



i2b2 Installation Guide

Ontology Management (ONT) Cell

Document Version: 1.6.1
i2b2 Software Version: 1.6

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ABOUT THIS GUIDE

Informatics for Integrating Biology and the Bedside (i2b2) is one of the sponsored initiatives of the NIH Roadmap National Centers for Biomedical Computing (<http://www.bisti.nih.gov/ncbc/>).

One of the goals of i2b2 is to provide clinical investigators broadly with the software tools necessary to collect and manage project-related clinical research data in the genomics age as a cohesive entity; a software suite to construct and manage the modern clinical research chart. This guide with the provided source code will help you deploy the i2b2 ONTOLOGY cell.

1. PREREQUISITES

1.1 Required Software

If you installed the prerequisite software from the Hive Installation Guide you may skip this section.

1.1.1 Java JDK

JDK 6.0 is recommended and can be downloaded from the java website:
<http://java.sun.com/products/>

1. Install the SDK into a directory of your choice.

Example: /opt/java/jdk1.6.0 or *YOUR_JAVA_HOME_DIR*

1.1.2 JBoss 4.2.2GA

Download JBoss (jboss-4.2.2.GA.zip) from the jboss website:
<http://labs.jboss.com/jbossas/downloads>

1. Unzip jboss-4.2.2.GA.zip into a directory of your choice.

Example: /opt/jboss-4.2.2.GA or *YOUR_JBOSS_HOME_DIR*

2. Set JBoss JVM to run with 1GB of extended memory.
3. Edit '*YOUR_JBOSS_HOME_DIR*/bin/run.conf' and change the JAVA_OPTS memory setting to those shown below. (-Xms512m -X, x1024m)

```
#
# Specify options to pass to the Java VM.
#
if [ "x$JAVA_OPTS" = "x" ]; then
  JAVA_OPTS="-Xms512m -Xmx1024m
-Dsun.rmi.dgc.client.gcInterval=3600000
-Dsun.rmi.dgc.server.gcInterval=3600000"
```

4. If default port 8080 is unavailable because another application is using this port then edit the server.xml file
(*YOUR_JBOSS_HOME_DIR*/server/default/deploy/jboss-web.deployer/server.xml) to reconfigure the following two items:

- a. The non-SSL HTTP/1.1 Connector to another port such as 9090

```
< ! -Define a non-SSL HTTP/1.1 Connector on port 9090 - >
<Connector port="9090" address="{jboss.bind.address}"
  maxThreads="250" maxHttpHeaderSize="8192"
```

```
emptySessionPath="true" protocol="HTTP/1.1"
enableLookups="false" redirectPort="8443"
acceptCount="100" connectionTimeout="20000"
disableUploadTimeout="true" />
```

- b. The AJP 1.3 Connector to another port such as 9009

```
< ! –Define an AJP 1.3 Connector on port 9009 - >
<Connector port="9009" address="{jboss.bind.address}"
maxThreads="250" maxHttpHeaderSize="8192"
protocol="AJP/1.3" emptySessionPath="true"
enableLookups="false" redirectPort="8443" />
```

1.1.3 Apache Ant 1.6.5

Download *Apache Ant version 1.6.5* (apache-ant-1.6.5-bin.zip) from the following Apache website: <http://archive.apache.org/dist/ant/binaries/>

1. Unzip the file into a directory of your choice.

Example: /opt/apache-ant-1.6.5 or *YOUR_ANT_HOME_DIR*

1.1.4 Apache Axis2 1.1

Download *Apache Axis2 version 1.1* from the following Apache website: http://ws.apache.org/axis2/download/1_1/download.cgi

Select the download type of WAR (Web Archive) Distribution (axis2.war).

1. Create a folder called **i2b2.war** inside 'YOUR_JBOSS_HOME_DIR/server/default/deploy' folder.
2. Unzip axis2.war inside 'YOUR_JBOSS_HOME_DIR/server/default/deploy/i2b2.war' folder.

