InterPSS OpenCIM
User's Guide

Software Release 1.2.1

March, 2010

InterPSS
Simple yet Powerful

Important Information

TABLE OF CONTENTS

1 OVERVIEW

1.1 INTRODUCTION

The Common Information Model (CIM) is an effort to develop a common power system information model that can be shared and exchanged among different applications across operations and planning in utility companies and, in the future, power trading companies to facilitate seamless power system information sharing and integration. Being a common power system information model, CIM was designed to serve as the foundation for integrating modern information systems in the power industry. Real-time integration of power system application is not feasible without a common information model that can be understood by everyone (human beings as well as computers).

We have observed that when major ISOs (Independent Service Operators) are creating, expanding and maintaining their CIM model (mostly based on RDF), their model, which is used by many regional utility companies, is growing bigger and bigger. For example, the latest ERCOT model is 4.4 GB as of October, 2008. InterPSS OpenCIM is developed with the following challenges in mind:

- No enterprise relational database software such as Oracle is needed.

- No high-end hardware and complicated configuration is needed.

- Easy to be adapted or extended to accommodate enhancement and customer-specific requirements.

- Easy to be integrated with other power system applications.

1.2 FEATURES

InterPSS OpenCIM solves the above concerns by providing:

- A graphical tool that can show all details of a CIM model, or selectively show only the interested/relevant part of the model.

- A Java-based tool with both GUI and API that can be run on any platform that has Java runtime software installed.

- An innovative RDF parser that parses large RDF model files quickly and efficiently.

- A flexible architecture design that can adapt quickly to different CIM versions and/or extensions by different ISOs.

- An OpenCIM API that can be used in any other power system applications in which programmatically managing CIM models is a requirement.

- No need for expensive enterprise relational database software such as Oracle; simple and easy installation.

- No need for high-end hardware. Parsing and displaying the large 4.4 GB CIM model can be done on a professional laptop computer.

- Intrinsic capability to convert CIM to the proposed IEEE ODM model and perform power system simulations.

- Intrinsic capability to seamlessly integrate with other power system information systems.

1.3   BASIC CONCEPTS

InterPSS OpenCIM has a CIM object model, which accurately represents the CIM standard as published by IEC. The OpenCIM CIM model has also been extended to represent the extensions by ERCOT. OpenCIM maintains a CIM model vocabulary dictionary. New vocabulary could be added to accommodate future changes of the CIM standard and cover extensions by other ISO.

When processing a CIM RDF file using InterPSS OpenCIM, there are two main steps, as follows:

- The CIM information stored in a RDF file is first mapped to the OpenCIM object model. For large RDF files, the object model is saved into the local file system.

- Then the object model is used for viewing RDF records and the relationships. For large RDF files, the saved model is loaded into InterPSS OpenCIM for the viewing purpose in a very efficient manner.

1.3.1   Model Object and Data Object

Analysis of the current ERCOT CIM model file indicates that 2/3 of the CIM objects in the file are related to data, such as RegularTimePoint or AnalogValue. The user often is not interested in the actual value of these data objects. Therefore OpenCIM breaks a large CIM model into two sets: Model Object and Data Object. When the Processing Large RDF file user preference option is selected, user has the option to load the model objects and data objects into OpenCIM Viewer separately.

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2 INSTALLATION

2.1 SYSTEM REQUIREMENT

Minimum: 1.8 GHz CPU, 2 GB physical memory.

2.2 SOFTWARE REQUIREMENTS

Java Runtime Environment (JRE) 1.6.x is required. It can be downloaded for free at Sun Microsystem's website at http://java.sun.com/javase/downloads/index.jsp. Choose the latest update of "Java SE Runtime Environment (JRE) 6".

Install the downloaded JRE 1.6.x. Add the path to the bin directory of the installed JRE to the system variable PATH. For example:

"C:\Program Files\Java\jre1.6.0_xx\bin"
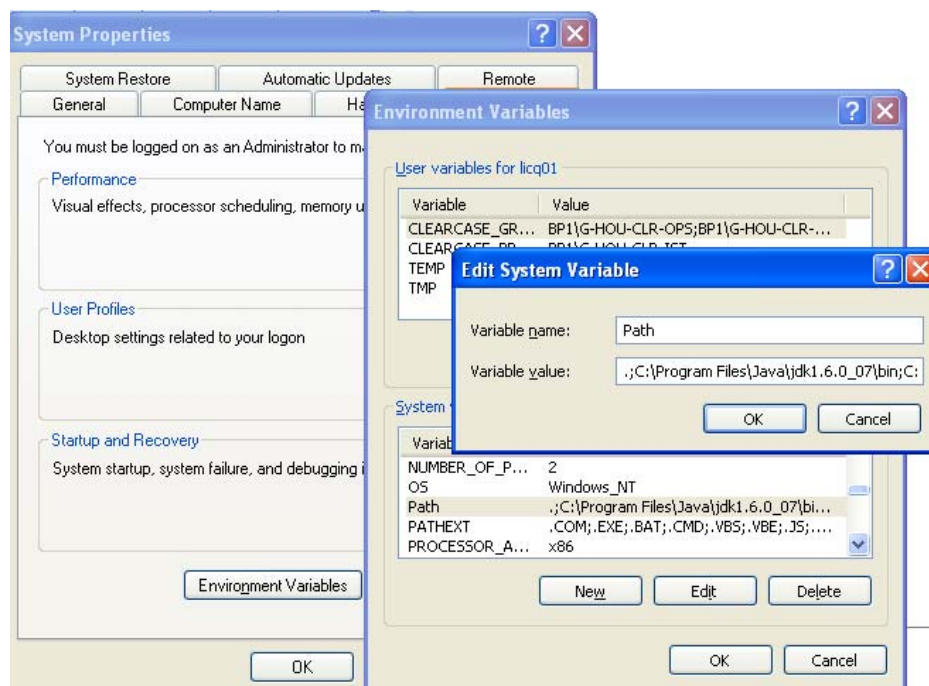
Please note: this step is normally done automatically by the Java installers.

2.3   INSTALLATION PROCEDURE

2.3.1 Download the installation zip file, interpss-opencim-install-**<***version_no***>-<***build_no***>**.zip, into a temporary folder. You should see the following three files:

install.cmd	1 KB	Windows NT Comm…	2/17/2010 3:11 PM
install_readme.txt	1 KB	Text Document	2/17/2010 3:11 PM
interpss-opencim-install-1.2.1.jar	77,951 KB	Executable Jar File	2/17/2010 3:12 PM

2.3.2 The install_readme.txt file briefly describes the installation procedures.

2.3.3 Open the install.cmd file, and modify the line for JAVA_HOME to reflect the Java JRE installation folder described in 2.2, e.g.:

<div align="center">set JAVA_HOME=C:/Program Files/Java/jre1.6.0_07</div>

2.3.4 Save, and then run install.cmd. Follow the instructions on the screen and finish the entire installation process.

2.3.5 OpenCIM is distributed with a community license key file, which can process up to 10,000 RDF records. If you have obtained a license file from InterPSS, copy the license file provided by InterPSS Systems LLC into the *<opencim_home>*/license folder and rename it to *opencim.license*.

Please note: InterPSS OpenCIM cannot function properly without a valid license file.

2.3.6 CIM version: the CIM standard over the years has been evolving and resulted in different CIM versions (10, 11, 13, 14, etc.). OpenCIM currently supports CIM version 10, CIM version 14 and the ERCOT CIM version, which is an extension to CIM version 11. The version field in the IEC61970 CIM*Version.version* record normally has a format of *<CIM version><minor version>*. For example, in CIM version 14, the field might have a value of CIM14v002. The CIM version validation inside OpenCIM checks the CIM version prefix. Therefore CIM14v001, CIM14002 and CIM14_v003 are all valid for CIM version 14.

In InterPSS OpenCIM, you can set the CIM version that you are working on in the <opencim_home>/ properties/opencim.properties file. Uncomment the right section for the CIM version you use, and comment all the other sections.

uncomment the following to use Cim10 model

#OpenCIM.Model=Cim10

#OpenCIM.Dictionary.Rdf_dict=cim10_rdf_dictionary.xml

#CustomView.Name=Cim10 View

#CustomView.XmlFileName=cim10_view.xml

Save the opencim.properties file, and restart InterPSS OpenCIM.

Please note: you need to restart OpenCIM after the above change to make the change effective.

InterPSS OpenCIM is currently configured to work with CIM Model version: Cim14. If you need to work on a different CIM version, modify <install_dir>/properties/ opencim.properties. Some operations may fail if the two CIM model versions don't match. See the User's Guide for details.

2.3.7 Memory configuration: InterPSS OpenCIM is shipped with a typical memory configuration. If you need to change it, e.g., to increase the system memory allocation for InterPSS OpenCIM, you can modify the opencim.ini file as follows.

-vmargs

-Xms512m: the minimum (or startup) memory allocation in MB.

-Xmx1024m: the maximum memory allocation in MB.

Increase the –Xmx parameter to the maximum (by trial and error) without seeing the following startup error.
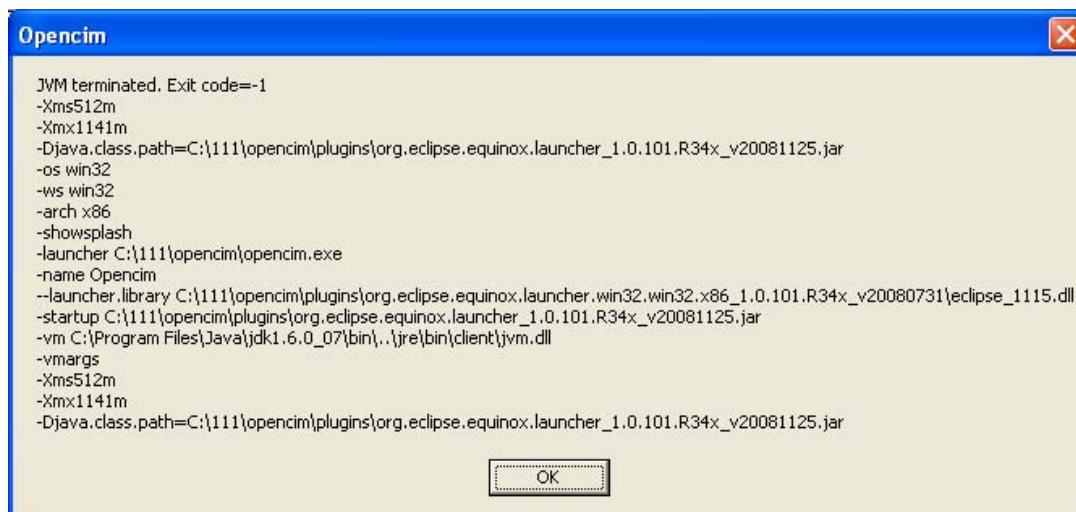
Save the opencim.ini file and restart InterPSS OpenCIM.

2.4   START INTERPSS OPENCIM SOFTWARE

Start InterPSS OpenCIM by going to Start > All Programs > InterPSS > InterPSS OpenCIM, or double-click on the InterPSS OpenCIM desktop shortcut, or execute *<opencim_home>*/opencim.exe.

# 3 INTERPSS OPENCIM QUICK START – A TUTORIAL

In this quick start tutorial, we will load a sample RDF file (located in <opencim_install_dir>/samples directory) into InterPSS OpenCIM; build an OpenCIM model from the RDF file and view the RDF record details. In addition, we will perform the RDF Analysis and Find RDF Record functions on an RDF file.

The tutorial will also cover the configuration details of InterPSS OpenCIM.

After this tutorial, you will be fairly familiar with all the major functions of InterPSS OpenCIM.

