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Acknowledgement

This product includes software developed by the SAIC and the National Cancer Institute.
FlowLIMS Installation
1. About This Guide

The *FlowLIMS Installation Guide* describes how to install FlowLIMS 2.1 and related components. Read the complete guide before beginning the installation process to ensure all of the basic software and hardware requirements have been met.
2. Preparing for FlowLIMS Installation

Before installing FlowLIMS, you should have an understanding of the various FlowLIMS components, and the design and configuration decisions you need to make.

FlowLIMS is a web application and it was configured to run under the Tomcat web server.

Tomcat requires java to be present on your system before it can be set. FlowLIMS will run with jdk 5.0

The authentication component is part of FlowLIMS and using LDAP is recommended. Other options include an encrypted flat file maintained by the FlowLIMS admin. If you decide to use LDAP, it should be set before FlowLIMS is installed. Authentication is based on JAAS implementation and can be extended to include other types of authentication.

Another important component is storage space. Disk storage space should be allocated based on the volume of data files collected and the number of flowcytometers used.

FlowLIMS is uses the database as a data description storage, Oracle and Postgres are possible choices.

FlowLIMS communicates with flowcytometers through shared disk space. Samba Share or NFS can be use to enable space sharing.

There is a perl script running as a cron job to retrieve data files generated by flowcytometers. Perl libraries should be installed on the same system where the perl script will run.

The Flowjo analyzer is using ftp to retrieve data, so if this is the analyzing software being used, then the ftp server should be set on the same machine where the data files are stored.
3. Configuration Decisions

Use the same user id to install Tomcat and flowLIMS. The installer is deploying FlowLIMS directly into Tomcat folders. It also creates folders and configuration files in the system so make sure your user has the rights to do that.

During the flowLIMS installation you will be prompted for basic configuration information. Decide how you are going to configure these basic parameters before beginning the installation process. You will be prompted for some or all of the following information, depending on the type of installation that you decide to perform:

- Authentication server: LDAP, password file
- Database server: url, username, password
- Ftp server: host, port, username, password
- Storage space location for data files
- Location of shared space between flowLIMS and flowcytometers
- Location of configuration and logs folders

Default values for all folders start from the user home folder. These should be changed to point to the space that was allocated.
4. Running the Installation Wizard

To run installer type in the command line: `java -jar flowlims-application-2.1-installer.jar`
5. Supported Platforms Overview

The flowLIMS installer was tested on:

- Redhat Linux ES
- Solaris 8 and 9
6. Supported Web Browsers

The flowLIMS was tested on:

- Firefox
- IEExplorer
- Safari
7. Hardware Requirements

The specific hardware requirements depend on the number of users and volume of data. The user’s IT department and laboratory personnel must evaluate and decide the exact requirements. Below are the suggested minimum requirements to run the program.

The Bioinformatics Facility at Fox Chase Cancer is not responsible for any miss-configured or malfunctioning systems on the user’s end.

(Minimum) Hardware Requirements:

Computer

- 2 CPUs
- UltraSPARC IIIi processor (Sun) or equivalent
- 1.3 Ghz clock speed
- 4 GB RAM

Storage

- 300 GB local
- Multiple TB external (actual size depends upon the level facility usage)

Operating System– Options are Linux or Solaris, both have been tested. Our production system uses Solaris (Sun)

- Linux – tested with RedHat Linux v.9
- Unix – tested with Solaris v.8 (2.8)
8. Preliminary Software Requirements

These software products should be installed before installing flowLIMS. This document describes only how to setup and configure flowLIMS.

- Jdk 1.5 [http://java.sun.com/j2se/downloads.html]
- Tomcat 5.5.7 or above [http://jakarta.apache.org/tomcat]
- Database: Oracle 8i or above, Postgres 8.0 or above [http://www.postgresql.org]
- Perl [http://www.cpan.org] version 5 or above with additional libraries installed
  - DBD-Pg (for Postgres database) or DBD-Oracle (for Oracle database)
  - HTML-Parser
  - libwww-perl
  - XML-Parser
  - DBI
  - Compress-Zlib
  - expat
- Samba share [http://us2.samba.org/samba/download/]
Figure 1. Example of flowLIMS hardware configuration.
9. Path Selection

9.1. Select the JDK path

This path points to the java installation used to run the Tomcat web server.

9.2. Select the Tomcat path

This path points to the Tomcat web server installation.

9.3. Select the flowLIMS configuration path

This path points to a folder where flowLIMS configuration files will be placed.

Based on the path selection the `setenv.sh` file, containing the environment variables, is created in the Tomcat `bin` folder.