1.1.5 Oracle Express Edition

Download *Oracle Database 10g Express Edition (Universal)* (oracle-xe-univ-10.2.0.1-1.0.i386.rpm) from the following Oracle website:

<http://www.oracle.com/technology/software/products/database/xe/htdocs/102xelinsoft.html>

1. Run rpm -i oracle-xe-univ-10.2.0.1-1.0.i386.rpm as root.
 - a. Configure the database by running '/etc/init.d/oracle-xe configure' as root

- b. Select HTTP and listener ports (use defaults 8080/1521 if they are available).
 - c. Select 'Y'es to start on boot when asked.
2. Verify Oracle was properly installed.
 - a. Open a browser
 - b. Enter <http://yourHost.yourPort/apex>
 - c. You should see an Oracle Database Express Edition login screen.

1.1.6 Update Environment Variables

Be sure to set the JAVA_HOME, JBOSS_HOME, and ANT_HOME variables to the JAVA, JBOSS, and ANT home directories you set up in the previous sections.

Example:

```
# Sample environment variables
JAVA_HOME=/opt/java/jdk1.6.0
JBOSS_HOME=/opt/jboss-4.2.2.GA
ANT_HOME=/opt/apache-ant-1.6.5
PATH=$PATH:$ANT_HOME/bin:$JAVA_HOME/bin
export JAVA_HOME
export JBOSS_HOME
export ANT_HOME
```

1.1.7 Data Installation or Upgrade

Data installation or upgrade has already been performed.

2. INSTALL

2.1 Installing the Ontology Management (ONT) Cell

2.1.1 Download and Extract Source Code

The following outlines the steps to download and extract the core server source code to a target area.

Ⓢ *You can skip this step if the core server source code was downloaded during a previous installation (e.g. PM or CRC).*

Steps:

1. Set up a target source_directory.
2. Extract the core server source code into the target source_directory.

2.1.2 Stop Services

In order to install the ONT properly it is important that certain services are **not** running. These services are further defined below.

2.1.2.1 JBOSS

Verify JBOSS is not running.

1. `cd $JBOSS_HOME/bin/`
2. `./$JBOSS_HOME/bin/shutdown.sh -S`

2.1.3 Deploy edu.harvard.i2b2.common

The following outlines the steps to deploy **edu.harvard.i2b2.common**.

Ⓢ *You can skip this step if edu.harvard.i2b2.common was deployed during a previous installation (e.g. CRC).*

Steps:

1. `cd source_directory/edu.harvard.i2b2.common`
2. Edit the **build.properties** file and set *jboss.home* and *axis2.war.name* properties.
`jboss.home=YOUR_JBOSS_HOME_DIR`

```
axis2.war.name=i2b2.war
```

3. Run *ant clean deploy jboss_pre_deployment_setup*

2.1.4 Deploy edu.harvard.i2b2.ontology

Steps:

1. cd `source_directory/edu.harvard.i2b2.ontology`
2. Edit the ***build.properties*** file and set *jboss.home* and *axis2.war.name* properties

```
jboss.home=YOUR_JBOSS_HOME_DIR  
axis2.war.name=i2b2.war
```

3. Edit the ***etc/spring/ontology_application_directory.properties*** file and specify a location for the application properties directory. This location can be anything you desire but must be a directory path that your Linux user has access permission granted.

```
edu.harvard.i2b2.ontology.applicationdir=YOUR_JBOSS_HOME_DIR/server/default  
/conf/ontologyapp
```

4. Edit the ***etc/spring/ontology.properties*** file and set the *database* and *project management* properties.

- a. Set the *metadata bootstrap database schema* name to the location of the `ONT_DB_LOOKUP` table.

```
#####  
# METADATA schema name  
#####
```

```
ontology.bootstrapdb.metadataschema=i2b2hive
```

- b. Set the *Project Management Property* settings: change the host and port settings.

 **Note the new address for the jboss-based PM Service**

```
ontology.ws.pm.url=http://localhost:9090/i2b2/rest/PMService/getServices
```



```
# Flag to bypass project management cell
ontology.ws.pm.bypass=false
ontology.ws.pm.bypass.role=ADMIN
ontology.ws.pm.bypass.project=Demo
```

- c. Set the File Repository Cell requirements: change the host and port settings.

```
edu.harvard.i2b2.ontology.ws.fr.url=http://localhost:9090/i2b2/services/FRService/
edu.harvard.i2b2.ontology.ws.fr.tempSpace=/tmp
edu.harvard.i2b2.ontology.ws.fr.timeout=10000
edu.harvard.i2b2.ontology.ws.fr.fileThreshold=4000
edu.harvard.i2b2.ontology.ws.fr.attachmentName=cid
edu.harvard.i2b2.ontology.ws.fr.operation=urn:recvfileRequest
```

