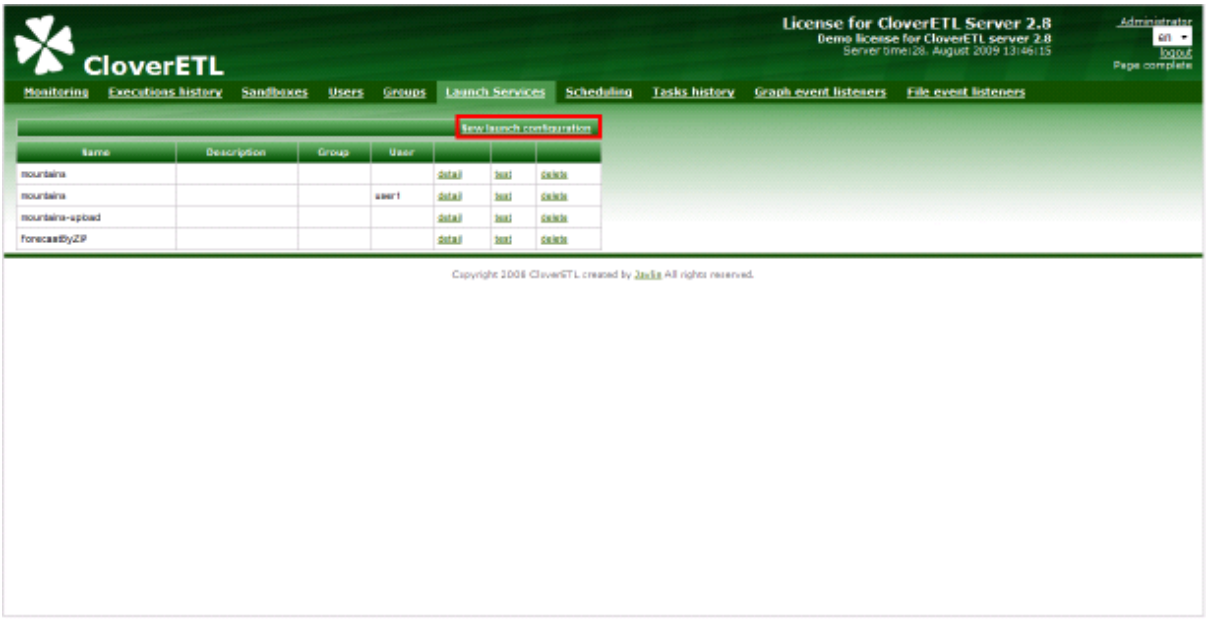


Figure 14.2. Launch Service section

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:

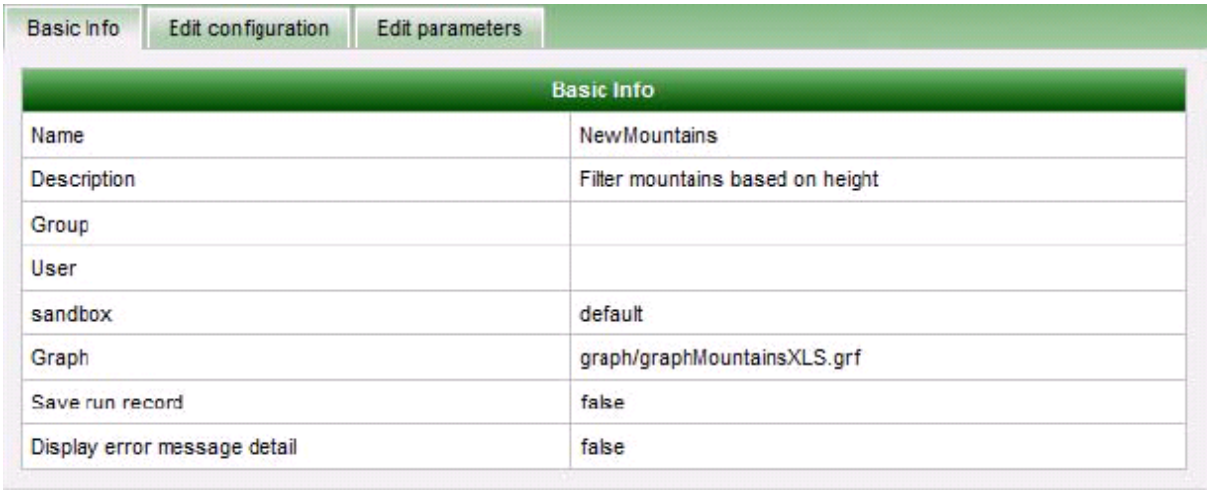


Figure 14.3. The Basic Info tab

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

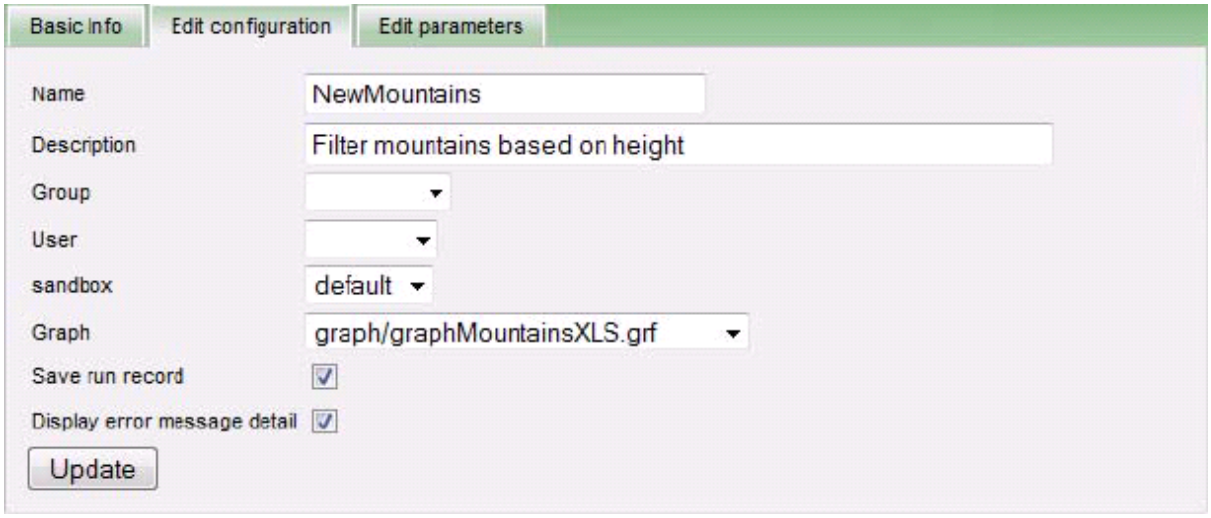


Figure 14.4. Edit Configuration tab

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.
- *Graph* - selects the graph 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 graph 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.

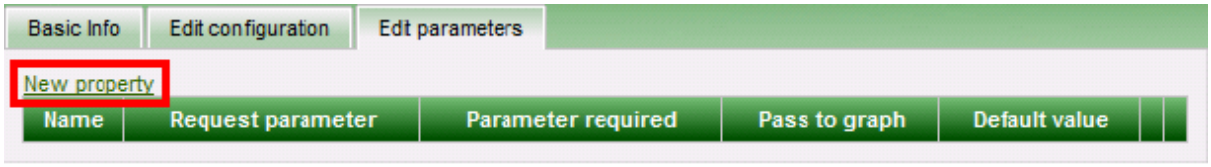


Figure 14.5. Edit Parameters tab

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

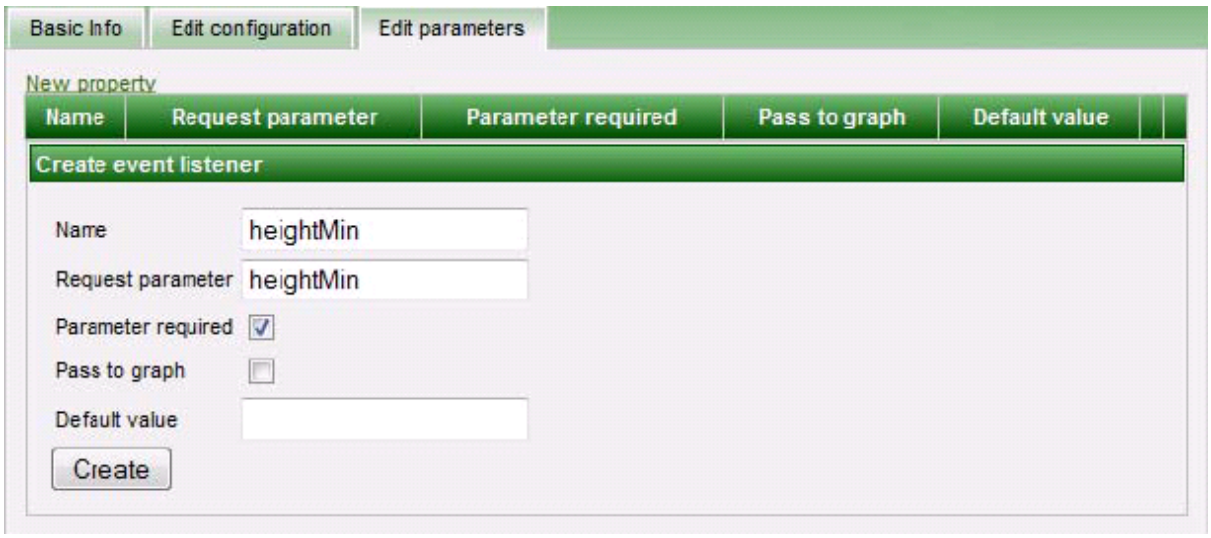


Figure 14.6. Edit Parameters tab

Following fields are available for each property:

- *Name* - the name of the property in the graph'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 graph's dictionary.
- *Parameter required* - if checked the parameter is mandatory and error will be reported if it is omitted.
- *Pass to graph* - if checked the parameter will be also passed to graph among the additional parameters as well as in the dictionary. In such case, the parameter can also be referenced as ${ParameterName} in the graph's XML file. Since the additional parameters are resolved when the XML file is parsed, the graphs 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.

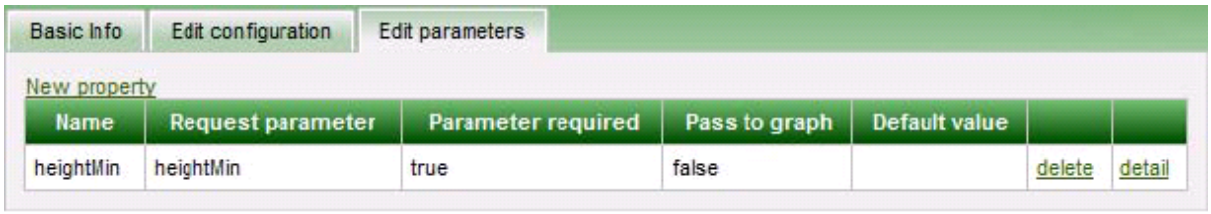


Figure 14.7. Edit Parameters tab

Sending the Data to Launch Service

To launch the graph 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 graph. 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 graph's run terminates, the results are sent back from the engine to the server and finally to the user. The output is partially defined in the dictionary which is declared in the graph's XML file. The dictionary can mark selected parameters as output parameters. All the output parameters are sent to the user after the graph execution is finished.