3.1 START INTERPSS OPENCIM

Start InterPSS OpenCIM.
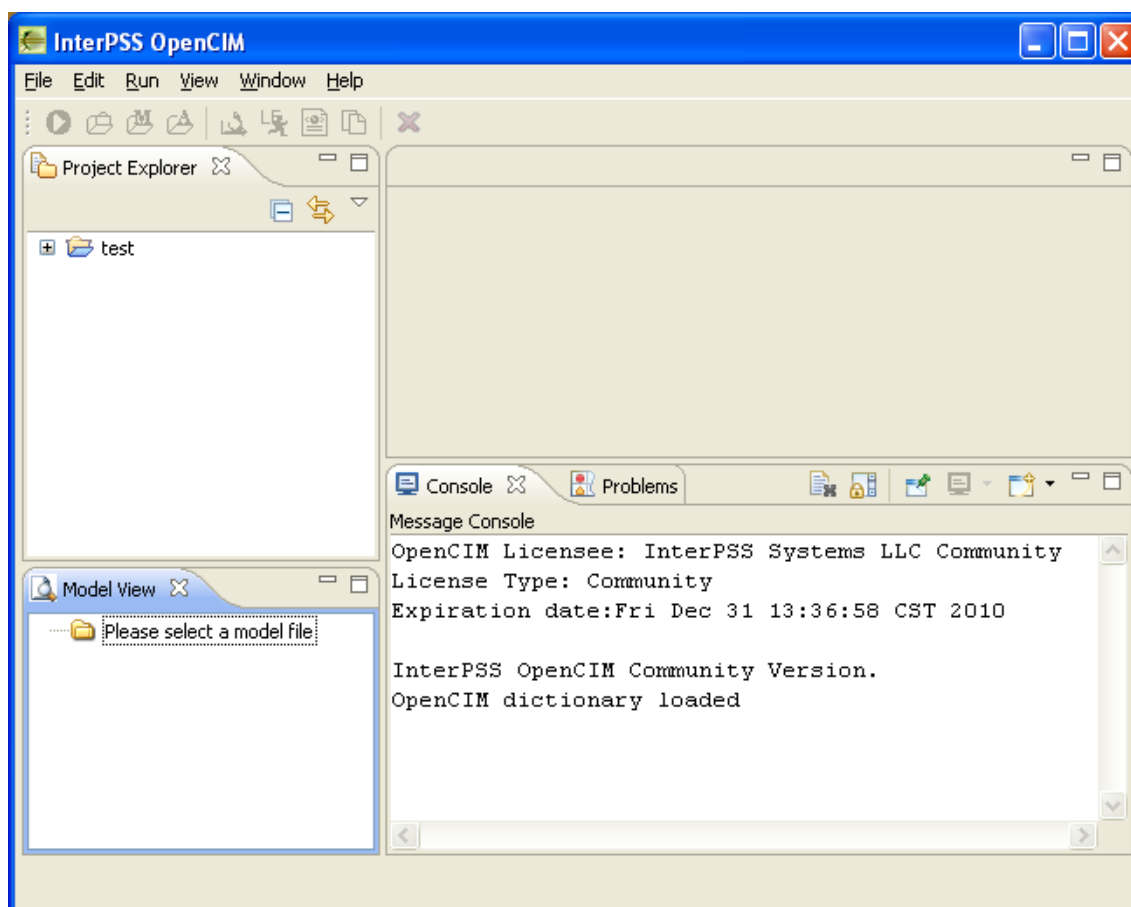
See Section **4. InterPSS OpenCIM User Interface** for detailed descriptions of the different panel areas in the above screen.
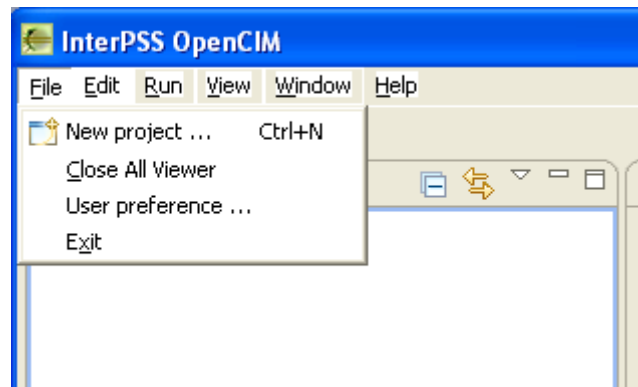
You may see the following pop-up dialog on the limitations of InterPSS OpenCIM Community Edition.
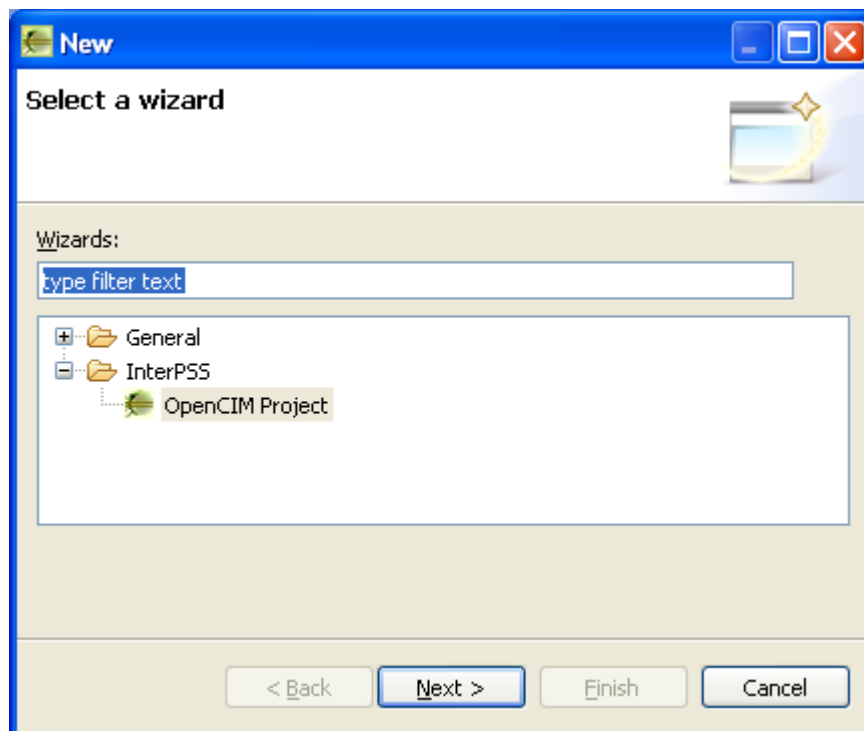

Contact info@interpss.com if you see any startup error related to license issues.
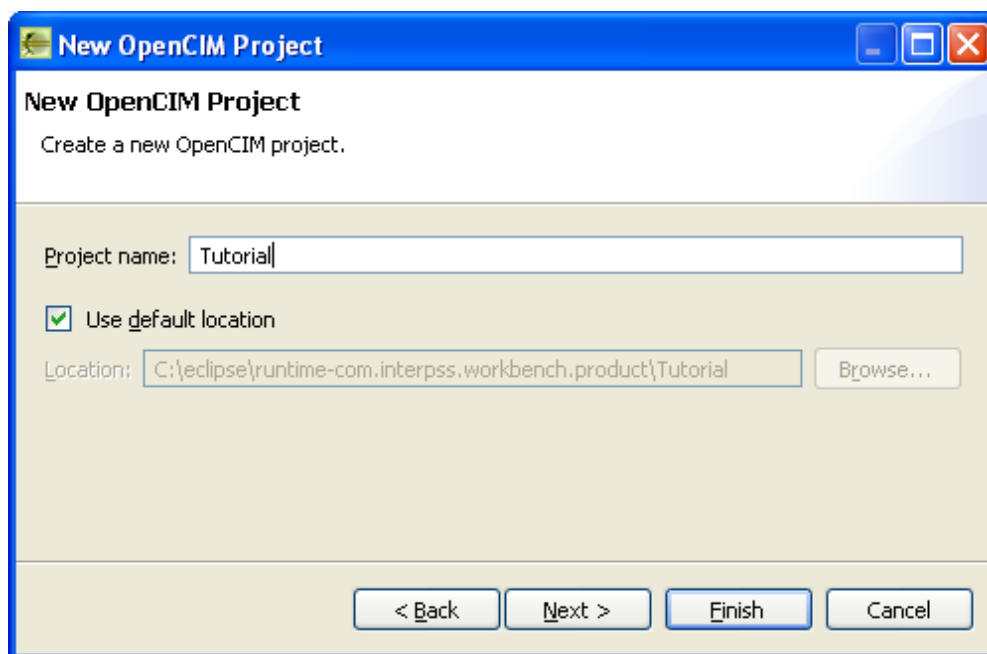
3.2 CREATE AN INTERPSS OPENCIM PROJECT

3.2.1   Go to menu item File > New Project….

3.2.2   In the New dialog, select wizard InterPSS > OpenCIM Project. Click on Next.

3.2.3   In the New OpenCIM Project dialog, enter Tutorial for Project name. Click on Next.

Note: At this stage, you can create an empty OpenCIM project by clicking the Finish button – you can add one or multiple RDF files to the project later on by following the steps in **Appendix A.1 Adding RDF files to an OpenCIM project**.

3.3   IMPORT RDF FILE

3.3.1   In the Import Rdf File dialog, click on Browse… and select the RDF file that needs to be imported. Click on Finish.
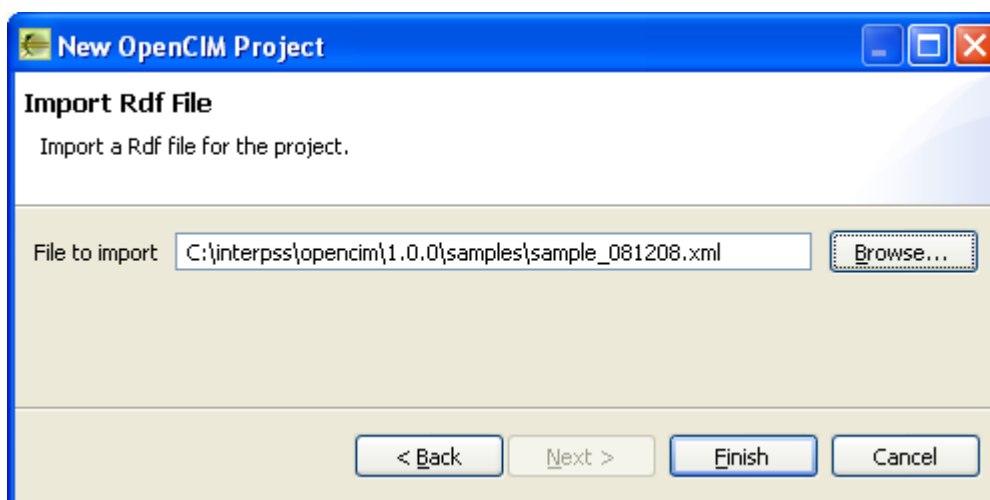
Note: Currently InterPSS OpenCIM only support RDF files with an extension or .xml or .rdf. If your RDF file has a different file extension, please rename the file extension to either .xml or .rdf.
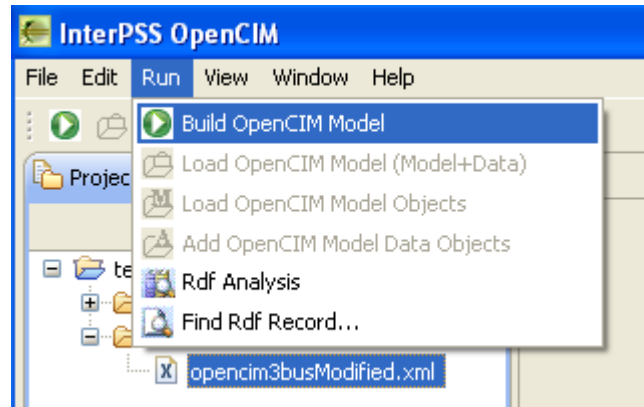
3.3.2   The RDF file import loading time depends on the size of the RDF file. After it is imported, the new **Tutorial** project is created.
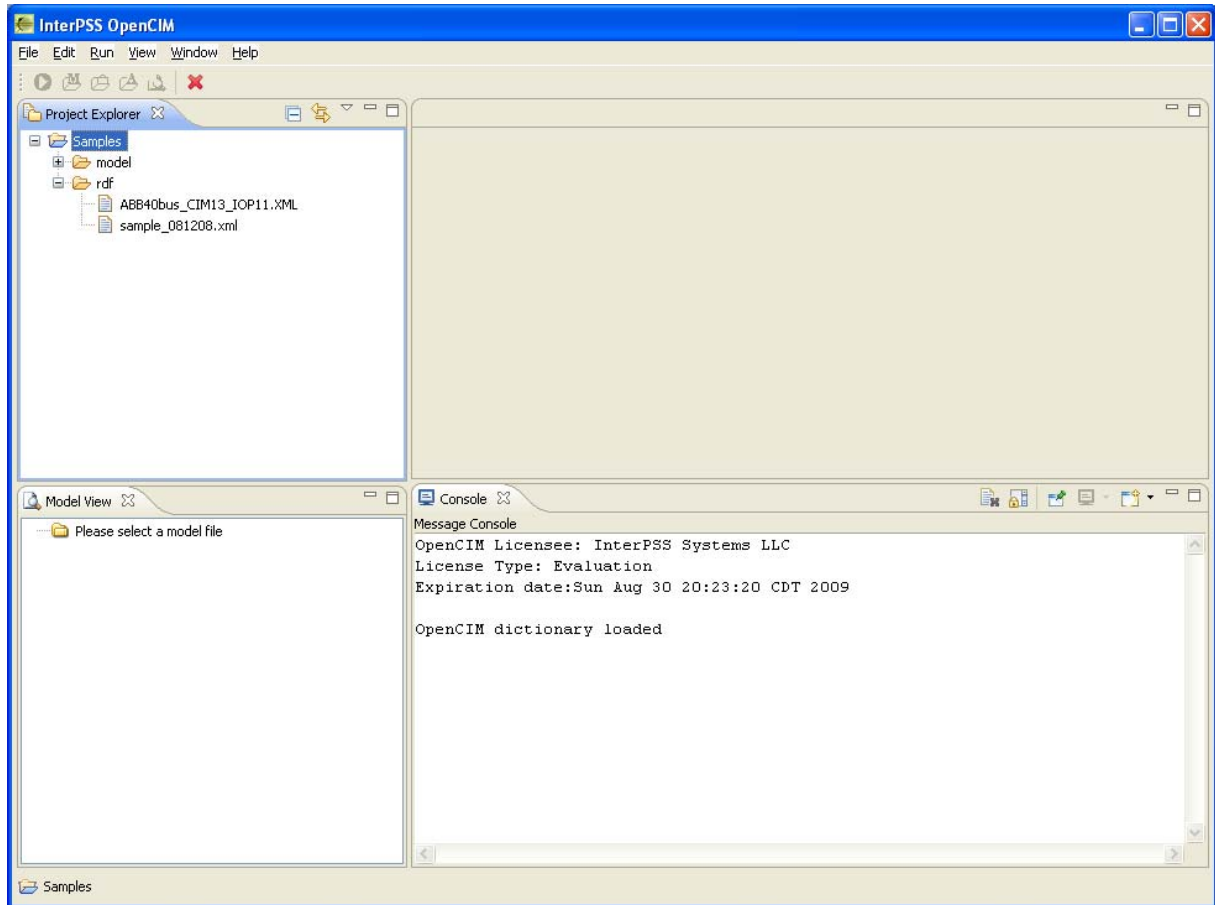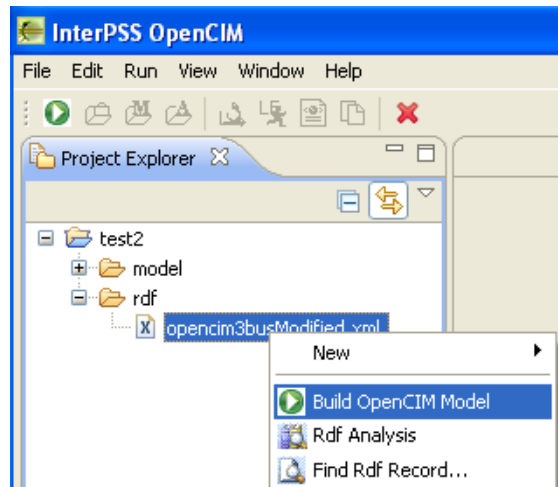
3.4 **BUILD OPENCIM MODEL**