 ***This was added in Release 1.5 to provide metadata/concept_dimension synchronization.***

- d. Set the CRC Cell requirements: change the host and port settings.

```
edu.harvard.i2b2.ontology.ws.crc.url=http://localhost:9090/i2b2/rest/QueryToolService
```

 ***This was added in Release 1.5 to provide metadata/concept_dimension synchronization.***

- e. Set the *METADATA delimiter* (backslash) setting.

```
ontology.terminal.delimiter=true
```

- If set to **'true'**, this parameter *adds a backslash automatically* to the metadata **fullpath name** if it does not already exist.

 ***This was added to fix a bug related to leaf-level metadata concepts with similar names: such as //i2b2/i2b2/metadata/pul and //i2b2/i2b2/metadata/pulm***

- Set this to **'false'** if you want true release 1.3 backward compatibility.

☉ **For Release 1.4 to Release 1.5 upgrade do step 5.**

5. Edit the etc/spring/OntologyApplicationContext.xml

a. Add appType and message_header bean.

```
<bean id="appType" class="edu.harvard.i2b2.ontology.datavo.i2b2message.ApplicationType">
  <property name="applicationName" value="edu.harvard.i2b2.ontology"/>
  <property name="applicationVersion" value="1.5"/>
</bean>

<bean id="message_header" class="edu.harvard.i2b2.ontology.datavo.i2b2message.MessageHeaderType">
  <property name="sendingApplication" ref="appType"/>
</bean>
```

6. Edit the **etc/jboss/ont-ds.xml** and configure your data sources.

- a. OntologyBootStrapDS points to the location of your ONT_DB_LOOKUP table.
- b. Any additional data source specified in the lookup table must be specified here as well (shown below as “OntologyDemoDS” for project Demo and “OntologyDemo2DS” for project Demo2).
- c. Data source samples for both sqlserver and oracle are provided in ont-ds.xml. Copy and modify the samples in on-ds.xml as needed to create the three data sources shown below. Comment out or remove any unused samples.

Example:

```
<datasources>
  <local-tx-datasource>
    <jndi-name>OntologyBootStrapDS</jndi-name>
    <driver-class>oracle.jdbc.driver.OracleDriver</driver-class>
    <connection-url>jdbc:oracle:thin:@localhost:1521:xe </connection-url>
    <user-name>i2b2hive</user-name>
    <password>i2b2hive_password</password>
  </local-tx-datasource>
  <local-tx-datasource>
    <jndi-name>OntologyDemoDS</jndi-name>
    <driver-class>oracle.jdbc.driver.OracleDriver</driver-class>
    <connection-url>jdbc:oracle:thin:@localhost:1521:xe</connection-url>
    <user-name>i2b2metadata</user-name>
    <password>i2b2metadata_password</password>
  </local-tx-datasource>
  <local-tx-datasource>
    <jndi-name>OntologyDemo2DS</jndi-name>
    <driver-class>oracle.jdbc.driver.OracleDriver</driver-class>
    <connection-url>jdbc:oracle:thin:@localhost:1521:xe </connection-url>
```

```
<user-name>i2b2metadata2</user-name>  
<password>i2b2metadata2_password</password>  
</local-tx-datasource>  
</datasources>
```