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

- *No output parameters* - only summary page is displayed to the user. The format of the summary page cannot be customized. The page will contain details like when the graph was started, when it finished, user name and so on.
- *One output parameter* - in this case the output is sent to the user with its content type defined by the property type in the dictionary.
- *Multiple output parameters* - in this case each output parameter is sent to user a part of multipart response. The content type of the response is either multipart/related or multipart/x-mixed-replace depending on the target browser (the browser 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 15. Installation

CloverETL Server is shipped as a *Web application archive* (WAR file). Use standard methods for deploying a web application on you application server. Detailed information concerning the installation on a specific application server can be found in the chapters below.

The default installation (without changes to the configuration) 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 the first startup with an empty database. In the **sandboxes** section of the web GUI, you can check that there is one "default" sandbox created with one test graph. *Note: Only one CloverETL Server instance may be working with the embedded DB. If you need more instances, you should configure an external DB.*

After successful installation open you browser and access the following URLs:

CloverETL web GUI - http://[host]:[port]/[contextPath]/gui

CloverETL HTTP API test page - http://[host]:[port]/[contextPath]/index.jsp

List of available installations:

In case of problems during the installation see Possible installation problems (p. 74).

Apache Tomcat

Installation of Apache Tomcat

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

If you have Apache tomcat already installed, you can move on to the next 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 License

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

For Tomcat, the license is distributed as a separate web application. It is not neccessary to install the license first. You can first install CloverETL Server and then its license.

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 in operation on URL:

   http://[host]:[port]/clover-license/ (contextPath "clover-license" is mandatory and cannot by changed)

CloverETL license can be changed anytime 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's redeployment, you have to delete the `[tomcat_home]/webapps/[contextPath]` directory. Tomcat will otherwise keep those obsolete files and changes will not take any effect.

Installation of CloverETL Server

The installation is by default a very simple task:

1. Download the web archive file (`clover.war`) containing CloverETL Server for Apache Tomcat.
2. Check if prerequisites are met:
   - JDK or JRE version 1.6.x or higher
   - `JAVA_HOME` and `JRE_HOME` environment variables have to be set.
   - Apache Tomcat 6.0.x is installed. CloverETL Server is developed and tested with the Apache Tomcat 6.0.x container. We strongly recommend that you use this version. See Installation of Apache Tomcat(p. 65) for details.
   - It is strongly recommended to change default limits for the heap and "perm gen" memory spaces.

     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). For instance, the minimum heap size being 128 MB and maximum heap size 1024 MB, type: JAVA_OPTS="-Xms128m -Xmx1024m". The best limits depend on many conditions, i.e. transformations which CloverETL should execute. If you do not have any idea about the memory required for the transformations, a maximum of 1 GB is recommended.

     You can set the maximum limit of "PermGen space" by the JVM parameter "-XX:MaxPermSize=256m". By default, it is just 64 MB which is not enough for enterprise applications. A suitable memory limit depends on various criteria, but 256 MB would make a good choice in most cases. If the PermGen space maximum is too low, "OutOfMemoryError: PermGen space" may occur.
   - For performance reasons, it is recommended the application is run in the "server" mode.

     Apache Tomcat does not run in the server mode by default. You can set the server mode by setting the "-server" JVM parameter. You can set the JVM parameter 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). That is: JAVA_OPTS="-server".

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

   If Tomcat is running, mind duration of the copying process! Too long copying might cause failure during deployment as Tomcat tries to deploy incomplete file.

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

5. Check whether CloverETL Server is running on URLs:

   - web GUI

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

     (use default administrator credentials to access the web GUI: user name "clover", password "clover")

     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

   - test page for HTTP API

     http://[host]:[port]/[contextPath]/index.jsp

     (see Chapter 11, Simple HTTP API (p. 43))

     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/index.jsp

Apache Tomcat on IBM AS/400 (iSeries)

To run CloverETL Server on the iSeries platform, the requirements are:

1. 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="-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

All jetty-6 releases are available from http://jetty.codehaus.org/jetty/. As of Jetty 7, there are huge differences in distribution packages as it is distributed by Eclipse foundation.

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

4. Create a context file "clover.xml" in [JETTY_HOME]/contexts nd 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.

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 `clover-license.dat` file.

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

2. Set the CloverETL Server `license.file` parameter to the path to `clover-license.dat`.

   There are more ways how to achieve this. The most direct way is to create an environment or a system property called `clover_license_file` (see the "Configuration" section for a description of all possibilities).

   If you are using Linux OS, follow these instructions:

   - Edit [JETTY_HOME]/bin/jetty.sh
   - Add a new line:

```
export clover_license_file=[absolute_path_to_license_file]/license.dat
```

   - Restart Jetty.

CloverETL license can be changed anytime by replacing the `clover-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.

IBM Websphere

Installation of CloverETL Server

1. get web archive file (`clover.war`) with CloverETL Server application, which is built for Websphere

2. check prerequisites

   - JDK or JRE version 1.6.x or higher
   - IBM Websphere 6.1 or IBM Websphere 7.0

3. deploy WAR file

   - go to **Integrated Solutions Console**

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

   - go to section **Applications →Install New Application**

4. change class loader setting

   CloverETL requires different class-loader settings in WebSphere 6 and WebSphere 7. In WebSphere 7, it's default value "Classes loaded with parent class loader first", whereas in WebSphere 6, default value must be changed to "Classes loaded with application class loader first"

   - change **Applications →Clover →Manage Modules →clover.war →Class loader Order** to value "Classes loaded with application class loader first".

5. configure system property on Websphere 6

   Websphere 6 sets system property "javax.xml.transform.TransformerFactory" to the value "com.ibm.xtq.xslt.jaxp.compiler.TransformerFactoryImpl". This setting overrides default value used by CloverETL Server which is vital for webservice API. So please set explicitly correct value in the Websphere admin console. It's not neccessary to set this in the Websphere 7.