There are three ways to build the OpenCIM model from the RDF file imported:
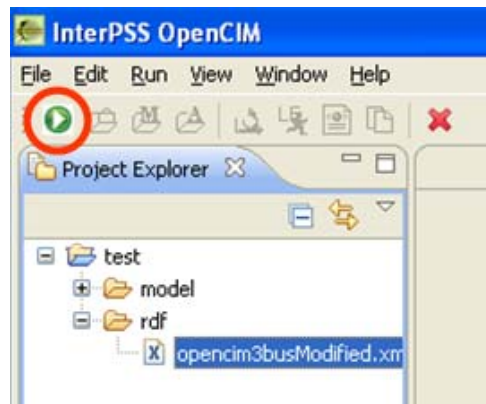
- Highlight the RDF file. Go to menu item Run > Build OpenCIM Model.

- Right-click on the RDF file and select Build OpenCIM Model from the popup menu.

- Click on the RDF file and then click on Build OpenCIM Model from the Toolbar.

If the CIM version number is either absent in the RDF file or different from what is configured for InterPSS OpenCIM (see Section 2.3.6), a warning message will pop up as follows.
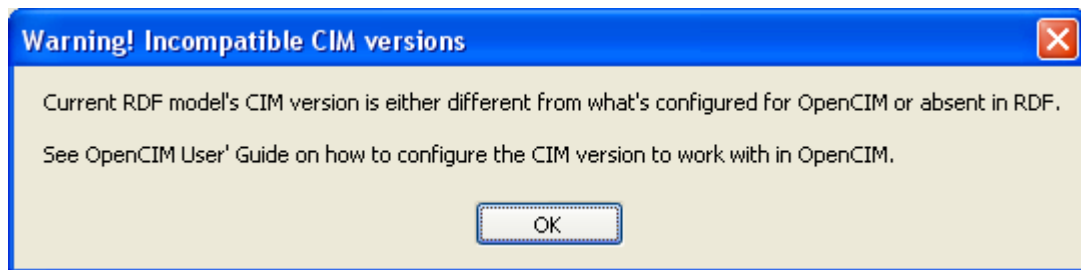
This is just a friendly remind that you might set OpenCIM CIM version configuration wrong, and your RDF file might be interpreted by OpenCIM using a wrong CIM version.

Please note: OpenCIM is using the <cim:IEC61970CIMVersion.version> element to determine the CIM version of the RDF file under processing. For example:

<cim:IEC61970CIMVersion.version>**CIM14v001**</cim:IEC61970CIMVersion.version>

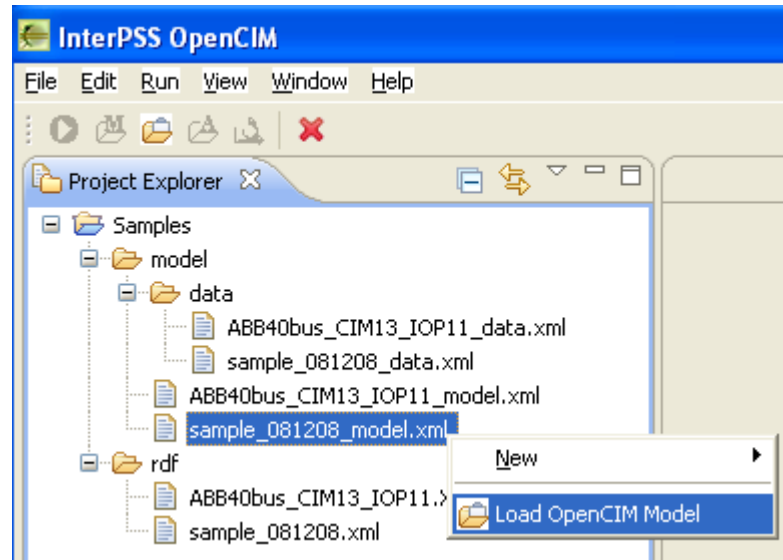## 3.5 VIEW DETAILS OF OPENCIM MODEL

Load OpenCIM Model (Large RDF Files Only)

For large RDF files, the object model build in the Build OpenCIM Model step is saved to a set of files. To view the model, you need to Load OpenCIM Model first. There are three ways to load the built OpenCIM model file details:
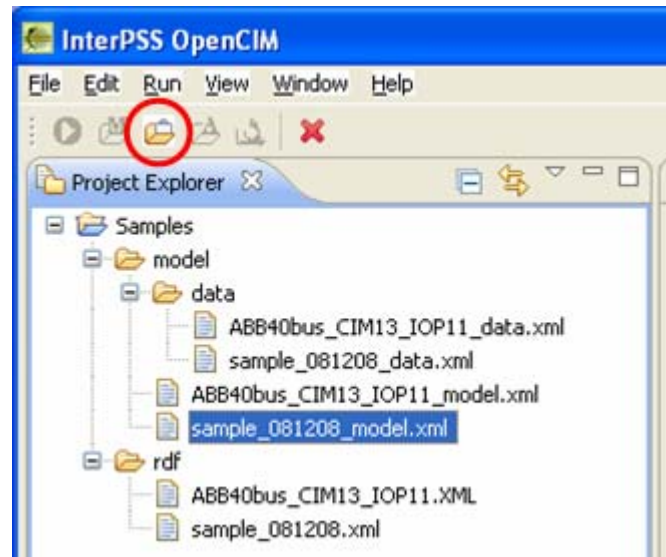
-   Highlight the built model file. Go to menu item Run > Load OpenCIM Model.
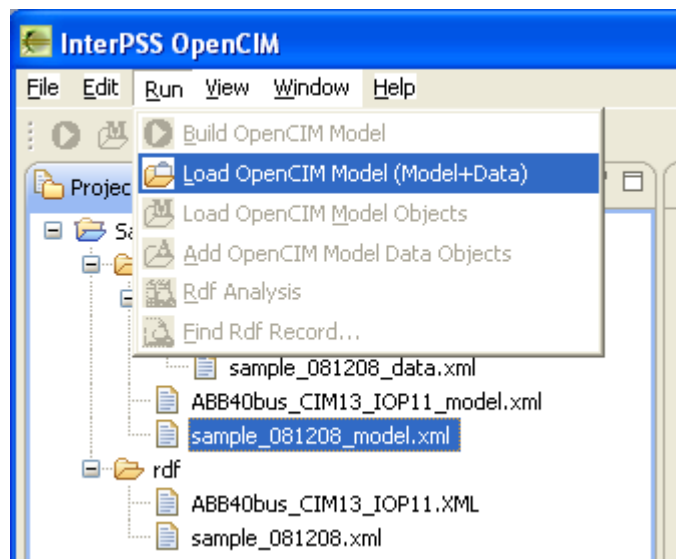
- Right-click on the built model file and select Load OpenCIM Model from the popup menu.

- Select the built model file and click on Load OpenCIM Model from the Toolbar.

In all cases, the tree structure of the built OpenCIM model will appear in the Model View (lower left) panel, which has a title of Model View.
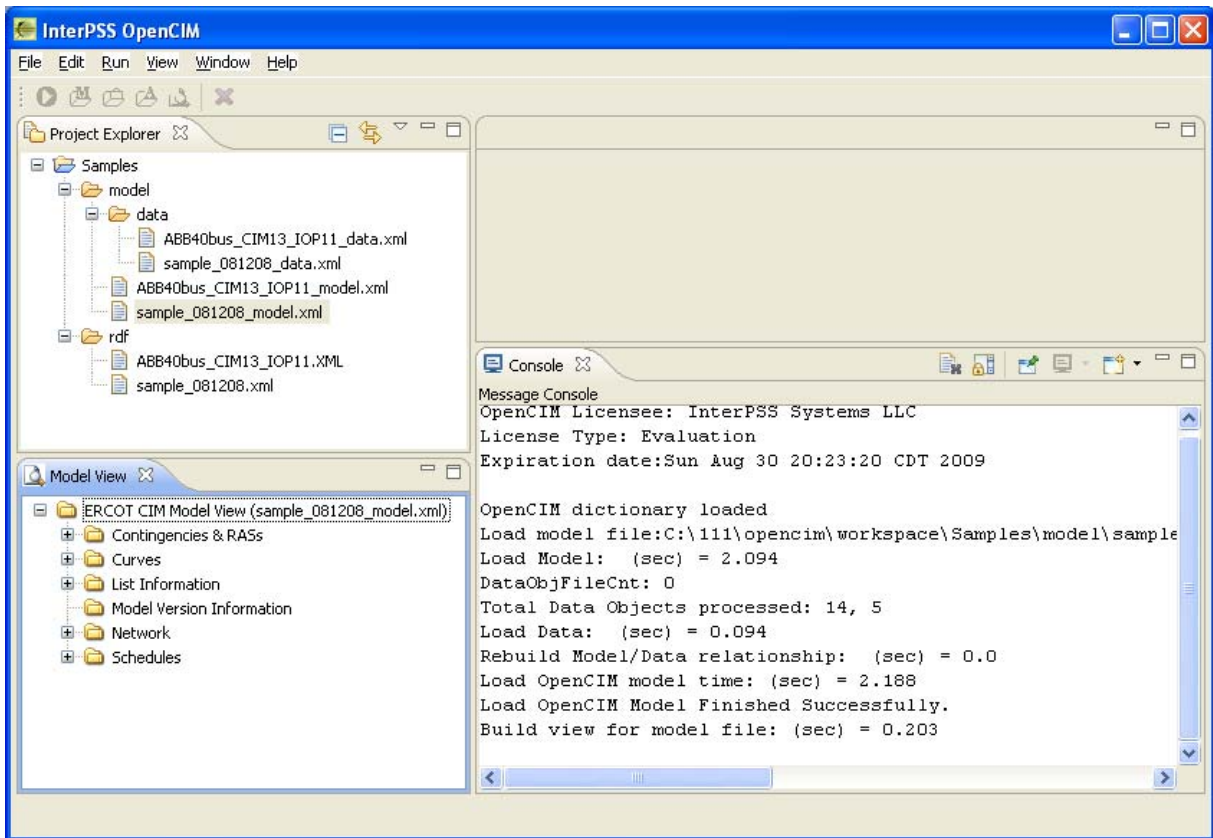
3.6 VIEW DETAILS OF OPENCIM MODEL

Expand the tree structure in the lower left panel, which has a title of Model View. When a model node (which is not a folder) is selected, the details of that node can be show in the upper-right panel in one of the following three ways:

- Highlight the model node. Go to menu item View > View Rdf Record.
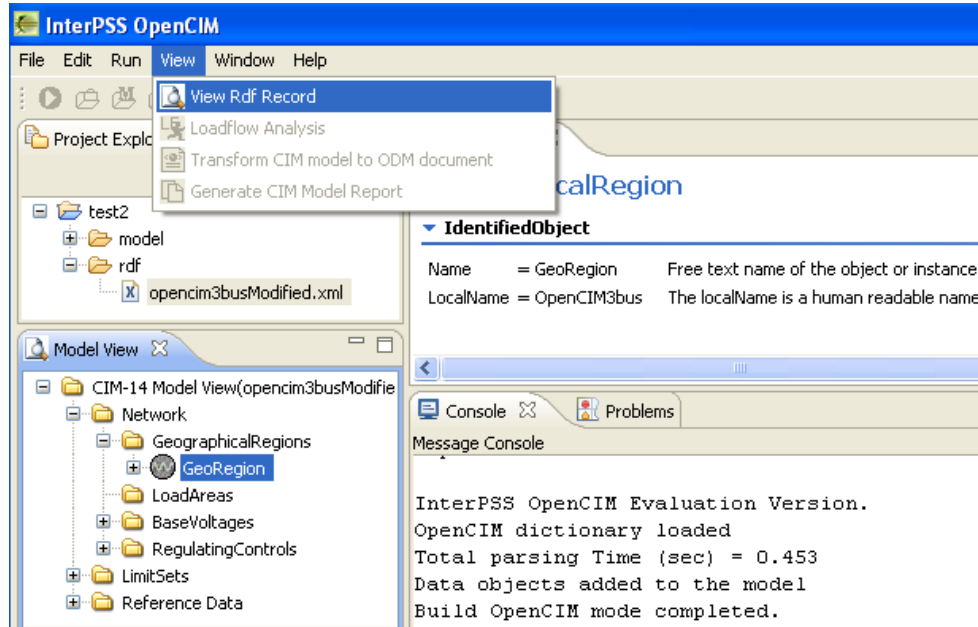
- Right-click on the model node and select View Rdf Record from the popup menu.
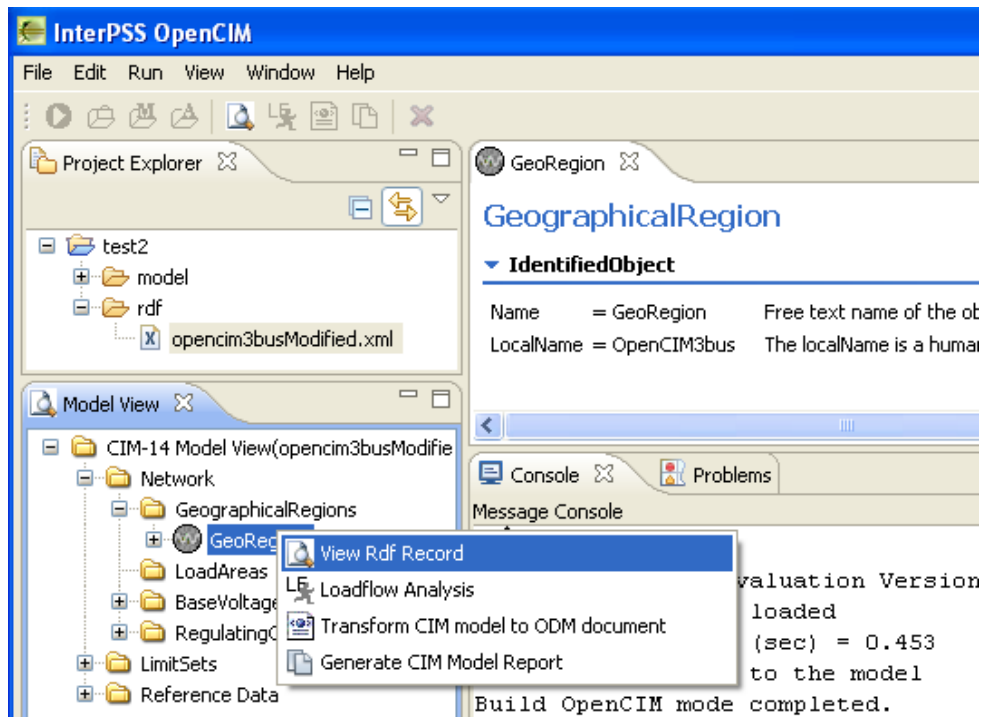
- Double-click on the model node.

In all cases, the details of the selected model node will appear in the upper-right panel Model View.

If there is a reference in the RDF record details, a link appears at the end of a section. Clicking on the link will bring up the RDF Record Detail Panel for the referenced model. For example, theSubGeographicalRegion has a Region link to its parent GeoGraphicalRegion object, as shown in the screenshot above.
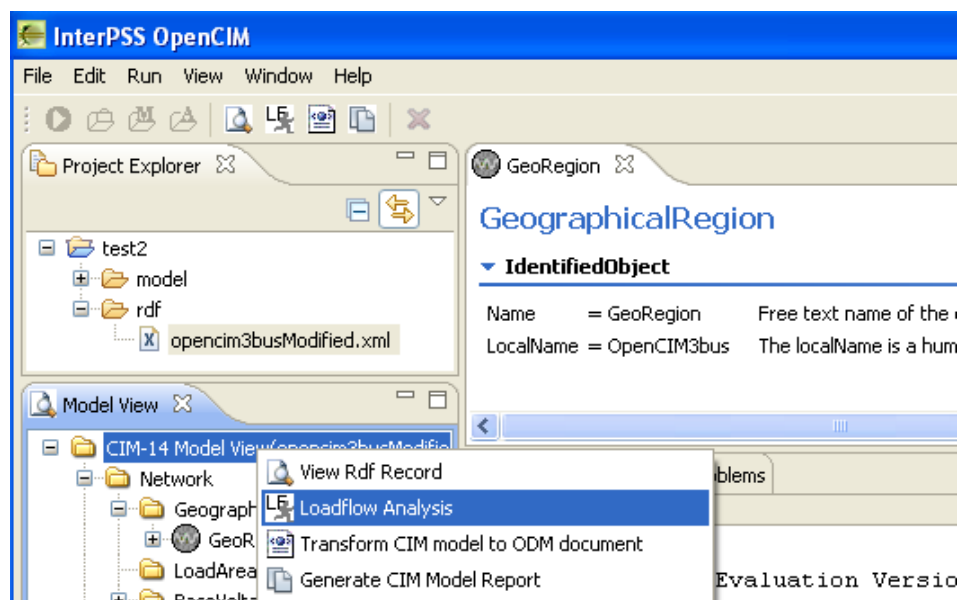
3.7   LOAD FLOW ANALYSIS

You can select the root node of the model tree view in the lower-left panel and run load flow analysis. The result will be displayed in the upper-right panel (the same area as the RDF record view). You can trigger the load flow analysis in one of the following three ways:
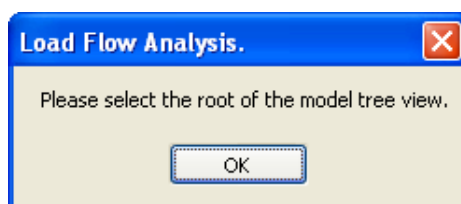
- Highlight the root of the model tree view. Go to menu item View > Loadflow Analysis.
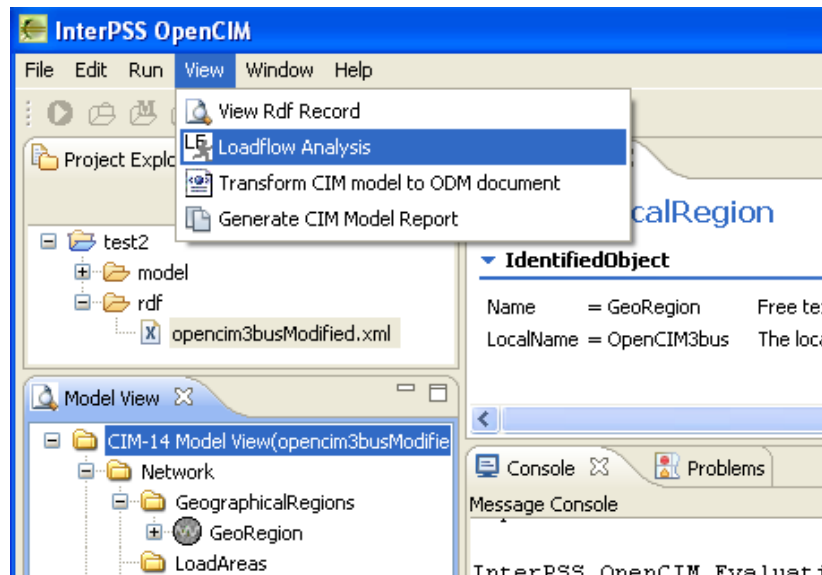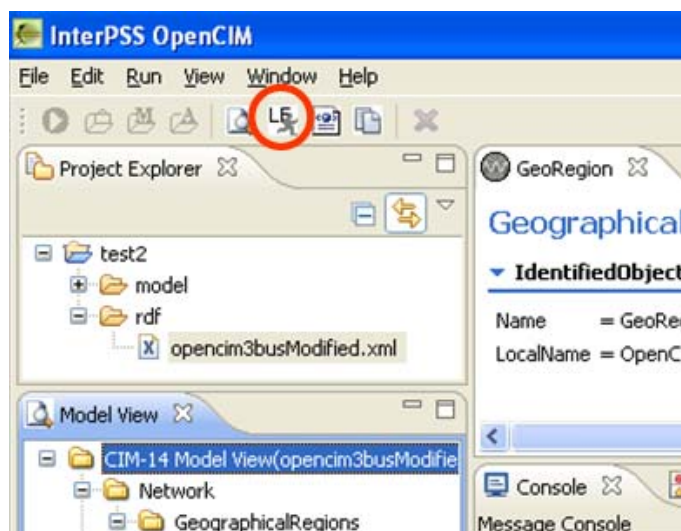

- Right-click on the root of the model tree view and select Loadflow Analysis from the popup menu.
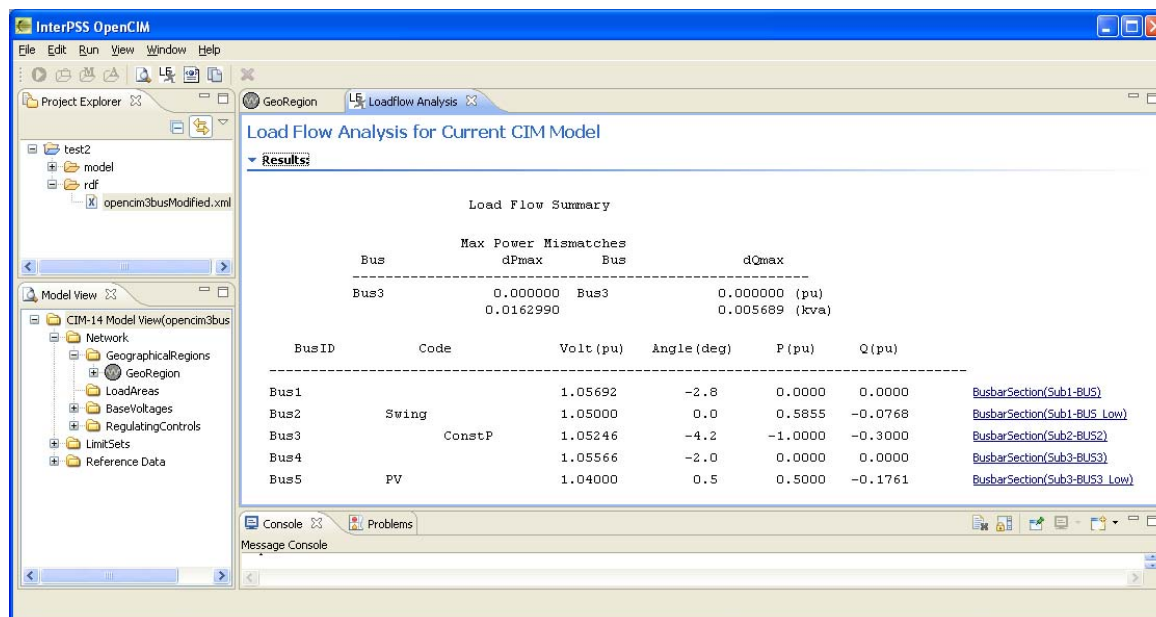
If you select any node in the model tree view other than the root, you will get this alert.

- Select the on the root of the model tree view and click on Loadflow Analysis from the Toolbar.

In all cases, the details of the load flow analysis will appear in the upper-right panel.