For example the file `setenv.sh` will include:

```bash
JAVA_HOME=/usr/local/jdk1.5.0_02; export JAVA_HOME
CATALINA_HOME=/usr/local/jakarta-tomcat-5.5.9; export CATALINA_HOME
FLOWLIMS_HOME=/usr/local/flowlims-application-2.1; export FLOWLIMS_HOME
CATALINA_OPTS="-Dorg.xml.sax.driver=org.apache.xerces.parsers.SAXParser
-Djava.security.auth.login.config=/usr/local/flowlims-application-2.1/jaas.config"
export CATALINA_OPTS
```
10. Configure User Authentication

The user authentication in flowLIMS can be provided using LDAP, REMOTE_USER variable, .htpasswd file or flat password file with MD5 encoding.

Depending on your choice for authentication, installer will create configuration file `jaas.config` with the following contents:

- If using LDAP for authentication:
  - `usernamefield` field is user's ID in LDAP (in this case it's `uid`)
  - `firstnamefield` field is your ldap settings for user's first name
  - `lastnamefield` field is your ldap settings for user's last name

  ```
  LIMSLogin
  {
    fccc.auth.LdapLogin required debug=true host="ldap://host:389" \
    usernamefield="uid" basedn="ou=People, ..." \
    firstnamefield="givenname" lastnamefield="sn ";
  }
  ```

- If using the REMOTE_USER variable for authentication:

  ```
  LIMSLogin
  {
    fccc.auth.RemoteUserLogin required debug=true;
  }
  ```

- If using the .htpasswd file for authentication:

  ```
  LIMSLogin
  {
    fccc.auth.CryptFileLogin required debug=true pwdFile="/path/.htpasswd";
  }
  ```

- If using the MD5 password file for authentication:

  ```
  LIMSLogin
  {
    fccc.auth.MD5FileLogin required debug=true pwdFile="/path/passwd";
  }
  ```

Format of the file should be:

```
userId:MD5 encoded password
```

Class `nci.lims.util.md5` can be used to encode the password.

The file `jaas.config` is defined by the option `-Djava.security.auth.login.config` which is located in the `setenv.sh` file.
11. Configure Database

The choices for database type are Oracle or Postgres. The database URL format is:

Contents of the lims.xml as follows:

- for Oracle:

```xml
jdbc:oracle:thin:@host:1521:sid
```

- for Postgres:

```xml
jdbc:postgresql://host:5432/dbname
```

Based on the input parameters the installer will create a datasource definition file lims.xml for the Tomcat web server. The file lims.xml will be created in the folder jakarta-tomcat-5.5.x/conf/Catalina/localhost.

- for Oracle database:

```xml
<Context path="/lims" docBase="lims"
    debug="5" reloadable="true" crossContext="true">
    <Logger className="org.apache.catalina.logger.FileLogger"
        prefix="localhost_lims_log." suffix=".txt"
        timestamp="true"/>
    <Resource name="jdbc/limsDS" auth="Container"
        type="javax.sql.DataSource"
        driverClassName="oracle.jdbc.driver.OracleDriver"
        url="jdbc:oracle:thin:@host:1521:sid"
        username="user" password="pass"
        validationQuery="select 1 from dual"
        maxActive="100" maxIdle="30" maxWait="10000"/>
</Context>
```

- for Postgres database:

```xml
<Context path="/lims" docBase="lims"
    debug="5" reloadable="true" crossContext="true">
    <Logger className="org.apache.catalina.logger.FileLogger"
        prefix="localhost_lims_log." suffix=".txt"
        timestamp="true"/>
    <Resource name="jdbc/limsDS" auth="Container"
        type="javax.sql.DataSource"
        driverClassName="org.postgresql.Driver"
        url="jdbc:postgresql://host:5432/dbname"
        validationQuery="select version();"
        username="user" password="pass"
        maxActive="100" maxIdle="30" maxWait="-1"/>
</Context>
```

Note

When undeploying flowLIMS from the Tomcat 5.5 file jakarta-tomcat-5.5.x/conf/Catalina/localhost/lims.xml is deleted by Tomcat. Keep a copy of this file elsewhere.

For Tomcat versions 5.5.x additional information about the datasource setup can be found in http://jakarta.apache.org/tomcat/tomcat-5.5-doc/jndi-datasource-examples-howto.html
12. FTP Configuration

Note

Ftp is used for the retrieval of FlowJo summary files only. If you are not using FlowJo, this can be ignored.

Ftp is used by the application for accessing data files placed by flowLIMS in the archive folder. This folder is defined in the next section, under Archive Folder.
13. FlowLIMS Input/Output Configuration

13.1. DiVa Export folder

The path to the folder where xml files, embedded inside the respective experiments folder for DiVa import, will be created automatically. This folder should be configured later in the system to be part of the samba share. It will be used to share space between the DiVa and flowLIMS applications.

13.2. DiVa Import folder

The path to the folder where experiments are exported from DiVa is automatically created. This folder should also be configured later to be part of the samba share.