7.Run *ant -f master_build.xml clean build-all deploy*

2.1.5 Start Services

2.1.5.1 START JBOSS

To start JBOSS run the following: *\$JBOSS_HOME/bin/run.sh -b 0.0.0.0*

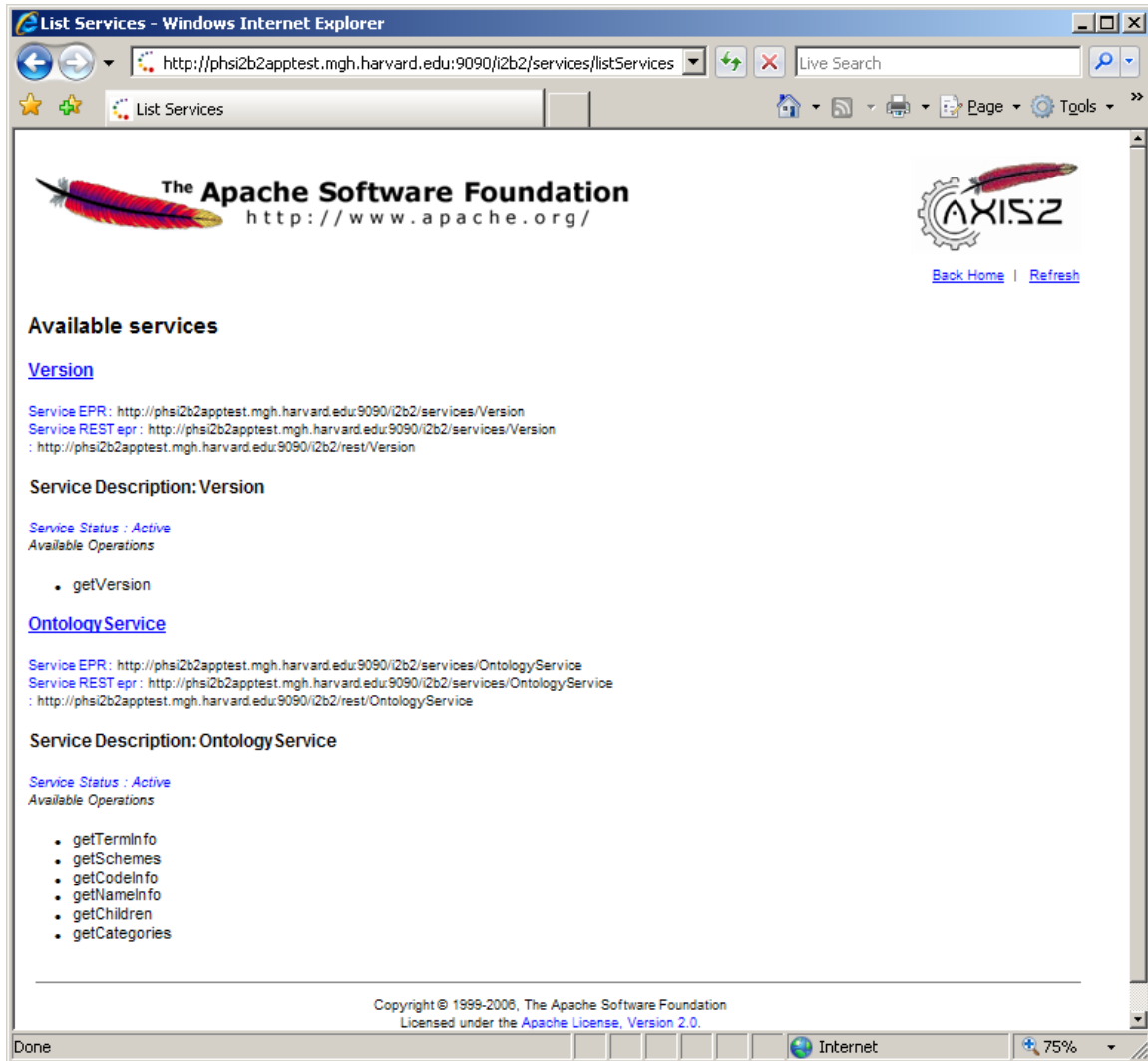
2.1.5.2 WEB SERVICE

The following are the steps to verify the web service is running.

1. In a browser, check the following URL:

http://yourHost:9090/i2b2/services/listServices

2. Verify OntologyService is listed as active.



2.2 Changing Server log level

By default JBOSS log will be in **DEBUG** mode, changing it to **INFO** mode will increase server performance.

1. Edit `$JBOSS_HOME/server/default/conf/jboss-log4j.xml` file and add the '*Threshold*' <param>

```
<appender name="FILE" class="org.jboss.logging.appender.DailyRollingFileAppender">
  <errorHandler class="org.jboss.logging.util.OnlyOnceErrorHandler"/>
  <param name="File" value="{jboss.server.home.dir}/log/server.log"/>
  <param name="Append" value="false"/>
</appender>
```

```
<param name="Threshold" value="INFO"/>
<!-- Rollover at midnight each day -->
<param name="DatePattern" value="'.yyyy-MM-dd"/>
<layout class="org.apache.log4j.PatternLayout">
  <!-- The default pattern: Date Priority [Category] Message\n -->
  <param name="ConversionPattern" value="%d %-5p [%c] %m%n"/>
  . . .
</layout>
</appender>
```