Please note: CIM based power system simulation currently only available for CIM version 14.
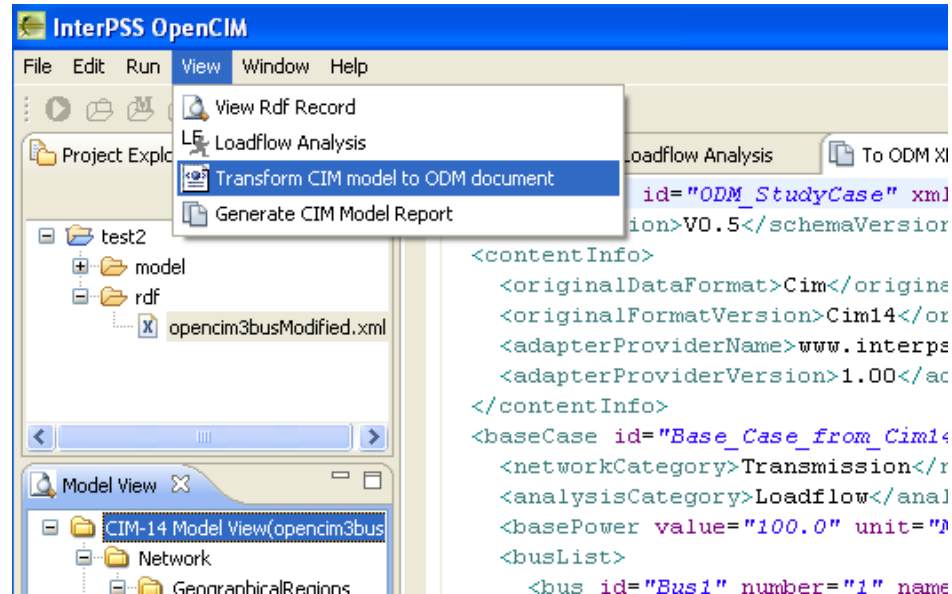
3.8 TRANSFORM CIM TO ODM

The ODM is an Open Model for Exchanging Power System Simulation Data, ODM - Open Data Model for short. The model will be defined using an XML schema. The schema is currently maintained by the IEEE PES OSS Task Force. More details can be found at :
*http://sites.google.com/a/interpss.org/interpss/Home/ieee-pes-oss*

You can select the root node of the model tree view in the lower-left panel and convert the current CIM model to ODM model document. The result will be displayed in the upper-right panel (the same area as the RDF record view). You can trigger the Convert to ODM in one of the following three ways:
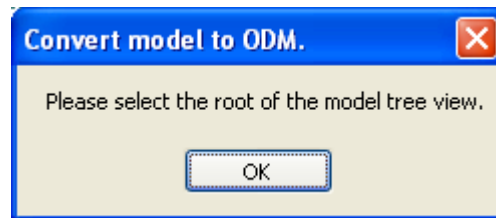
- Highlight the root of the model tree view. Go to menu item View > Transform CIM model to ODM document.
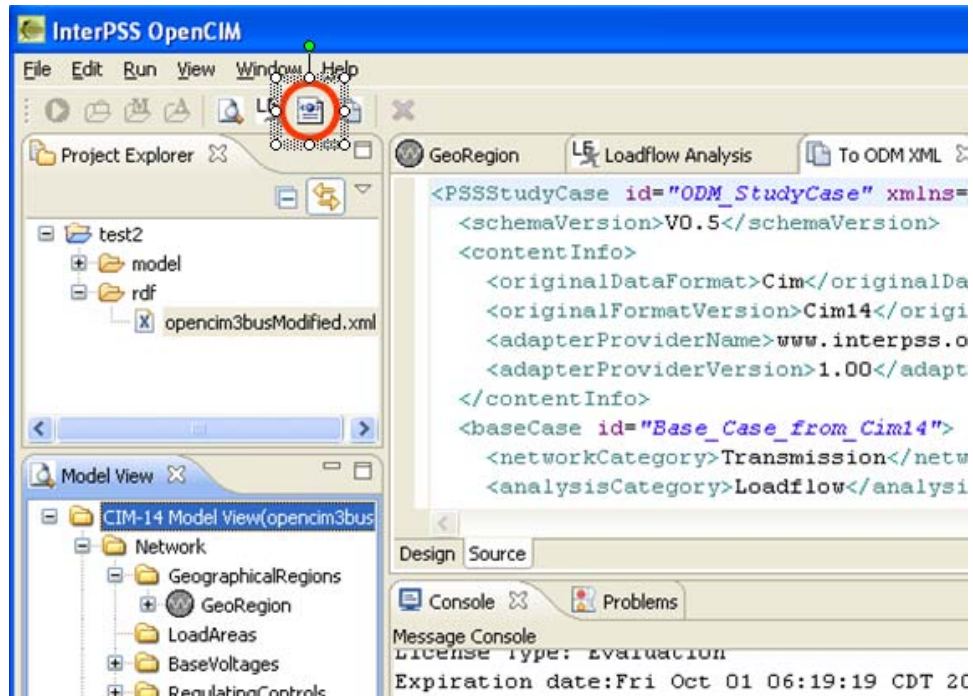

- Right-click on the root of the model tree view and select Transform CIM model to ODM document from the popup menu.
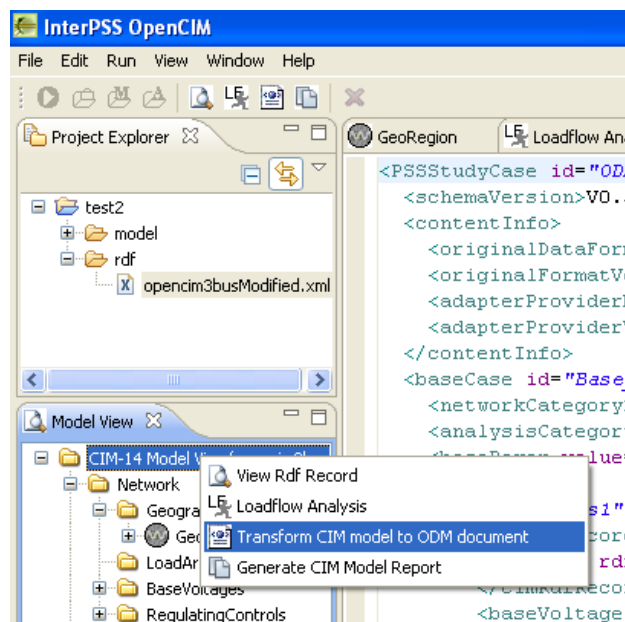
If you select any node in the model tree view other than the root, you will get this alert.

- Select the on the root of the model tree view and click on Loadflow Transform CIM model to ODM document from the Toolbar.

In all cases, the details of the load flow analysis will appear in the upper-right panel. You can select the Design view or the Source view on the generated ODM document.
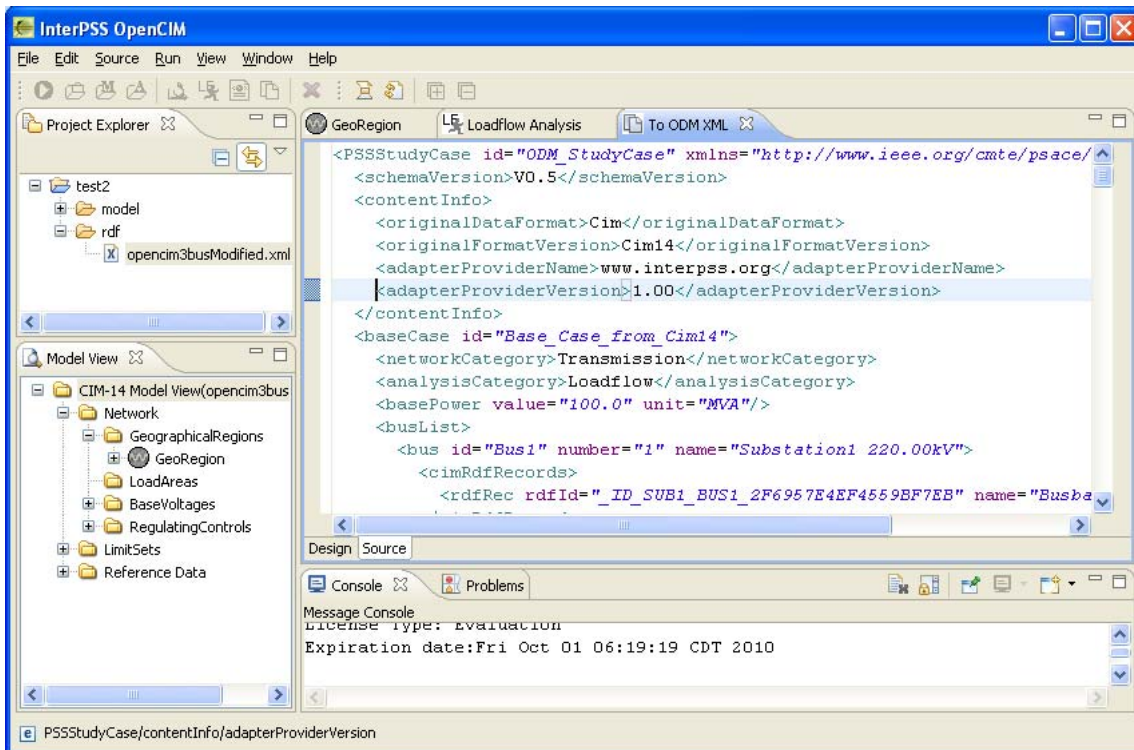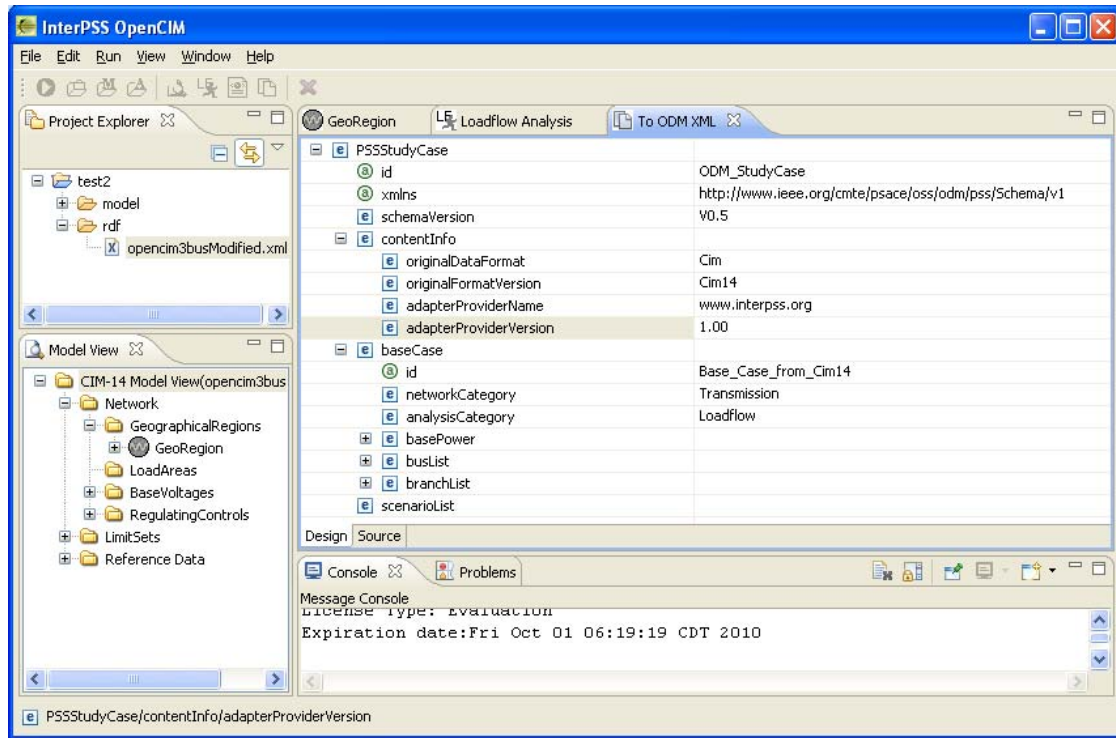
4   INTERPSS OPENCIM USER INTERFACE

The major components of InterPSS OpenCIM user interface are:

- Menu.

- Toolbar.

- Workspace:

  o   Project Explorer

  o   Model View Panel

  o   RDF Record Detail Panel

  o   Message Console.

4.1 MENU ITEM DESCRIPTIONS

4.1.1 File:
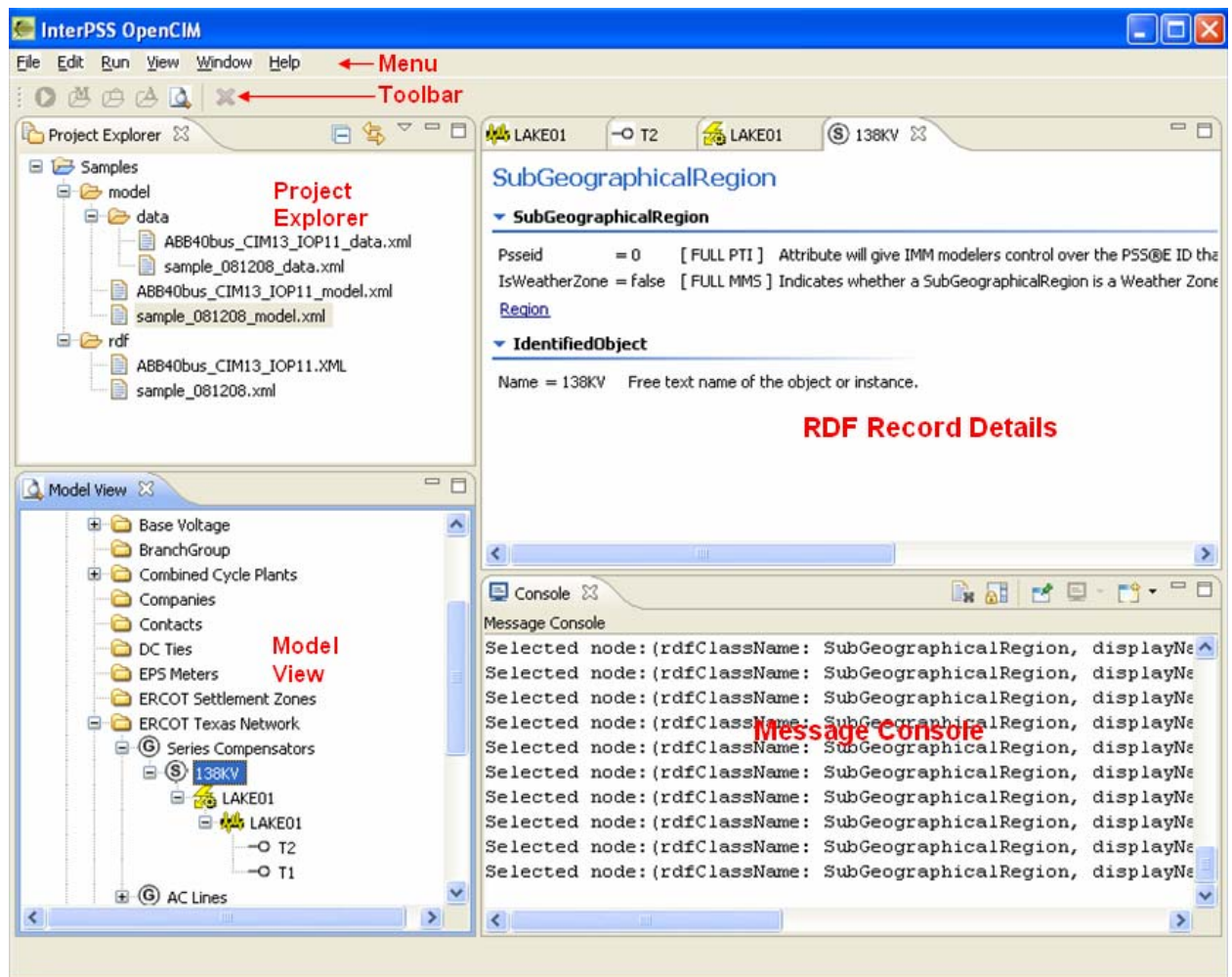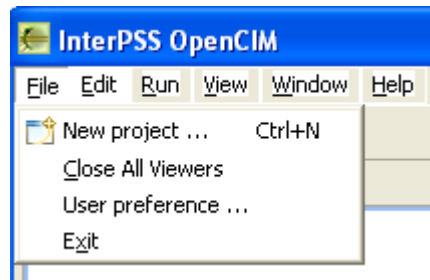

- **New project …**: create a new OpenCIM project.