13.3. FACScan Export folder

The path to where the experiment folder for FACScan data collection will be created. This folder should be configured later to be part of samba share. It will be used to share space between FACScan and flowLIMS applications.

13.4. FACScan Configuration file

The path to the FACScan configuration file will be created automatically. If you create a new file with the installation, fill in the contents according to your FACScan setup.

The format of the file is as follows:

The first column specifies the channel number followed by the list of allowed fluorochromes for this channel, separated by a colon.

For example:

```
1:FL
2:PE
3:TRPE:Cy5PE
```

13.5. Summary files folder

The path to the folder where Summary files for FlowJo will be created. This is just a temporary storage space allowing files to be created. The user downloads FlowJo summary files to the desktop using flowLIMS.

13.6. Archive folder

The path to the root folder where experiment data will be permanently archived.

13.7. Log folder

The path to the folder where flowLIMS log files will be created.
14. Package Installation

Select the packages to be installed. The only required package is FlowLIMS, it contains the web application.

The installation process creates the flowLIMS configuration and runs several creation and copy processes.

14.1. Contents of flowLIMS configuration folder

The location of the configuration folder was defined in Path Selection, section 2.

- The file flowlims.conf contains parameters set through the flowLIMS Input/Output configuration.

```
lab.ifs.conf
lab.DiVs.conf
lab.contextDir
lab.exportDir
lab.exportFACScanDir
lab.facscan.conf
lab.db.conf
lab.importFCSDir
lab.importXMLDir
lab.logging.error
lab.logging.info
lab.logging.warning
```

- The file db.conf contains database settings.

Datasource JNDI name:

```
ds_lookup=java:comp/env/jdbc/limsDS
db_type=oracle or postgres
```

- The file ifs.conf contains settings for the file system storage area.

Contents of ifs.conf:

FTP URL is for accessing data files in the archive - used in FlowJo summary files only.

```
ftp = ftp://user:password@host/
archive_folder= /path to the archived experiments (used by FlowJo to ftp files from)
import_script = /path to perl script (used to import experiment result files into the flowLIMS)
```

**Note**

If installing on Macintosh OS X add "perl" in front of the "/path ..." for import_script parameter.

i.e. "import_script = perl /path/parse_lims_data_update.pl"

- The file diva.conf contains settings for creating the DiVa xml file.

```
worksheets=/folder name where files containing plots settings are kept
Plots settings files consist of a part taken from DiVa generated xml file,
the top part specifying plot settings.
```
**instrSettings=*/folder name where files containing instrument settings are kept. Instrument settings files consist of a part of DiVa generated xml file, the part that specifies instrument settings.

gateSettings = /folder name containing gates settings files. Gate settings file is a part of the DiVa generated xml file and it must have corresponding file in worksheets with plot settings. Sample identifier is removed from gate files and is filled for each flowLIMS sample with the appropriate sample name.

keywords=/file name containing keyword section to be placed in the xml file. Keyword file is a part of the DiVa generated xml file, which allows the storing and passing of a keyword.

### 14.2. Database setup

The installer runs an SQL script to create the database tables and fill in some initial values. For the Oracle database, script `oracle.sql` is executed; for the Postgres database the script is `postgres.sql`.

### 14.3. Archiving script

**Note**

The archive script is necessary only if you are using a DiVa flowcytometer. Otherwise, the archive script is not used.

- The configuration file for the script is `parse_lims_data.conf`. It contains the following settings:

```
"SOURCE" => path to shared export space
"DESTINATION" => path to archive space
"LIMS_ERR_LOG" => path to flowLIMS log file
"SUMMARY_FLOWJO_DIR" => path to folder with flowjo summary files
"URL" => 'http://localhost:8080/lims'; url to the running flowLIMS application under Tomcat
"DB_URL" => URL for database
"DB_USERNAME" => database user ID
"DB_PASSWORD" => password for database user
```

The format of DB_URL is:

- For Oracle:
  - $host is your host name
  - $sid is your sid name

```
dbi:Oracle:host=$host;sid=$sid;port=1521
```

- For Postgres:
  - $dbname is your database name
  - $host is your host name

```
dbi:Pg:dbname=$dbname;host=$host;port=5432;
```
The script `parse_lims_data.pl` will be set to run as a scheduled process through `crontab`. The file `cronjob.txt` is used to set the script in `crontab`. The contents of the file are:

```
0 * * * * /path/parse_lims_data.pl
10 * * * * /path/parse_lims_data.pl
20 * * * * /path/parse_lims_data.pl
30 * * * * /path/parse_lims_data.pl
40 * * * * /path/parse_lims_data.pl
50 * * * * /path/parse_lims_data.pl
```

An execution frequency of 10 minutes is pre-set, it can be increased or decreased if necessary.