   - go to **Integrated Solutions Console**

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

   - go to **Servers →Application servers →[server1] (or the other server of correct name) →Java and Process Management →Java Virtual Machine →**

   - In this section add "-Djavax.xml.transform.TransformerFactory=org.apache.xalan.processor.TransformerFactoryImpl" to the input labeled "Generic JVM arguments"

   - Then submit the form by "OK" button, then commit changes by "save" link. This change needs restart of Websphere to take effect.

   - You can check whether it's properly set or not in CloverETL Server web GUI, in the section "monitoring", "System properties" tab. There should be "javax.xml.transform.TransformerFactory" system property with correct value.

6. configure logging

   Websphere loggers don't use log4j by default which may cause, that CloverETL Server logging is misconfigured. Result is, that some CloverETL Engine messages are missing in graph execution logs. Thus it's recommended to configure Websphere properly to use log4j. Add this config file to the Websphere directory:

```
AppServer/profiles/AppSrv01/properties/commons-logging.properties
```

   Content of the file should be like this:

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

Add these jar files to the Websphere directory AppServer/libs: commons-logging-*.jar log4j-*.jar

Installation of CloverETL Server license

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

1. get file `license.dat`
   - If you have only clover_license.war, extract it as common zip archive and you will find `license.dat` file in `WEB-INF` subdirectory
2. set CloverETL Server parameter `license.file` with path to `license.dat` file

   There are more ways how to do this. The most direct way is to set environment property `clover_license_file`. (See Chapter 16, Configuration (p. 75) for description of all possibilities).
   - 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 property named `clover_license_file` which value is absolute path to `license.dat` file on file system
   - Then you have to let CloverETL Server know, that license is changed. Go to **web GUI →monitoring section →license tab**. Then click the button **reload license**. Or you can restart CloverETL Server application.

CloverETL license can be changed anytime by replacing file `license.dat`. Then you have to let CloverETL Server know, that license is changed.

- Go to **web GUI →monitoring section →license tab**
- Then click the button **reload license**.
- Or you can restart CloverETL Server application.

Glassfish / Sun Java System Application Server

Installation of CloverETL Server

1. get web archive file (`clover.war`) with CloverETL Server application, which is built for Glassfish
2. check prerequisites
   - JDK or JRE version 1.6.x or higher
   - Glassfish (CloverETL Server is tested with V2.1)

3. deploy WAR file

   - go to **Glassfish Admin Console**

     It's accessible on URL http://localhost:4848/ by default; default username/password is "admin"/"adminadmin"

   - go to section **Applications > Web Applications →Deploy button**
   - Fill in attributes "Application name" and "Context Root" with value "clover". Fill in path to WAR file.
   - Submit form

Installation of CloverETL Server License

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

Settings of configuration and license is quite similar like WebSphere configuration.

1. get file `license.dat`

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

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

   - There are more ways how to do this. The most direct way is to set environment property `clover_license_file`. (See "configuration" section for description of all possibilities).

     - go to **Glassfish Admin Console**

       By default accessible on URL http://localhost:4848/ with username/password admin/adminadmin

     - go to **Configuration →System Properties**
     - create property named `clover_license_file` which value is absolute path to `license.dat` file on file system
     - This change requires restart of Glassfish.

CloverETL license can be changed anytime by replacing file `license.dat`. Then you have to let CloverETL Server know, that license is changed.

- Go to **web GUI →monitoring section →license tab**
- Then click the button **reload license**.
- Or you can restart CloverETL Server application.

JBoss

Installation of CloverETL Server

1. get web archive file (`clover.war`) with CloverETL Server application, which is built for JBoss.

2. check prerequisites

- JDK or JRE version 1.6.x or higher
- JBoss 6.0 or JBoss 5.1
- correct memory settings for jboss java process

  Set at least 256MB for PermGen space (512MB is recommended), and at least 1024MB heap memory limit. You can set these java parameters i.e. in `[jboss-home]/bin/run.sh`

```
export JAVA_OPTS="-XX:MaxPermSize=512m -Xms128m -Xmx1024m"
```