- **Close All Viewers**: in the RDF Record Details Panel, multiple pages can be opened, each with a tab, when Multiple viewer is selected for Rdf Record Viewer Option. Multiple viewer or Single viewer is configured using User Preference … menu item in this group.

- **User Preference…**: user preference settings for InterPSS OpenCIM user interface:

  o Rdf Record Viewer Option: Multiple viewers or Single Viewer in the RDF Record Details Panel. To close all open RDF details panels, use **Close All Viewers**.

  o Rdf Viewer Config: in the RDF Record Details panel:

    ▪ Show field help message: show/hide model field help message.

    ▪ Show field profile info: show/hide model field profile information.
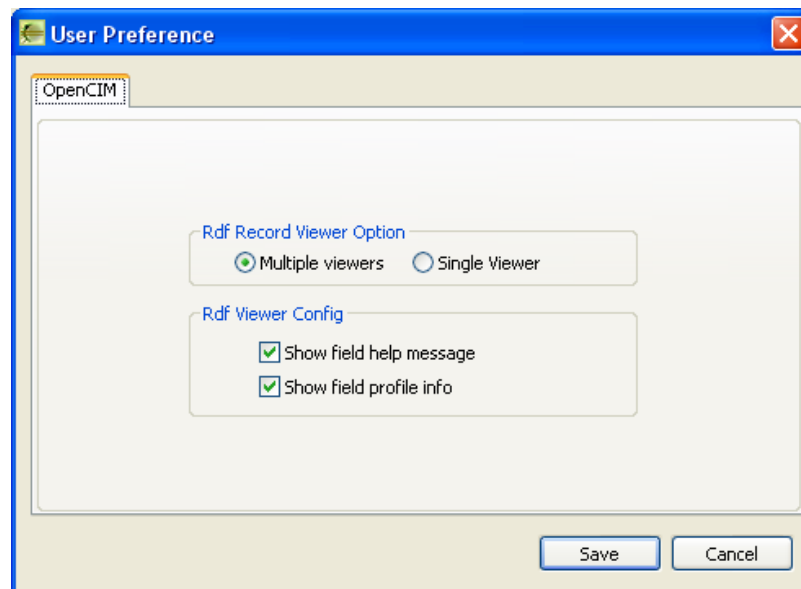
- **Exit**: exit InterPSS OpenCIM.

4.1.2   Edit:
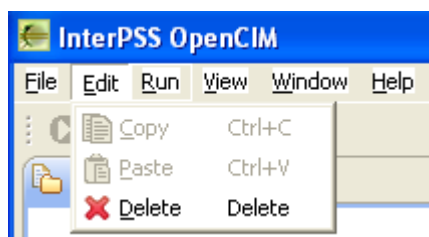
- **Copy**: Copy function. Short-cut key Ctrl+C.
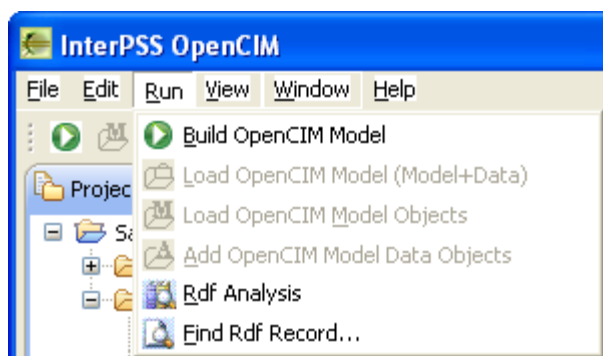
- **Paste**: Paste function. Short-cut key Ctrl+V.

- **Delete**: Delete function. Short-cut key Delete. Also available on the Toolbar.

These actions may not be available in some context cases.

4.1.3   Run:

- **Build OpenCIM Model**: build OpenCIM model from an RDF file. Only activated when an RDF file is selected in Project Explorer.

- **Load OpenCIM Model (Model + Data)**: load OpenCIM model and data. Only activated when an OpenCIM model file under *<project>*/model is selected in Project Explorer.

- **Load OpenCIM Model objects**: load OpenCIM model objects only. Only activated when the Processing large RDF file checkbox is checked and an OpenCIM model file under *<project>*/model is selected in Project Explorer.

- **Add OpenCIM Model Data Objects**: add OpenCIM data objects to the already loaded OpenCIM model objects. Only activated when the Processing large RDF file checkbox is checked, an OpenCIM model file under *<project>*/model is selected in Project Explorer and Load OpenCIM Model objects has been run.

- **Rdf Analysis**: Run OpenCIM analysis on the selected RDF file. Only activated when an RDF file is selected in Project Explorer.

- **Find Rdf Record…**: Find one or multiple RDF records in the selected RDF file by either RDF IDs or RDF names. Only activated when an RDF file is selected in Project Explorer.

4.1.4   View
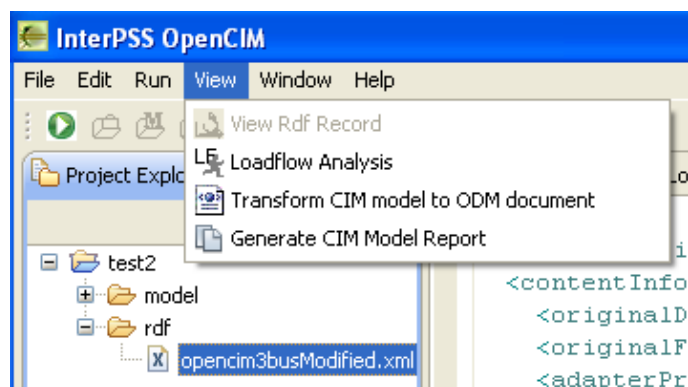
- **View Rdf Record**: Show the details of the selected model node in the Model View panel. The details will be shown in a new RDF Record Details panel (if the user preference is Multiple Viewers) or in the existing RDF Record Details panel (if the user preference is Single Viewer) Only activated when a model node is selected in the Model View panel.

- **Loadflow Analysis**: run load flow analysis on the current CIM model. The result will be displayed in the upper-right panel (the same area as the RDF record view).

- **Transform CIM model to ODM document**: transform the current CIM model to ODM model document. The result will be displayed in the upper-right panel (the same area as the RDF record view).

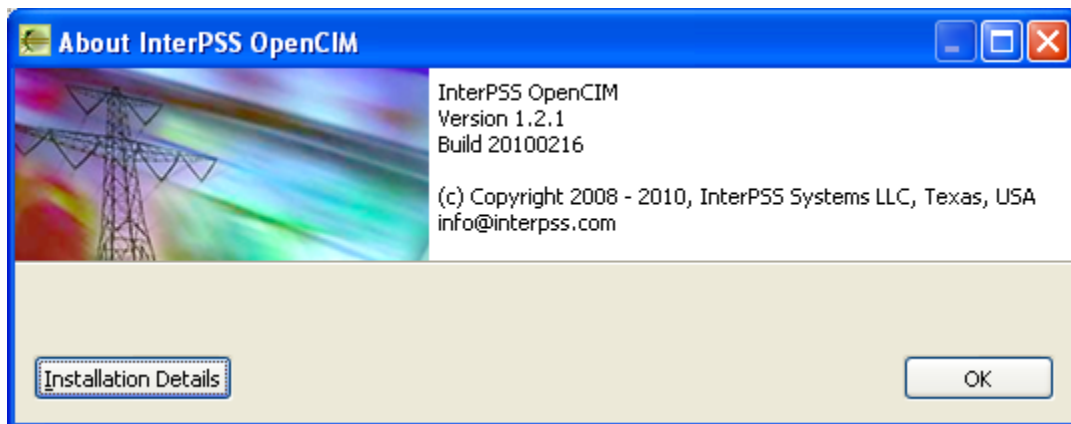**4.1.5   Window**
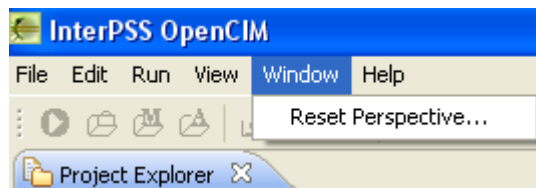
- Reset Perspective…: restore the default original OpenCIM configurations.
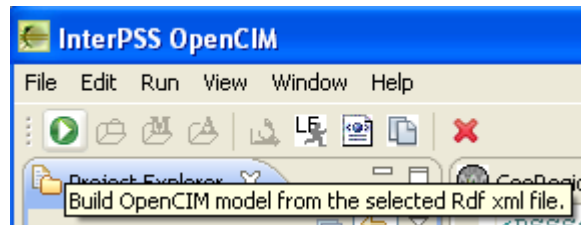
4.1.6   Help
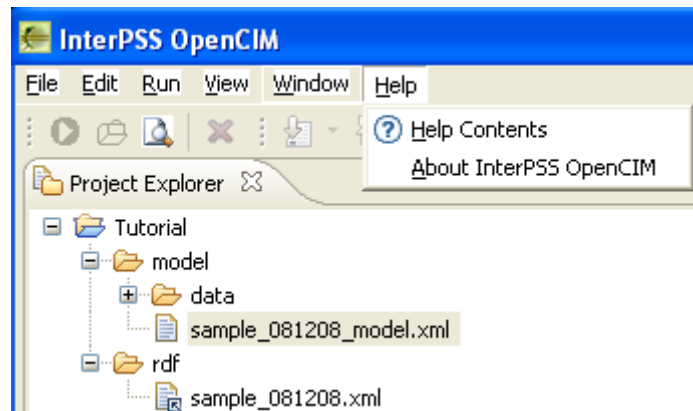
- **Help Contents**: User's Guide. Same content as this document.
- **About InterPSS OpenCIM**: InterPSS OpenCIM product information.
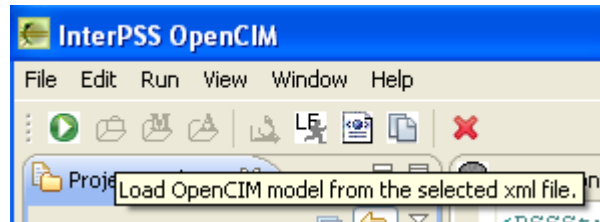
4.2   TOOLBAR ITEM DESCRIPTIONS

4.2.1   Build OpenCIM Model:

4.2.2   Load OpenCIM Model from the selected xml file:
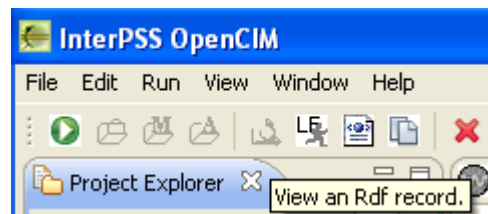

4.2.3   Load OpenCIM Model, model objects only, from the selected xml file:
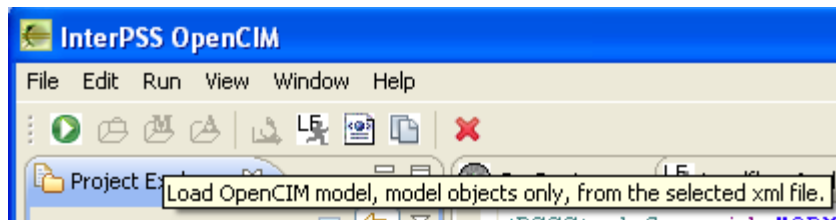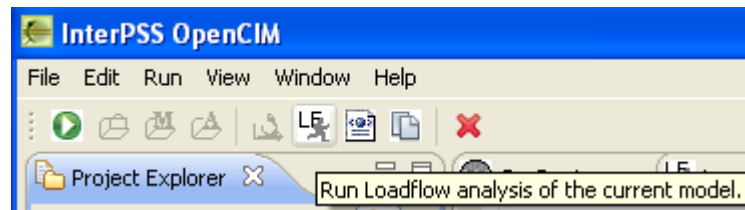

