Informatics for Integrating Biology and the Bedside

i2b2 Functional Specification

CRC Analysis Plug-in

Document Version: *1.6.1*

I2b2 Software Version: *1.6*

Table of Contents

DOCUMENT MANAGEMENT

Revision Number	Date	Author	Description of change
1.6.1	07/22/10	Janice Donahoe	Created 1.6 version of document.

1. OVERVIEW

The analysis plug-in is one of the ways to extend the CRC cell. The plug-ins are a custom process which can be started from the command line within the CRC cell. The plug-ins can perform anything from simple short tasks like calculating breakdowns of patients by disease, to more time intensive tasks like a full two-set patient comparison analysis which could typically run for almost a day. The plug-ins can be started as a daemon process or can be called from the client via the web service call. The plug-in supports the following main features:

- Supports new analysis process without having to create a new web service.
- Supports scaling by the Queue models
- Tracking the plug-ins run status
- Plug-in authorization based on project and user role
- Auto cleanup of run data

2. DESIGN

The analysis plug-in uses a lot of the same tables that are used by the standard CRC queries.

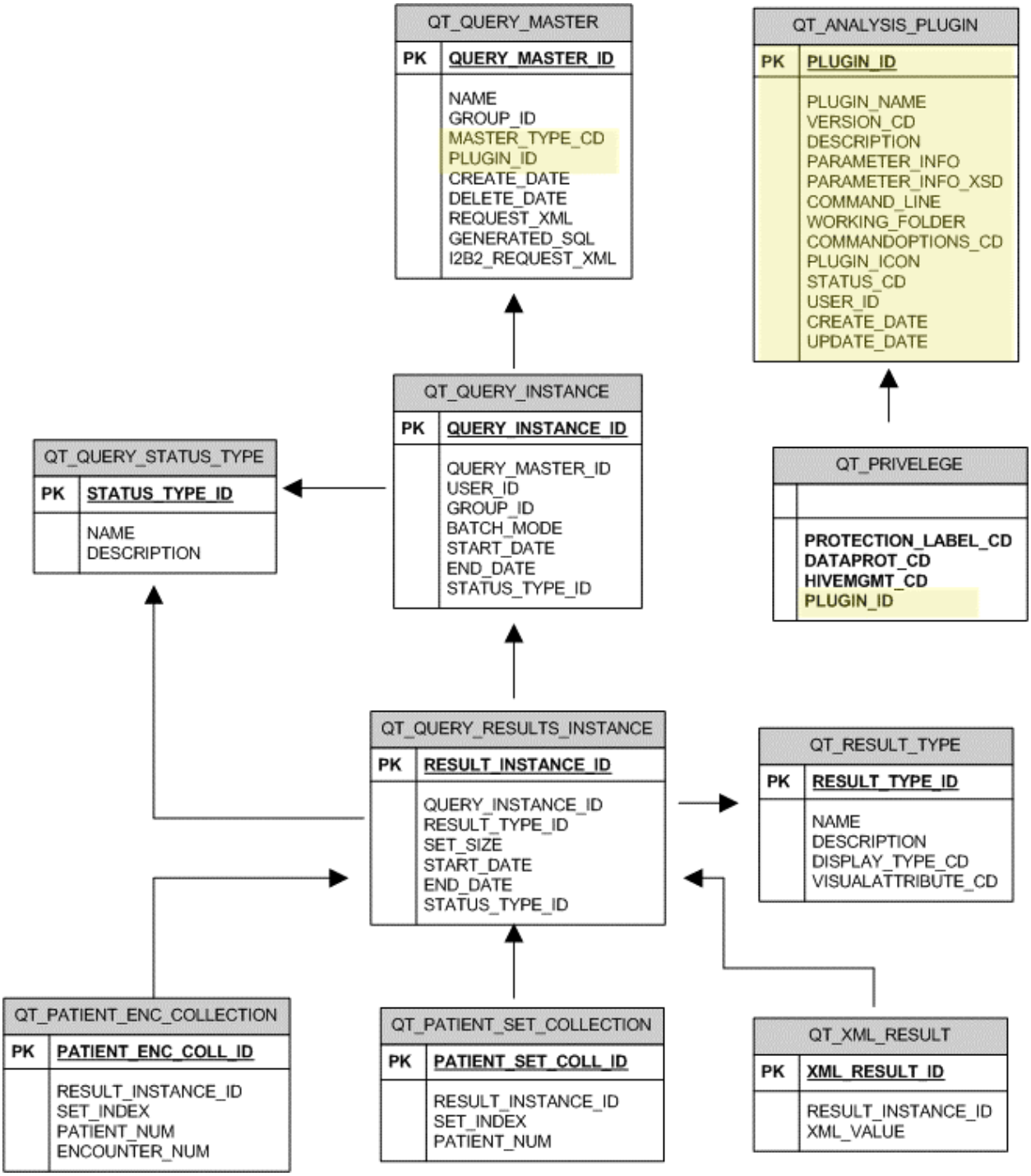
The *requests* and *results* for the plug-in are stored in the existing query tables. As is typical for existing queries, the output goes into any of the three result tables.