3. configure DB data source

   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>
```

     JNDI name must be exactly "CloverETLServerDS". Set DB connection parameters to the created database, which must be empty before first execution. Server creates its tables itself.

     JNDI data source is the only way how to configure 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 the `[jboss-home]/server/default/lib`

4. configure CloverETL Server

   - create `cloverServer.properties` in some suitable directory

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

     Don't change datasource.type and datasource.jndiName properties, but set correct JDBC dialect according to your DB server and Chapter 16, Configuration (p. 75). Also set path to your license file.

5. Set system property (or environment property) clover_config_file.

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

   The most simple way is to set java parameter i.e. in `[jboss-home]/bin/run.sh`

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

Please don't override some other settings in the JAVA_OPTS property. i.e. memory settings as described above.

6. deploy WAR file

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

7. start jboss by [jboss-home]/bin/run.sh

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

8. Check JBoss response and CloverETL Server response

   - JBoss administration console is accessible on URL http://localhost:8080/ by default. Default username/password is "admin"/"admin"
   - CloverETL Server is accessible on URL http://localhost:8080/clover by default.

9. If you like, you can move default and example sandboxes (created automatically in temp directory) to some more suitable directory on your filesystem.

   - These sandboxes are created automatically during the first deployment and they are located in temp directory which is related to the specific deployment. If you redeployed the web application from some reason, the temp directory would be recreated, so it's better to move the sandboxes to the location which won't change.

JBoss - JDBC possible problems

Due the JBoss classloading mechanism, CloverETL graphs can't use "internal" JDBC drivers packed with CloverETL. So please add all JDBC drivers you need to the JBoss classpath (`[jboss-home]/server/default/lib`) and don't use internal drivers in your graphs.

Installation of CloverETL Server License

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

1. get file `license.dat`

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

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

   The best way how to configure license, is to set config property license.file in the cloverServer.properties file as described in the biginning of this section.

   There are more ways how to do this. (See Chapter 16, Configuration (p. 75) for description of all possibilities).

3. Change of configuration requires restart of app-server.

CloverETL license can be changed anytime by replacing file `license.dat`. Then you have to let CloverETL Server know, that license is changed.

- Go to **web GUI →monitoring section →license tab**
- Then click the button **reload license**.
- Or you can restart CloverETL Server application.

Possible installation problems

Since CloverETL Server is considered as universal jee application which runs on various application servers, databases and jvm implementations, problem may occure during installation which can be solved by proper configuration of server environment. This section contains tips for such configuration.

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 occure, 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 don't cause fail of server startup, but it's issue of deployment on application server, thus it still suits to this chapter.

Since version 2.9, clover.war itself doesn't 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 doesn't. so it 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 aproach is recommended for JMS Reader/Writer components, even if these components allow to specify external libraries. It's due to common memory leak in these libraries which causes "OutOfMemoryError: PermGen space".

Chapter 16. 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: Don't combine sources specified below. Configuration become confusing and mantainance will be much more difficult.

Context Parameters (Available on Apache Tomcat)

Some application servers allows 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's 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 Properties

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

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 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 take place 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 environment property `clover_config_file` or `clover.config.file`
   - default location (`[workingDir]/cloverServer.properties`)
3. environment properties
4. default values

Examples of DB Connection Configuration

Configuration of DB connection is optional. Embedded Apache Derby DB is used by default and it's sufficient for evaluation, however configuration of external DB connection is strongly recommended for production deployment. It's 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:

Upgrade of DB schema

If you replace older version of CloverETL Server by new one above the same DB, there may be some changes in DB schema. Since CloverETL Server version 1.2, DB patches above existing DB schema are done automatically, during first startup. However If you are upgrading from DB schema of version 1.1. you will have to preset this feature by these SQL updates:

```
CREATE TABLE sys_schema_patches ( patch varchar(256) unique not null, applied timestamp );
INSERT INTO sys_schema_patches (patch,applied) values ('0000_create.sql', null );
```

Don't execute it above empty DB! It's intended only for upgrading from existing DB schema of 1.1. version.

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 any problems with connection to Derby DB, we recommend to 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]
```

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="org.apache.derby.jdbc.EmbeddedDriver" override="false" />
<Parameter name="jdbc.url" value="jdbc:derby:databases/cloverDb;create=true" override="false" />
<Parameter name="jdbc.username" value="" override="false" />
<Parameter name="jdbc.password" value="" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.DerbyDialect" override="false" />
```

Or If you use properties file for configuration:

```
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 jdbc.url parameter. Part "databases/cloverDb" means subdirectory for DB data. This subdirectory will be created in directory, which is set as derby.system.home or in working directory if "derby.system.home" is not set. Value "databases/cloverDb" is default value, which may be changed.

MySQL

CloverETL Server requires MySql 5.x

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="com.mysql.jdbc.Driver" override="false" />
<Parameter name="jdbc.url" value="jdbc:mysql://127.0.0.1:3306/clover?useUnicode=true&amp;characterEncoding=utf8" o
<Parameter name="jdbc.username" value="root" override="false" />
<Parameter name="jdbc.password" value="" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.MySQLDialect" override="false" />
```

Or If you use properties file for configuration:

```
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 isn't 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

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="com.ibm.db2.jcc.DB2Driver" override="false" />
<Parameter name="jdbc.url" value="jdbc:db2://localhost:50000/clover" override="false" />
<Parameter name="jdbc.username" value="usr" override="false" />
<Parameter name="jdbc.password" value="pwd" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.DB2Dialect" override="false" />
```

Or If you use properties file for configuration:

```
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 behavior 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 doesn't 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 doesn't 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.

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="com.ibm.as400.access.AS400JDBCDriver" override="false" />
<Parameter name="jdbc.url" value="jdbc:as400://localhost/cloversrv;date format=iso" override="false" />
<Parameter name="jdbc.username" value="javlin" override="false" />
<Parameter name="jdbc.password" value="clover" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.DB2400Dialect" override="false" />
```

Or If you use properties file for configuration:

```
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.

Don't forget to add jar with JDBC driver to the Tomcat classpath.

Oracle

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="oracle.jdbc.OracleDriver" override="false" />
<Parameter name="jdbc.url" value="jdbc:oracle:thin:@host:1521:db" override="false" />
<Parameter name="jdbc.username" value="user" override="false" />
<Parameter name="jdbc.password" value="pass" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.Oracle9Dialect" override="false" />
```

Or If you use properties file for configuration:

```
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
```

Don't 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**

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="com.microsoft.sqlserver.jdbc.SQLServerDriver" override="false" />
<Parameter name="jdbc.url" value="jdbc:sqlserver://localhost:1433;databaseName=clover" override="false" />
<Parameter name="jdbc.username" value="user" override="false" />
<Parameter name="jdbc.password" value="pass" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.SybaseDialect" override="false" />
```

Or If you use properties file for configuration:

```
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
```

Don't forget to add jar with JDBC driver to the Tomcat classpath.