4.2.4   Add OpenCIM model data objects to selected OpenCIM model objects:
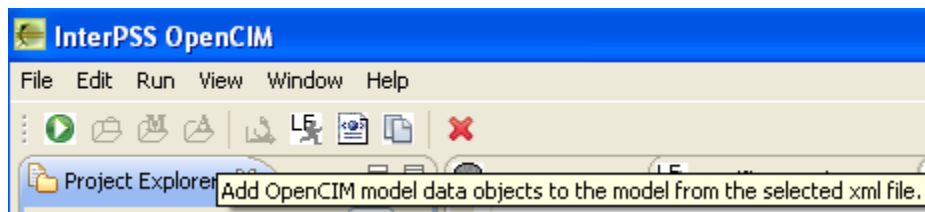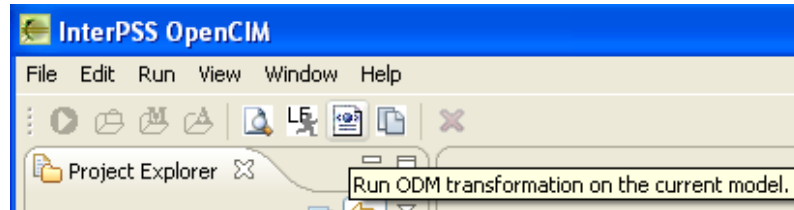

4.2.5   View RDF Record:

4.2.6   Run Loadflow analysis of the current model:

4.2.7   Run ODM transformation on the current model:

4.2.8   Delete: delete the highlighted item. May not be available in some context cases.

4.3 WORKSPACE

4.3.1   Project Explorer:

This is the OpenCIM project organizer. Multiple projects can be contained in this explorer. Within each project, resources such as RDF files, OpenCIM model files and OpenCIM data files are organized in different folders

4.3.2   Model View Panel:

This is the tree view of the OpenCIM model built from an RDF file. If a node is a model element, the associated icon (if any) will be shown. RDF record details can be show in the RDF Record Details panel, when the View Rdf Record action is triggered. See **4.4 View Details of OpenCIM Model** for details on how to trigger the View Rdf Record action.

4.3.3   RDF Record Details Panel:

When the View Rdf Record action is triggered, the detail of the selected model node is shown here. User Preference Rdf Record Viewer Option controls whether a single panel or multiple panels will be used. See **4.1.1 File** menu items on how to configure Rdf Record Viewer Option.

4.3.4   Message Console:

This is the console where significant error and info messages, RDF Analysis and Find RDF Record… results, etc, are shown. The same messages will also output to *<opencim_home>*/log/opencim_log.0. These messages are very important for trouble-shooting.

5   USING INTERPSS OPENCIM

5.1   HANDLING LARGE RDF FILES

Processing (including building model and loading model) large (multi-GB) RDF files can be very time consuming. OpenCIM uses different approaches when it comes to processing large and small RDF files.

- Small file: Run > Build OpenCIM Model will build and load the RDF model in one step, i.e., after the Build OpenCIM Model operation, the whole RDF model tree structure is available in the lower-left Model View panel for viewing. This is extremely fast since every piece of information only stays in memory. If you shut down InterPSS OpenCIM, nothing is saved, and you have to rebuild the model the next time you start InterPSS OpenCIM.

- Large file: Running Run > Build OpenCIM Model in this case will only build the OpenCIM model and save the model information and data information in separate model files and data files. Refer to Section 1.3.1 for definitions of model and data information. The next step you can either

    o   Run > Load OpenCIM Model (Model + Data) or

    o   Run > Load OpenCIM Model Objects

    Either way you can start to navigate the model tree view in the lower-left Model View panel. With the second way, you can optionally go Run > Add OpenCIM Model Data Objects to load all the data object details if you are interested in the leaf details within the model tree.

    When processing large RDF files, all the processing results are saved in files, so you don't have to rebuild and load the model again when InterPSS OpenCIM is restarted.

Users of InterPSS OpenCIM have control over what file sizes are "large" and what are "small" – open <opencim_home>/properties/opencim.properties and locate the following line:

    Model.LargeRdfFile.SizeMB = 1024

Change the value to a number in MB as what you define as the dividing line between "large" and "small" RDF files. Save and close opencim.properties and restart InterPSS OpenCIM.

5.2   SAVING YOUR WORK

There is no need to explicitly save you work. All your work is saved under *<opencim_home>*/workspace/*<your_project>*.

5.3   ORGANIZING YOUR WORK

You should organize your models using OpenCIM project. OpenCIM projects can be individually opened, saved, closed, exported and imported.
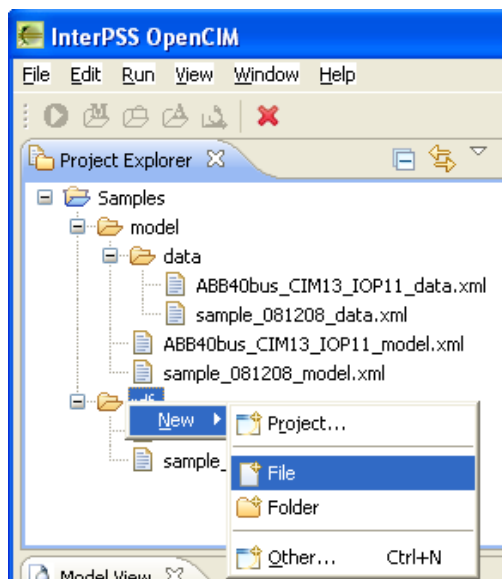
5.4   SHARING YOUR WORK WITH OTHERS

To share an InterPSS OpenCIM model project, zip up all content under *<opencim_home>*/workspace/*<your_project>* and share the zip file.

## APPENDIX A.1   ADDING RDF FILES TO AN EXISTING OPENCIM PROJECT

Additional RDF files can be added later to an existing InterPSS OpenCIM project.

Right-click the rdf folder, and select New > File from the popup menu.

There are two ways that new RDF files can be included:

- Create a new file: enter File name. Click Finish. And paste the content of the RDF file into this newly created file.
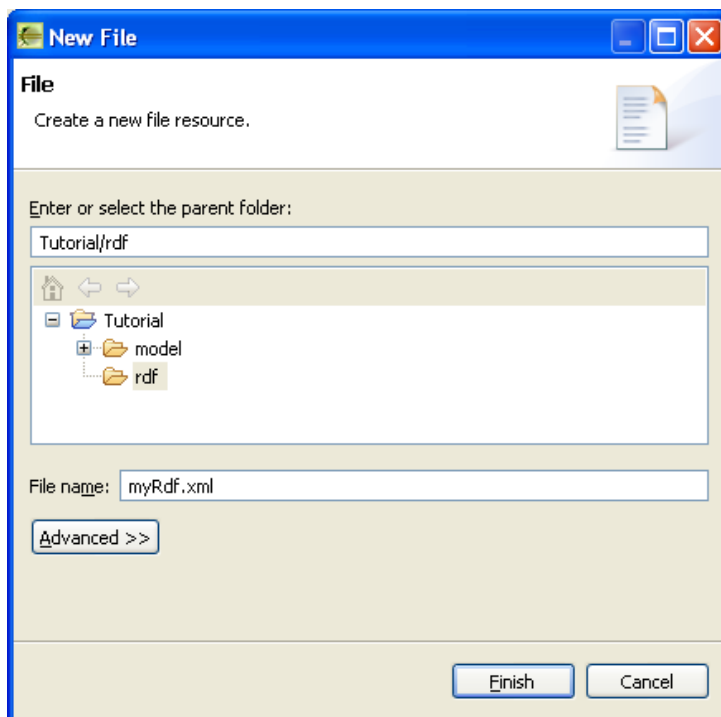
- Include an existing file: Click on the Advance >> button. Check Link to file in the file system. Click on Browse… and select the RDF file to include from the local file system. Click on Finish.
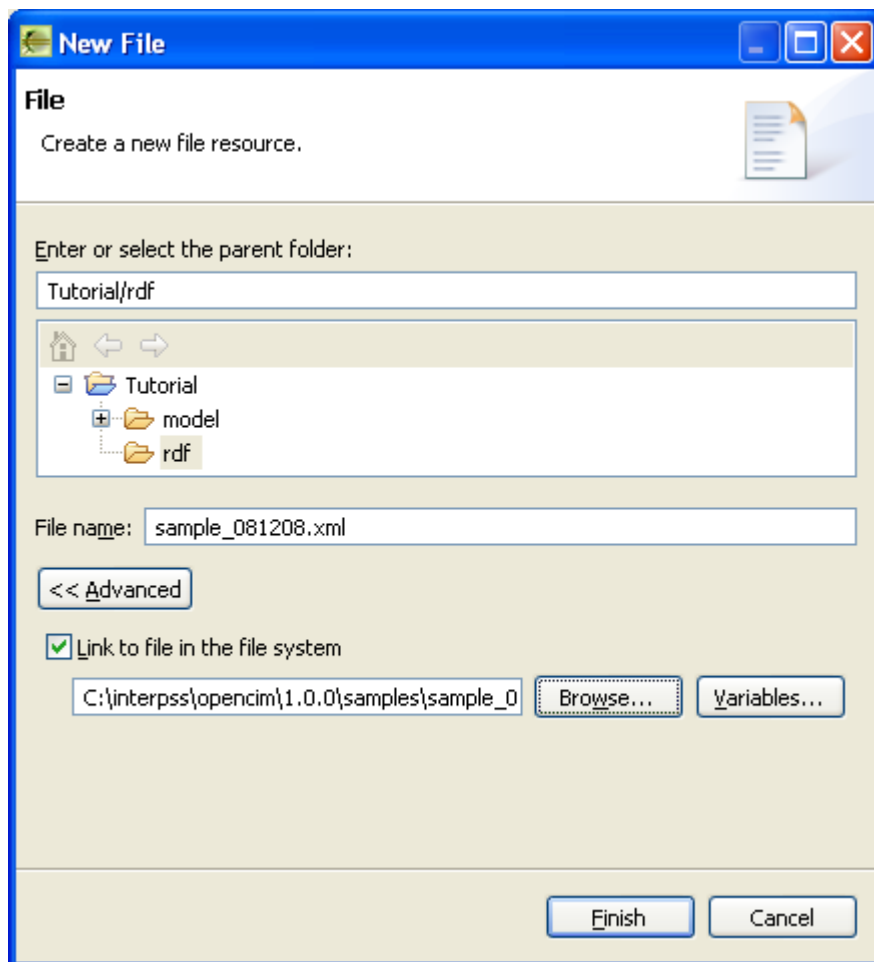

Note: The text content of the RDF file may be opened in the RDF Record Details panel. Just close it if you do not need it.

Note: You can also delete an RDF file from the project by choose the RDF file in the Project Explorer, and click on menu Edit > Delete or Toolbar Delete.

Note: It would be much quick to add files if you copy the new files, go to the target folder under <eclipse_workspace> and paste the new files there within Windows explorer. Come back in Eclipse and refresh the workspace (by hitting F5)
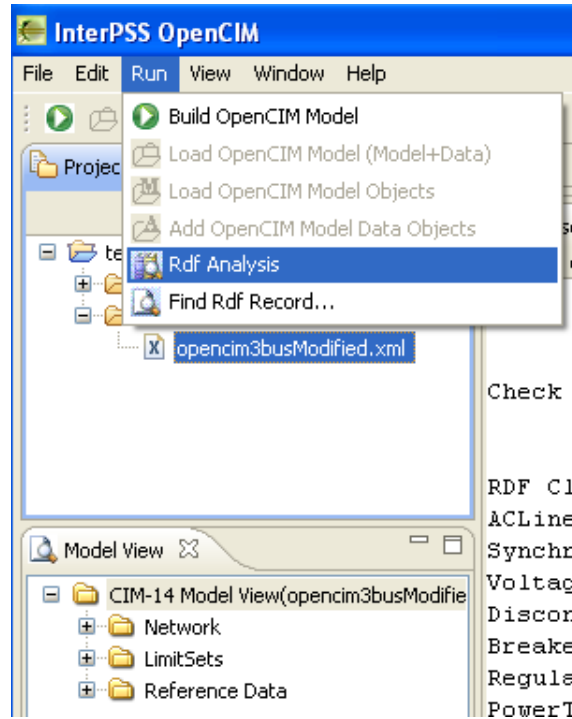
APPENDIX A.2   RDF ANALYSIS