2. To switch back to DEBUG mode, *comment out* the 'Threshold' <param> and wait a minute.

 ***There is no need to restart JBOSS.***

3. VERIFY INSTALLATION

3.1 Ontology (ONT) Cell Sanity Test via the i2b2Workbench

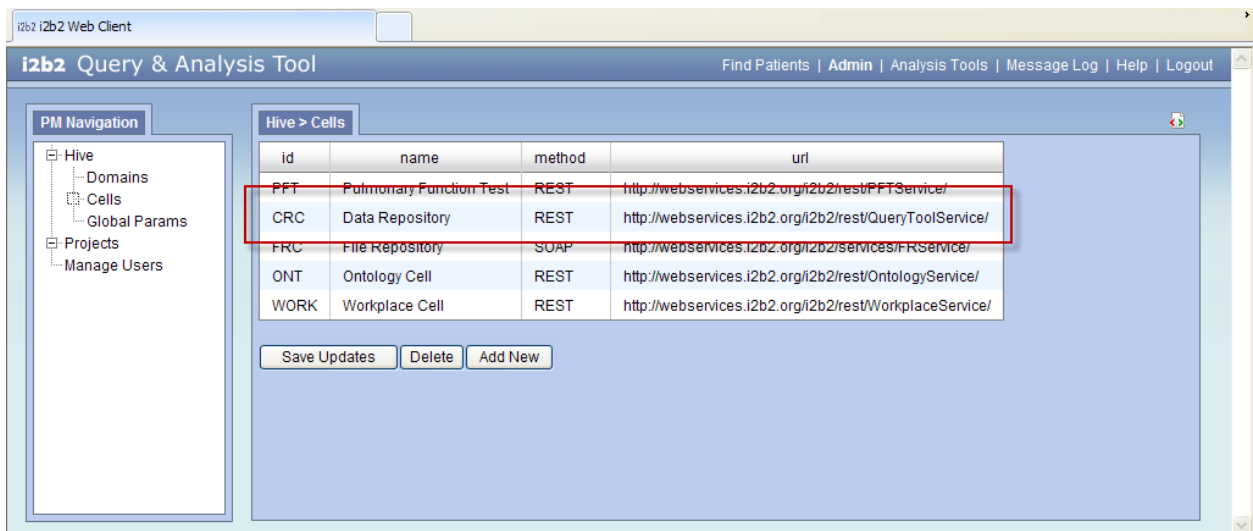
3.1.1 Configure the i2b2Workbench to communicate with your ONT cell.

Cell configuration is addressed in the Project Management (PM) Cell installation and set up. Please refer to this document if the Ontology Cell has not yet been configured.

To verify the data, go to the web client site ***http://host/webclient***.

Once logged on, select “Cells” under the “Hive” primary navigation tab. If the Ontology Cell has been configured it will be listed as an existing, registered cell:

- To verify cell data, click on the cell name (ONT).
- To edit the cell data, click on the field you want to edit. Click on “Save Updates” to save the changes you have made.



The screenshot shows the i2b2 Query & Analysis Tool web client interface. The main content area displays a table of cells under the 'Hive > Cells' tab. The table has columns for 'id', 'name', 'method', and 'url'. The rows are:

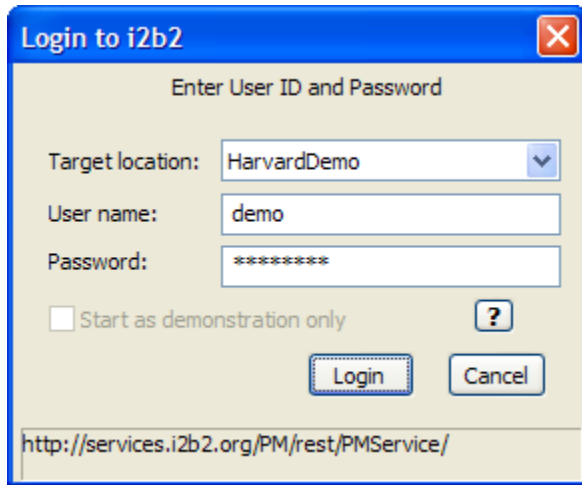
id	name	method	url
PFT	Pulmonary Function Test	REST	http://webservices.i2b2.org/i2b2/rest/PFTService/
CRC	Data Repository	REST	http://webservices.i2b2.org/i2b2/rest/QueryToolService/
FRC	File Repository	SUAP	http://webservices.i2b2.org/i2b2/services/FRService/
ONT	Ontology Cell	REST	http://webservices.i2b2.org/i2b2/rest/OntologyService/
WORK	Workplace Cell	REST	http://webservices.i2b2.org/i2b2/rest/WorkplaceService/

Below the table are three buttons: 'Save Updates', 'Delete', and 'Add New'. The 'ONT' row is highlighted with a red box.