Postgre SQL

For modification Tomcat context params, add to context config file (and modify according to your credentials):

```
<Parameter name="jdbc.driverClassName" value="org.postgresql.Driver" override="false" />
<Parameter name="jdbc.url" value="jdbc:postgresql://localhost/clover?charSet=UTF-8" override="false" />
<Parameter name="jdbc.username" value="postgres" override="false" />
<Parameter name="jdbc.password" value="" override="false" />
<Parameter name="jdbc.dialect" value="org.hibernate.dialect.PostgreSQLDialect" override="false" />
```

Or If you use properties file for configuration:

```
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
```

Don't 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
```

Above parameters 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"/>
```

List of Properties

Table 16.1. 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
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's 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.	
security_enabled	true | false If it's set to false, then no authentication is required and anyone has admin privileges.	true
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

key	description	default
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 can't 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's 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 checkes (in milliseconds) See Chapter 9, File event listeners (p. 38) 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's false, username and password are ignored	
clover.smtp.username	SMTP server username	
clover.smtp.password	SMTP server password	

key	description	default
launch.log.dir	Location, where server should store launch requests logs. See Launch Services section for details.	${java.io.tmpdir}/cloverlogs/launch where ${java.io.tmpdir} is system property
graph.logs_path	Location, where server should store Graph run logs. See Logging section for details.	${java.io.tmpdir}/cloverlogs/graph where ${java.io.tmpdir} is system property
graph.debug_path	Location, where server should store Graph debug info.	${java.io.tmpdir}/cloverdebug where ${java.io.tmpdir} is system property
graph.dictionary_path	Location, where server should store graph dictionary temporary files.	${java.io.tmpdir}/cloverdictionary where ${java.io.tmpdir} is system property
graph.pass_event_params_to_graph_in_old_style	Since 3.0. It's 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 Task - Execution of Graph (p. 20) for details.	false
threadManager.pool.corePoolSize	Number of threads which are always active (running or iddling). 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 immediatelly 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

key	description	default
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 enought.	1024
task.archivator.batch_size	Max number of records deleted in one batch. It's used for deleting of archived run records.	50

Table 16.2. Defaults for graph execution configuration - see section Graph 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's 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 doesn't have to be listed here, since it's 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

key	description	default
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 17. 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 17.1. Defaults for graph execution configuration - see section Graph config properties for details

key	description
SANDBOX_CODE	Code of sandbox which contains executed graph.
GRAPH_FILE	Path to the graph file, relative to sandbox root path. It's often referred as "graphId".
SANDBOX_ROOT	Absolute path sandbox root.
RUN_ID	ID of the graph execution. In standalone mode or in cluster mode, it's 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 paased 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

no more parameters

executed by task "graph execution" by scheduler

Table 17.2. 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's the user who created the schedule
event_schedule_id	ID of schedule which triggered the graph

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 specified 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 17.3. 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 miliseconds which specifies interval of timeout. Makes sence 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's the user who created the graph event listener

executed by task "graph execution" by file event listener

Table 17.4. passed parameters

key	description
event_file_path	Path to file, which is source of the event. Doesn't contain file name. Doesn't end with file separator.

key	description
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's the user who created the file event listener

How to add another graph parameters

Additional “Graph Config Parameters”

It's possible to add so called additional parameters in Web GUI section “Sandboxes” for selected graph or for all graphs in selected sandbox. See details in chapter “Graph config properties”.

Task “execute_graph” parameters

Task “execute graph” 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 18. Recommendations for transformations developers

Use java transformations as inline code

CloverETL allows transformation developer to specify inline java code or class name which is expected to be in classpath.

CloverETL Server runs in application server, which uses complex classloading mechanism, which depends on application vendor. This may be problem when external java class is used (specified just by class name). On the other hand, when inline java code is used, CloverETL itself manages classloading of this transformation.

However it's possible to specify extra classpath for external classes since version 1.3.2; See graph config ""

Add external libraries to app-server classpath

i.e. connections (JDBC/JMS) may require third party libraries. It's 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.

Chapter 19. 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's usually "[TOMCAT_HOME]/temp"

Default logging configuration may be overriden 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 must have contain following fragment to preserve Graph run logs

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

Graph run logs

Each graph run has it's 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's possible to specify different location for these logs by CloverETL property "graph.logs_path". This property doesn't have any influence over main server logs.

Chapter 20. Plugin-ability (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's 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's 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's 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's unreliable when the servlet bridge to the servlet container is used, so it's 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 21. 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 doesn't 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's 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 nodewhich 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's 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's 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's 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. 96) 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 don't 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 doesn't 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 choosen during graph execution primarilly 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. Spliting 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 doesn't 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.

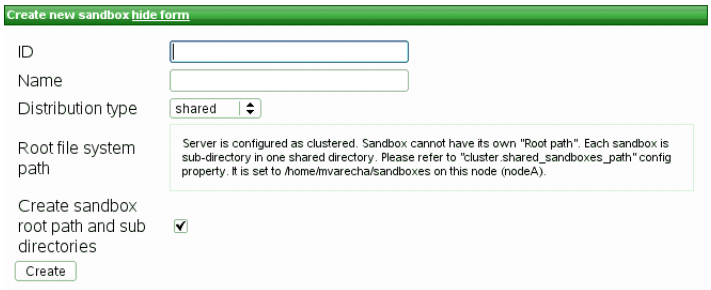


Figure 21.1. Dialog form for creating new shared sandbox

As you can see in the screenshot above, you can't 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. 97) for details.

Don't use local sandbox for common project data (graphs, metadata, connections, lookups, properties files, etc.). It would cause odd behavior. Use shared sandboxes instead.

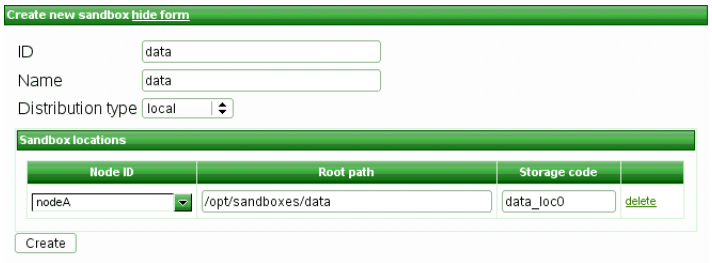


Figure 21.2. Dialog form for creating new local sandbox

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 doesn't have to actually store any data to "its" location. It's 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.