- Patient Set Table
- Encounter Set Table
- XML Result table

If the results can not fit into any of the above results tables

- It can have its own local tables and have the pointer of the result in the XML result table.
- It can also produce file output that can be accessed through the file repository.

2.1 CRC Schema with plug-in specific features highlighted



2.2 Tables

2.2.1 QT_ANALYSIS_PLUGIN

The plug-in's metadata for an individual project is stored in this QT_ANALYSIS_PLUGIN table. The CRC looks up the *command_line* field by the *plug_name*, *version_cd* and the *group_id* field.

Column	Description
plugin_id	Uniquely generated id and primary key of the table
group_id	Project_id values goes in this column, and is a project that is registered to run a plug-in. Each project needs a separate row to run a plug-in (and thus can have different run parameters). A plug-in can be run by all projects if this column has a value of "@"
plugin_name	Plug-in name, consistent across versions of plug-in
version_cd	Plug-in version code
description	Description
command_line	The value of the field will be the full path of the plug-in script for a particular project. By having separate command line per project/group supports constraining the resource allocation. i.e. a project plug-in can be set with some specific memory, priority, etc.
working_folder	This column specifies the folder name where the command line process will be started.
status_cd	This column will have the value 'A' for active and 'D' for deleted.
commandoptions_cd	Similar to "options" characters that one appends to the Unix command string, the following options are available: A The run instance and result data for the plug-in will be automatically cleaned at the end of the day. L Run in long-running queue only (low priority). M Keep plug-in in memory (for quick startup).
parent_plugin_id	This field helps to maintain relationship with its parent plug-in
parameter_info	The value of this column is in the plug-in request xml. The plug-ins can specify their inputs and outputs via the request xml. i.e. *analysis_definition_type*. The plug-in client can take advantage of this sample xml to render input and output values to users.
parameter_info_xsd	This column will have the xsd of the parameter_info.

2.2.2 QT_PRIVELEGE

The QT_PRIVELEGE table specifies the minimum user role required to access the plug-in.

Column	Description
protection_label_cd	This column can be used as follows: 1. To map the plug-in access control to the user's role then the value will be '@'. 2. To map access control within the plug-in, then the value could be some marker/label name.
plugin_id	Plug-in id – negative numbers are used for built-in processes (such as patient-setfinder)
dataprod_cd	Minimum data track role.
hivemgmt_Cd	Minimum management track role.

2.2.3 QT_QUERY_MASTER

This master table to the holds the client's anaysis plug-in request information. i.e. the user_id, analysis definition , the i2b2 request_xml, etc..