3.1.2 Launch the i2b2Workbench

The following outlines the steps to log into the i2b2 Workbench.

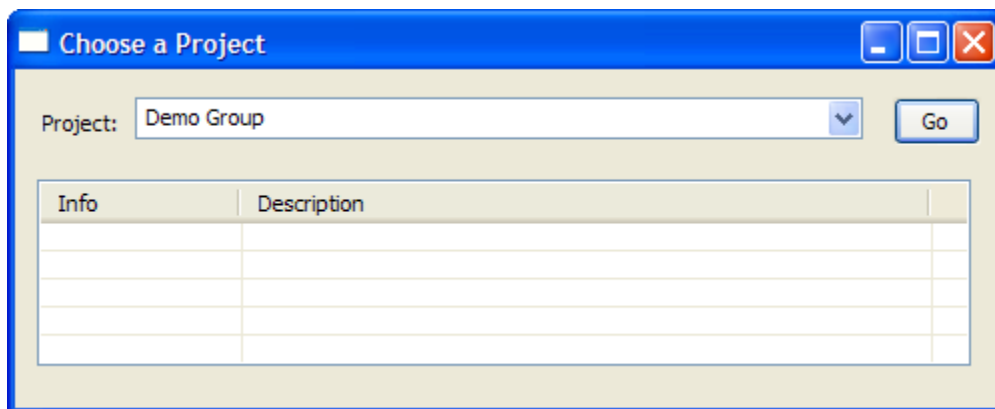
1. Go to the location (folder) in which the i2b2 Workbench was installed.
2. Double click on **i2b2Workbench.exe**.
3. The **Login dialog box** will open.




4. Select your **target location** (YourSite)
5. Enter you **User name** (ID) and **Password**. (demo/demouser)
6. The *URL at the bottom of the login screen* should be the address of your PM cell. If it isn't then edit the *i2b2Workbench.properties* file to point to the correct location of your PM cell.
i2b2.1=**YourSite**,REST,http://jbossHost:port/i2b2/rest/PMService/

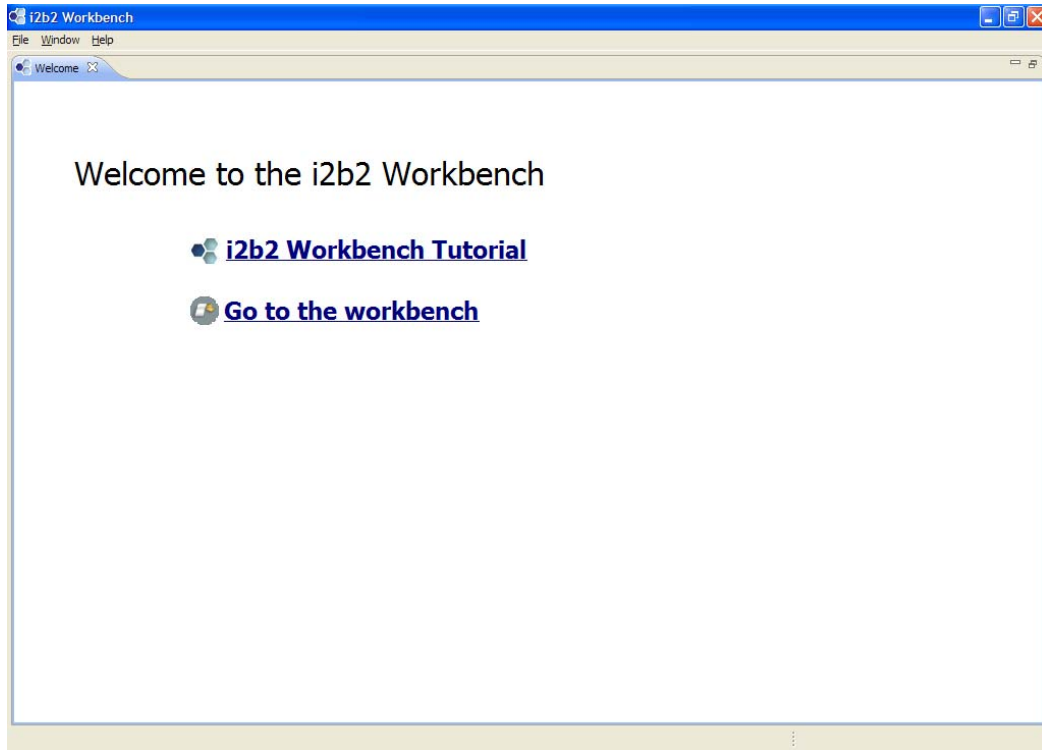
7. The **Choose a Project** dialog box will open.