Before building the OpenCIM model, an RDF file can be analyzed for missing classes and attributes.
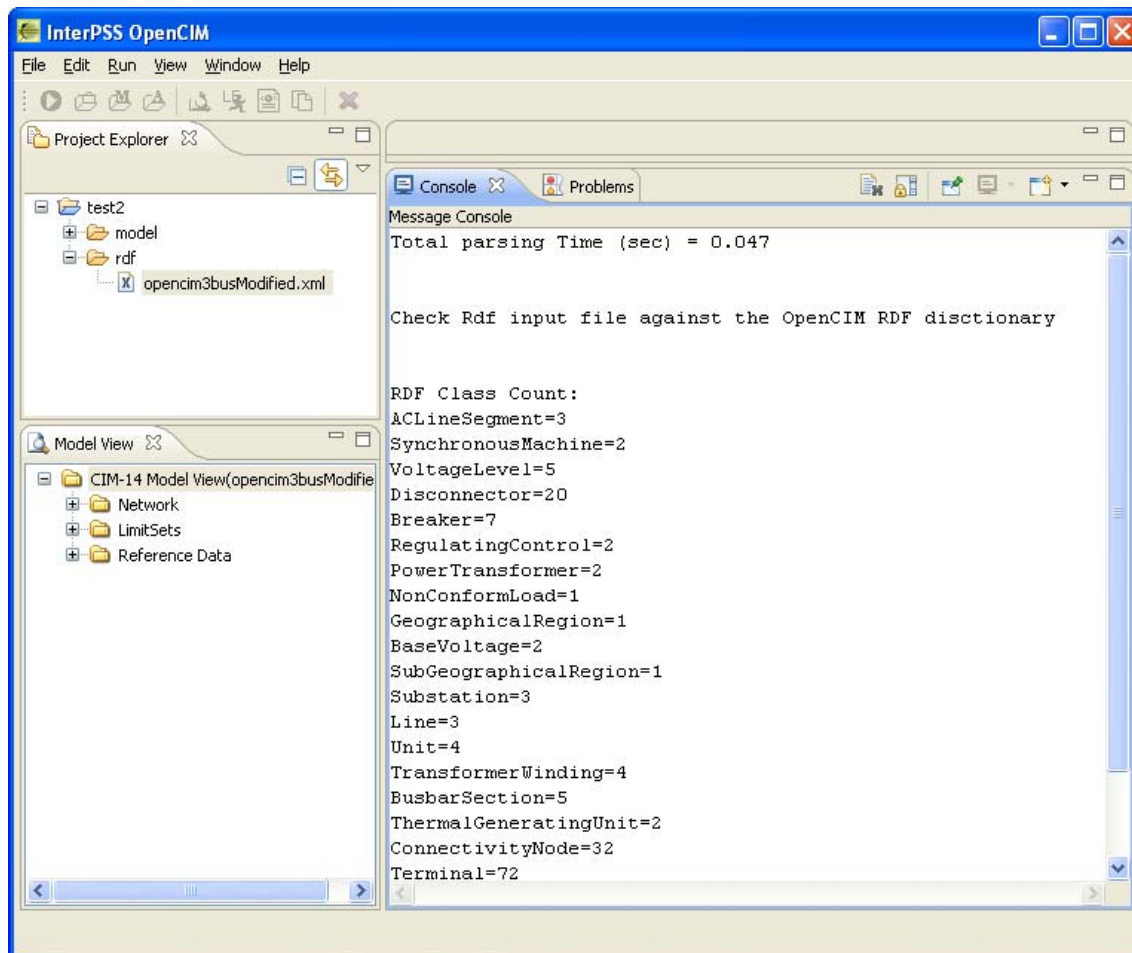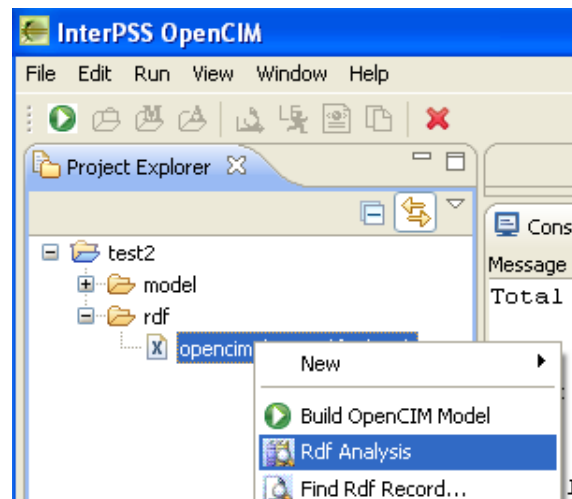
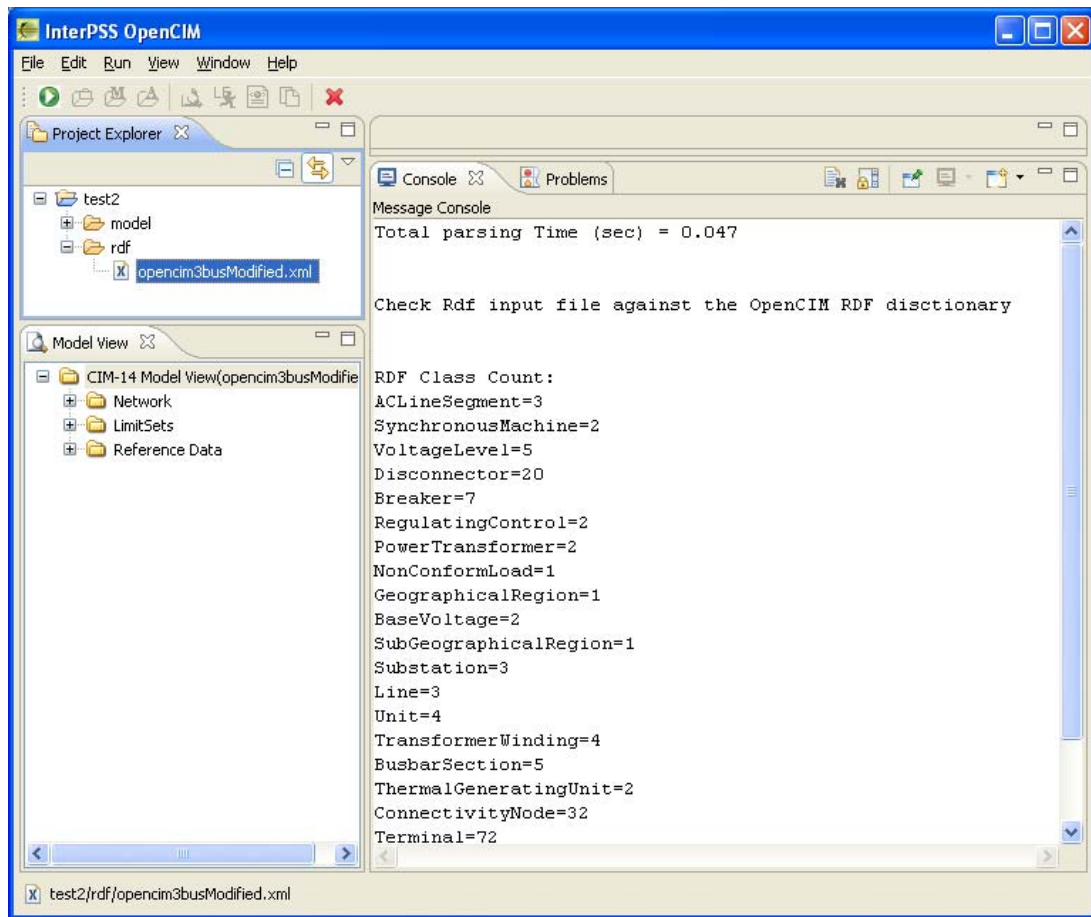There are two ways to run RDF analysis on an RDF file:

- Highlight the RDF file. Go to menu item Run > Rdf Analysis.

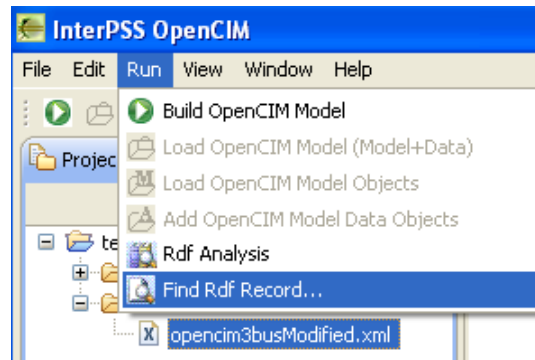- Right-click on the RDF file and select Rdf Analysis from the popup menu.

Either way, the analysis report will show up in the lower-right Console panel:
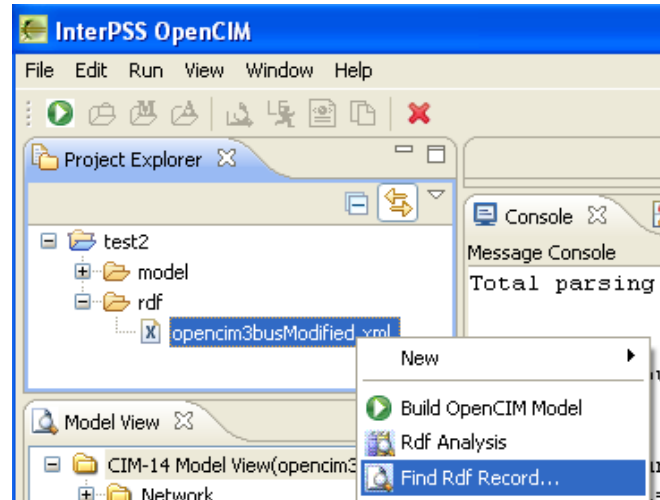
APPENDIX A.3   FINDING RDF RECORD

RDF records can be found by their RDF IDs or by their RDF names. There are two ways to find RDF records in an RDF file based on RDF IDs or RDF names:
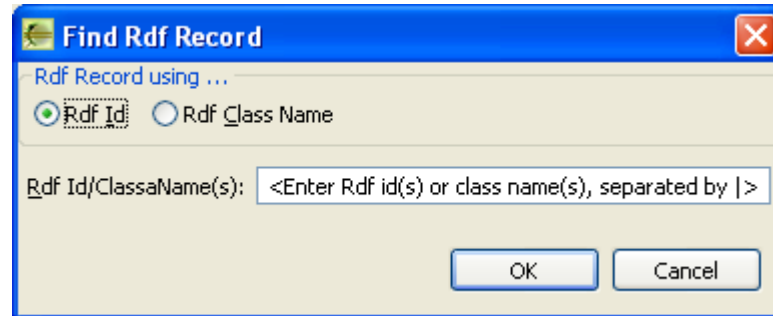
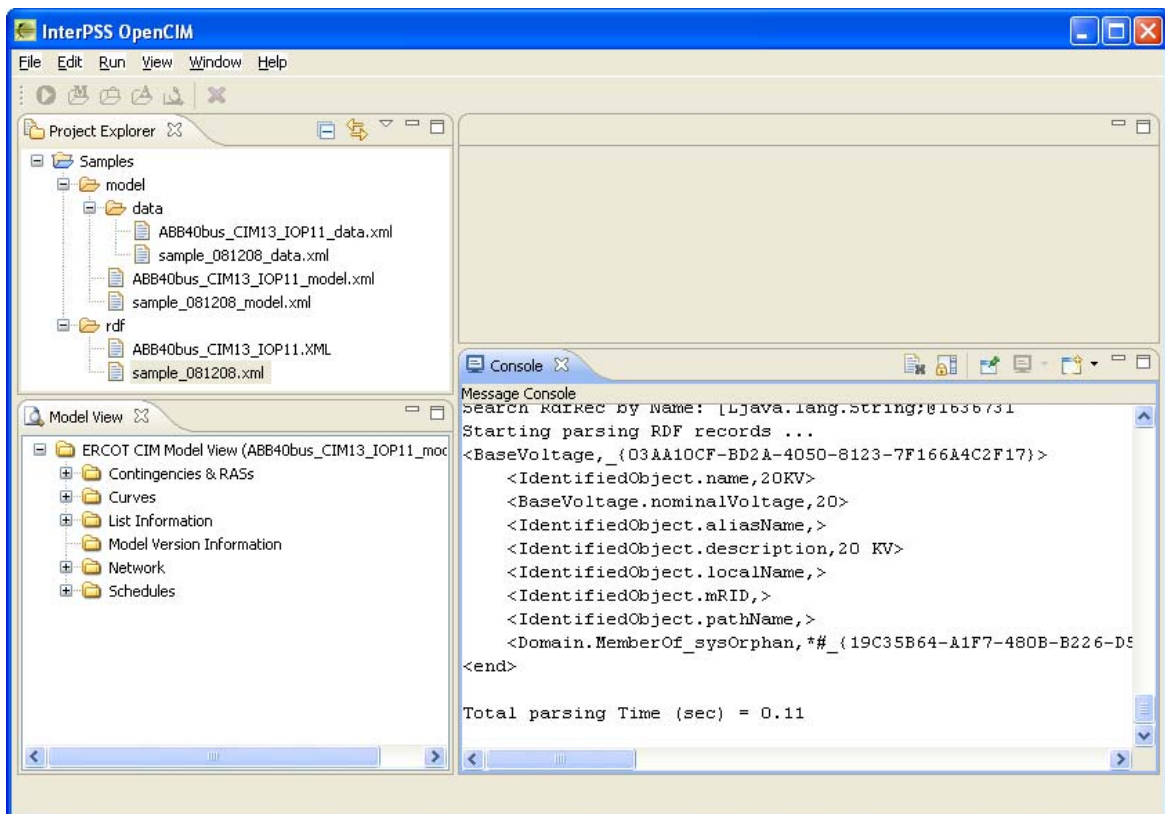-   Highlight the RDF file. Go to menu item Run > Find Rdf Record

-   Right-click on the RDF file and select from the Find Rdf Record popup menu.

- The **Find Rdf Record** dialog appears.

- Select the appropriate option of either **Rdf Id** or **Rdf Class Name**. Enter the **Rdf Id** or **Rdf Class Name**, and click on OK. The search result appears in the lower-right **Console** panel.

Note: multiple Rdf Ids or Rdf names can be entered, separated by "|" (the vertical bar).