Don't 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's 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 doesn't 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 minimalize 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 it's 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's excelent 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's 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. Don't 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.

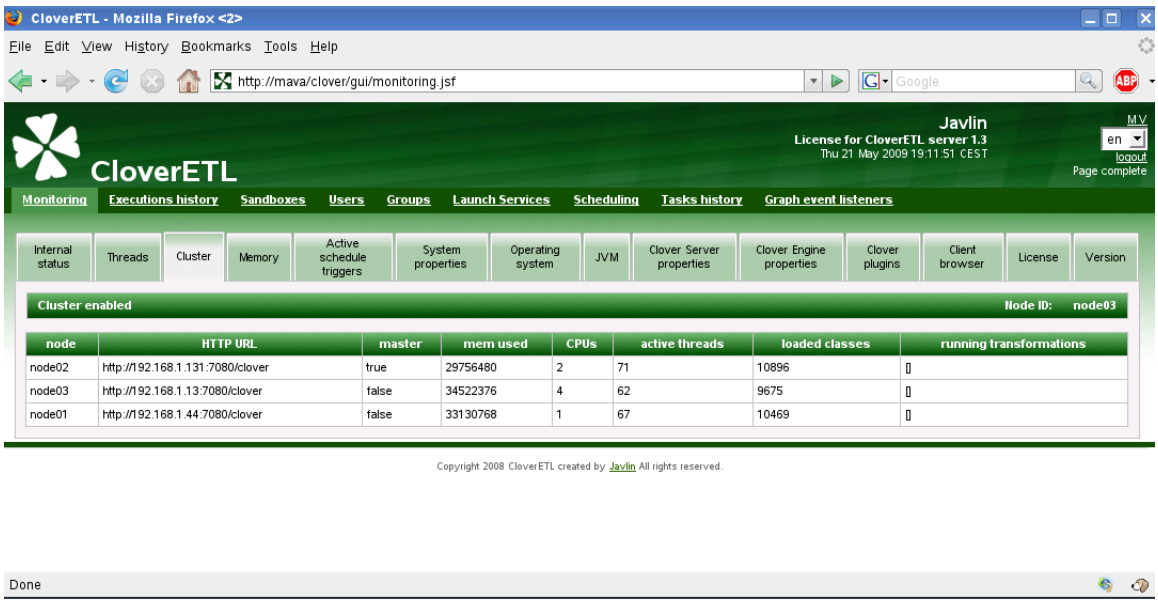
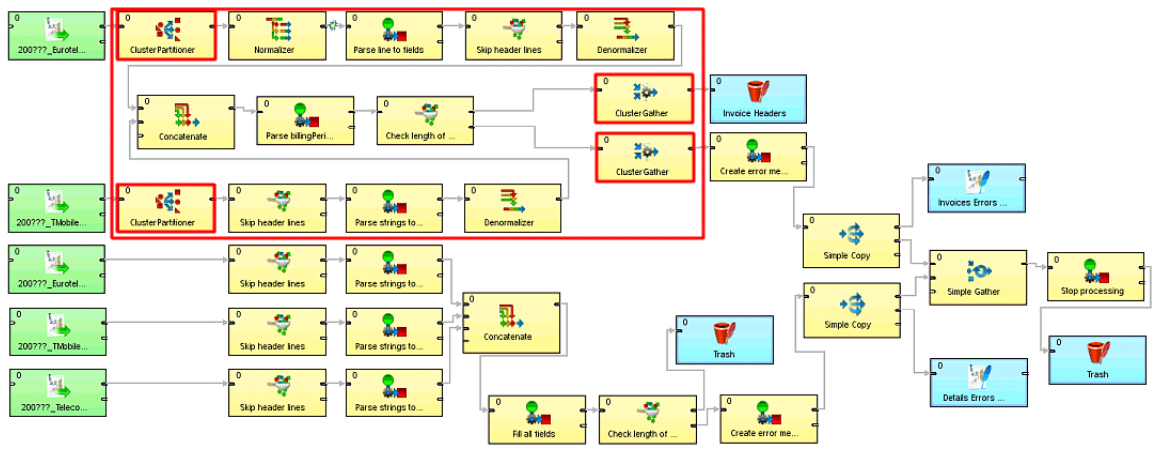


Figure 21.3. List of nodes joined to the cluster

Example of Distributed Execution

The following diagram shows a transformation graph used for parsing invoices generated by a few cell phone operating companies in Czech Republic.



The size of these input files may be up to a few gigabytes, so it's 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".

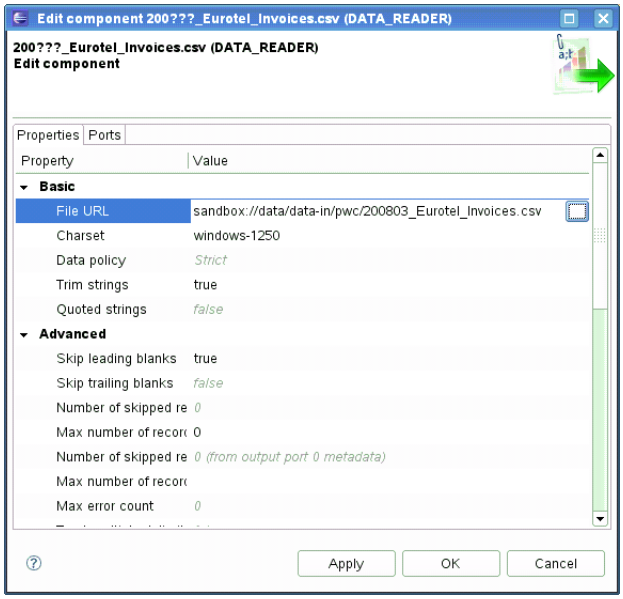
Specification of "node allocation"