The project dialog box will only appear if you have access to multiple projects. If you only have access to one project you will be brought to the Welcome page.

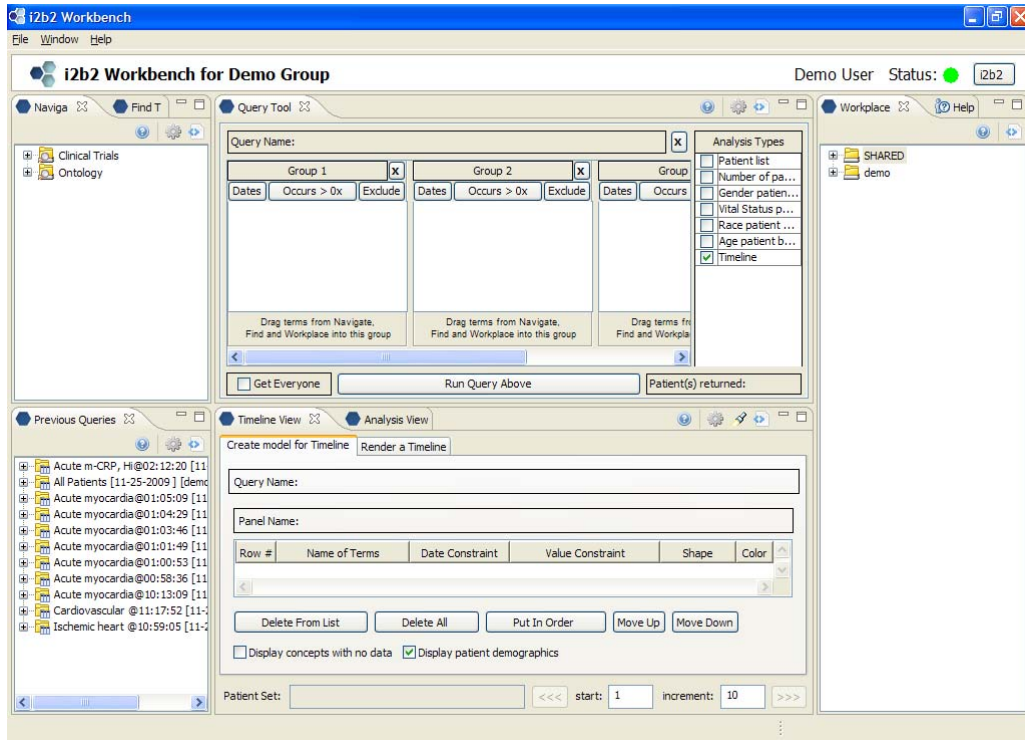


8. Select the project you want to log into.
9. The **Welcome** page will open.

 ***The welcome page will open the first time you login. All subsequent logins will bring you directly to the desktop. You can access the welcome page anytime by selecting it from the Help menu on the toolbar.***