The following command is used to set up the `cronjob.txt` in the crontab:

```
 crontab cronjob.txt
```

After the flowLIMS installation is completed, edit file `parse_lims_data_update.pl` and replace the path in line:

```
require "/flowlims/conf/parse_lims_data_update.conf"
```

with the path pointing to `parse_lims_data_update.conf` in your system.

### 14.4. FlowLIMS deployment

The file `lims.war` is placed in the Tomcat `webapps` folder.
15. Customizing Web Descriptor web.xml

After Tomcat is started with the `startup.sh` command, the flowLIMS folder will be created under the Tomcat webapps folder. The file `web.xml` can be found in webapps/lims/WEB-INF.

There are a few parameters embedded into `web.xml` which can be customized. These include: passwords for `admin` and `operator` users, and the default number of columns on the plate.

One can edit this file and change the default values as described below. For your changes to take effect, you need to restart Tomcat.

Below are the contents and description for `web.xml`:

```xml
<param-name>lab.operator</param-name>
<param-value>operator</param-value>
<param-name>lab.oppassword</param-name>
<param-value>password for operator</param-value>
<param-name>lab.fleditor</param-name>
<param-value>admin</param-value>
<param-name>lab.password</param-name>
<param-value>password for admin</param-value>
<param-name>lab.plateColumnNum</param-name>
<param-value>12</param-value> default number of columns on the plate
</param-name>
```
16. Jars Installed with flowLIMS.

JDBC drivers are placed in the Tomcat common/lib folder, other jars are in the webapps/lims/WEB-INF/lib folder.

- **JDBC jars for the database:**

  The Oracle driver `ojdbc14.jar` or Postgres driver `postgresql-8.0-311.jdbc3.jar` is used. Upgrade database drivers if necessary.

  - If using Oracle, the driver for your Oracle version can be found at http://www.oracle.com/technology/software/tech/java/sqlj_jdbc/index.html
  
  - If using Postgres, the driver for your Postgres version can be found at http://jdbc.postgresql.org/download.html

- **The Oreilly cos.jar is used for uploading files:**

  - If you need to upgrade this file, the current version can be found at http://www.servlets.com/cos

  - Download any cos-*.zip

  - Unzip cos-*.zip

  - Find cos.jar and place it in the Tomcat webapps/lims/WEB-INF/lib folder.

- **SAX parser for parsing DiVa xml file:**

  - If you need to upgrade this file, go to http://xml.apache.org/xerces2-j

  - Download latest version

  - Find xercesImpl.jar and place it in the Tomcat webapps/lims/WEB-INF/lib folder
17. Running flowLIMS

Start Tomcat after all configuration steps are finished.

The URL to access the flowLIMS login page is:

http://host:port/lims/Login.jsp

If authentication is through REMOTE_USER the URL is:

http://host:port/lims/LoginServelet?RequestType=Login

17.1. Use flowLIMS

This is a short scenario which can be used for a basic flowLIMS functionality check.

Also, notice that each of the flowLIMS pages contains a help button with more detailed information.

1. Feed flowLIMS with desired DiVa instrument and plots/gates settings. From the DiVa application (version 4 or above) create an experiment with just ONE sample. For this sample create all plots with the desired gates. Export the experiment from DiVa as an xml file. Have this file on your desktop machine.

2. Log into flowLIMS as the admin user, set fluorochromes and some reagents. Fluorochrome names should match the ones defined for the DiVa machine. Add one more entry "BI" in the fluorochrome list not related to regular channels. BI is used to create biotin labeled reagents.

3. As admin, select "Manage Settings Files". Select the DiVa xml file generated earlier. Provide names for the settings and press "generate settings". This should generate files in the subfolders conf/InstrSettings and Plots/Gates.

4. As admin add one or more labs, add flowLIMS regular users and assign lab roles to the users.

5. Log into flowLIMS as a regular user.
   • go into "Workspace" as it is the place where experiments and protocols are created
   • create a new protocol
   • add some cells through the cell editor and select admin-generated reagents
   • put cells and reagents into tubes, save protocol
   • from "Workspace" create an experiment based on the newly created protocol, select the desired instruments settings (generated earlier by admin)

6. Go to the DiVa machine and import the experiment folder with the xml file generated by flowLIMS into the DiVa. The location of the folder was defined in the configuration file flowlims.conf as a parameter lab.exportDir. Samba share can be used to share space between applications.

7. Execute the experiment and export it from the DiVa to the export folder. The location of the folder was defined in the configuration file flowlims.conf as a parameter lab.importDir. This
folder can be shared using samba share.

8. The perl script running through crontab processes exports experiments and puts them in the archive folder.

9. In flowLIMS, experiment status is changed to *processed* and the user can create flowjo workspaces for the experiment. These are files which can be read by flowjo, they contain ftp paths used by flowjo to retrieve fcs files.