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)

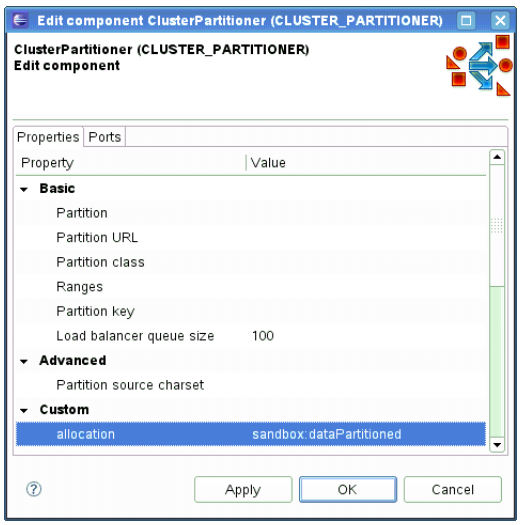
- the outer part of the graph run on a single node - primary worker.

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's the "data" *local* sandbox which defines the primary worker in the graph.



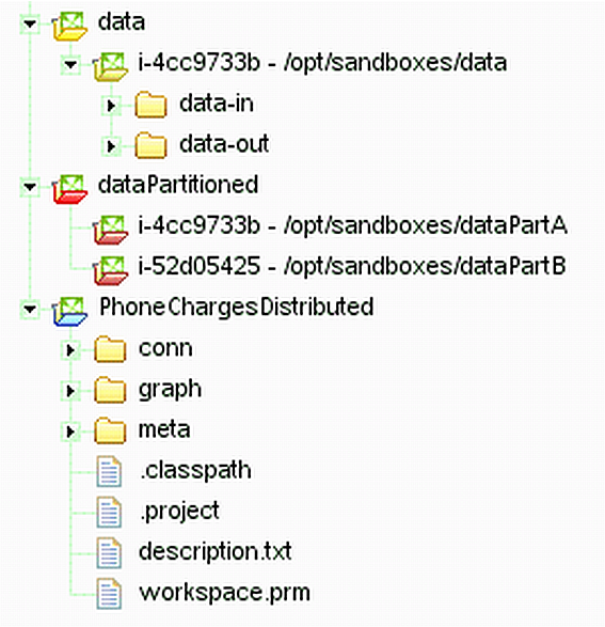
The part of the graph demarcated by the four cluster components may have specified its allocation by the file URL attribute as well, but this part doesn't work with files at all, so there is no file URL. Thus, we will use the "allocation" attribute. Since all components in this part must have the same allocation, it's 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
  - doesn't contain any data and since the graph doesn't read or write to this sandbox, it's 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 milion 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:

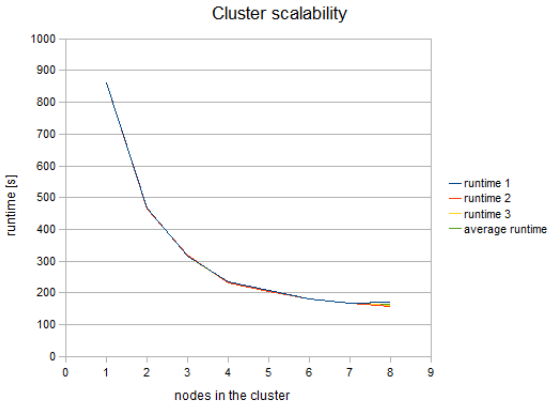


Figure 21.4. Cluster Scalability

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:

```
speedupFactor = avgRuntime(1 node) / avgRuntime(x nodes)
```

We can see, that the results are favorable up to 4 nodes. Each additional node still improves cluster performence, however the effect of the improvement decreases. Nine or more nodes in the cluster may even have a negative efect 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.

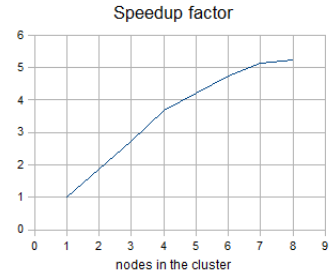


Figure 21.5. Speedup factor

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

Table 21.1. Mandatory properties - these properties must be properly set on each node of the cluster

property	type	default
cluster.enabled	boolean	false
description:	switch whether server is connected to the cluster or not	
cluster.node.id	String	node01
description:	each cluster node must have unique ID	
cluster.shared_sandboxes_path	String, path	
description:	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
description:	IP address of ethernet interface, which is used for comunication with another cluster nodes. Necessary for inter-node messaging.	
cluster.jgroups.start_port	int, port	7800
description:	Port where jGroups server listens for inter-node messages.	
cluster.jgroups.tcpping.initial_hosts	String, in format: "IPaddress1[port1],IPaddress2[port2]"	127.0.0.1[7800]
description:	List of IP addresses(with ports) where we expect running and listening nodes. It's related to another nodes "bind_address" and "start_port" properties. I.e. like this: bind_address1[start_port1],bind_address2[start_port2],... It's 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
description:	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 21.2. 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's 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 it's unique group name. If you need 2 clusters in the same network environment, each of them would have it's own group name.
cluster.max_allowed_time_shift_between_nodes	int	2000	How many miliseconds 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's neccessary 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 it's own configuration.

These properties aren't vital for cluster configuration - default values are sufficient

Table 21.3. 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 memmory 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 doesn't 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 multiplicator great enough, it will cause, that graph will be always executed on the same node, which processes request for execution.

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