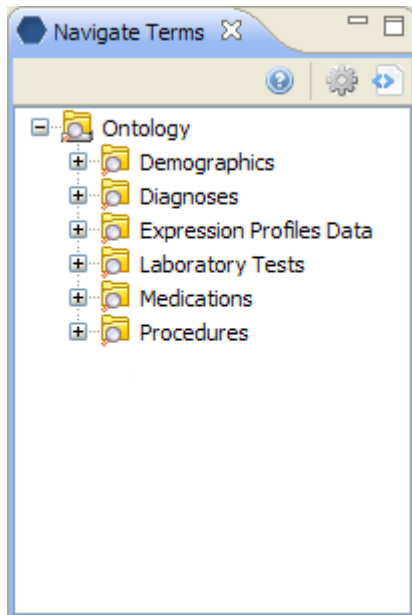


10. Click on Go to the workbench.
11. The **desktop** of the i2b2 Workbench will open.



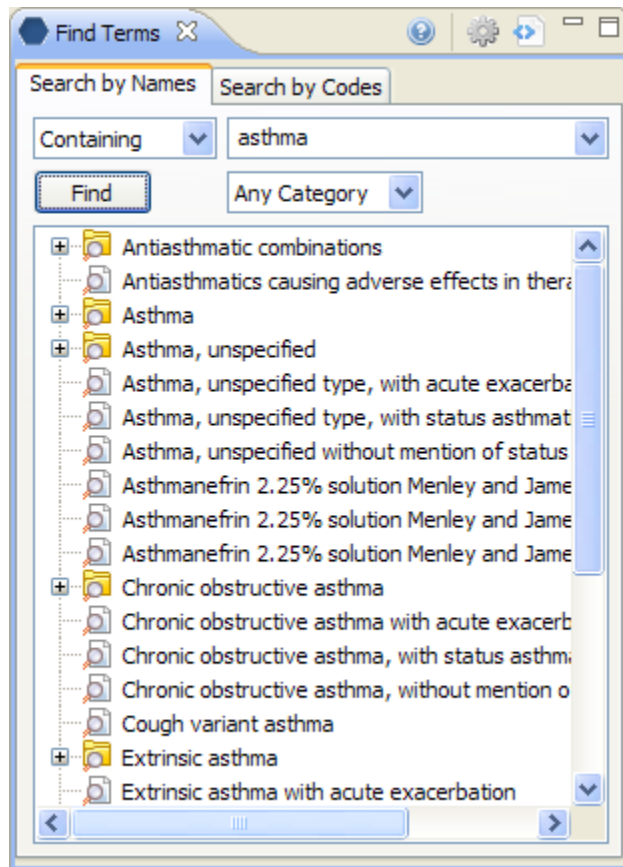
3.1.2.1 OPEN THE NAVIGATE TERMS VIEW IN THE WORKBENCH

If all is configured properly, you will be greeted with a top level folder called "Ontology". Double click on this folder to expand.



3.1.2.2 OPEN THE FIND TERMS VIEW IN THE WORKBENCH

- Enter a diagnostic term to search on such as “asthma”.
- Click on the Find button.
- If all is configured properly, you will see a list of entries each containing the work ‘asthma’.



3.1.3 Possible problems

One of the following error messages may appear in view window.

1. Ontology cell is unavailable

The possible cause for this error message may be one of the following:

- Ontology cell address in the PM webclient is incorrect.
 - a. See the section labeled “*Configure the i2b2Workbench to communicate with your ONT Cell*” (section 3.1.1) to verify the Ontology cell address is correct.
- Ontology cell may be down. Follow these steps to check the status of the ONT cell.
 - a. In a browser, check the url
`http://yourHost:9090/i2b2/services/listServices`
 - b. Verify that *OntologyService* is listed as active.

2. Remote server is unavailable

The possible cause for this error message may be one of the following:

- Server may be down. Follow these steps to check the status of the server.
 - a. In a browser, check the URL
`http://yourHost:9090/i2b2/services/listServices`
 - b. Verify that *OntologyService* is listed as active.

3. PM service is not responding

The Project Management Cell is down or its address was not configured properly in the following sections:

- a. Section: Deploy edu.harvard.i2b2.ontology (section 2.1.4)
Step 4: Edit the *etc/spring/ontology.properties* file

4. Database error

The possible cause for this error message may be one of the following:

- Problem connecting to the database.
- Table_access data may be incorrect. Verify configuration parameters in the following sections:
 - a. Section: Deploy edu.harvard.i2b2.ontology (section 2.1.4)
Step 3: Edit the *etc/spring/ontology_application_directory.properties* file
Step 4: Edit the *etc/spring/ontology.properties* file
Step 5: Edit the *etc/jboss/ont-ds.xml*

LICENSE

The i2b2 source code is licensed under the i2b2 Software License Software. This includes but not limited to all code in the edu.harvard.i2b2.* package namespace.