Column	Description
query_master_id	Unique generated id for every entry
name	Name of the plug-in plus the create time stamp.
master_type_cd	The master_type_cd field determines what type of master record stored. i.e. For the plug-in's the value would be 'ANALYSIS_PLUGIN'
plug_id	Plug-in id - negative numbers are used for built-in processes (such as patient-setfinder)
request_xml	The analysis definition part of the plug-in run request xml will be stored here.
i2b2_request_xml	The entire plug-in request which includes the i2b2 header xml is stored here.
create_date	Create date
delete_date	Delete date

2.2.4 QT_QUERY_INSTANCE

The QT_QUERY_INSTANCE table tracks the plug-in's execution information. Like start time, status, result, etc.

2.2.5 QT_QUERY_RESULT_INSTANCE

The QT_QUERY_RESULT_INSTANCE table holds the pointer to instance and the result information. It has the many to one relation with QT_QUERY_INSTANCE table. There could be more than one result type for a plug-in run instance. Hold status and size for of the plug-in result.

2.2.6 QT_PATIENT_SET_COLLECTION

The QT_PATIENT_SET_COLLECTION table holds a list of patient numbers for a result instance id. The *set_index* field holds index value for the list.

2.2.7 QT_PATIENT_ENC_COLLECTION

The QT_PATIENT_ENC_COLLECTION table holds a list of patient numbers and corresponding encounter number (visit) for a result instance id

2.2.8 QT_XML_RESULT

The QT_XML_RESULT table stores the result in XML format. The schema for the common XML result format is in the ***i2b2_result_msg.xsd***.

3. MESSAGE

Run an Analysis plug-in by passing the plug-in name and its parameters. The analysis name and parameter usually is part of the individual Analysis plug-in document. The response message for this request is similar to the setfinder's run query request.

Request Type	Request	Response
CRC_QRY_runQueryInstance_fromAnalysisDefinition	analysis_definitionType	master_instance_result _responseType

3.1 Analysis Definition Type

Element Name	Description
analysis_plugin_name	Name of the plug-in
crc_analysis_input_param	This element contains the input xml that is defined in the parameter_info_xsd column of the qt_analysis_plugin table. *Example*: <crc_analysis_input_param> <param type="int" column="param1"> param1 values </param> . . . </crc_analysis_input_param>
crc_analysis_result_list	This element contains the output xml that is defined in the parameter_info_xsd column of the qt_analysis_plugin table. <crc_analysis_result_list> <result_output full_name="XML" priority_index="1" name="XML"/> . . . </crc_analysis_result_list>

3.2 Example Message

```
<request_header>
    <result_waittime_ms>90000</result_waittime_ms>
</request_header>

<message_body>
    <crc:psmheader>
        <request_type>
            CRC_QRY_runQueryInstance_fromAnalysisDefinition
        </request_type>
    </crc:psmheader>

    <crc:request  xsi:type="crc:analysis_definition_requestType">
        <analysis_definition>
            <analysis_plugin_name>CALCULATE_PATIENTCOUNT_FROM_CONCEPTPATH
            </analysis_plugin_name>
            <crc_analysis_input_param name="ONT request">
                <param type="int" column="item_key">
                    \\rpdr\RPDR\Diagnoses\Circulatory system (390-459)\
                </param>
            </crc_analysis_input_param>
            <crc_analysis_result_list>
                <result_output full_name="XML" priority_index="1" name="XML"/>
            </crc_analysis_result_list>
        </analysis_definition>
    </crc:request>

    <crc:response xsi:type="crc:master_instance_result_responseType">
        <query_master>
            <query_master_id>0</query_master_id>
            <name>CALCULATE_PATIENTCOUNT_FROM_CONCEPTPATH</name>
            <user_id/>
            <group_id/>
            <create_date>2000-12-30T00:00:00</create_date>
            <request_xml/>
        </query_master>
        <query_instance>
            <query_instance_id>0</query_instance_id>
            <query_master_id>0</query_master_id>
            <user_id/>
            <group_id/>
```

```
            <batch_mode/>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>6</status_type_id>
                <name>COMPLETED</name>
                <description/>
            </query_status_type>
        </query_instance>
        <query_result_instance>
            <result_instance_id>0</result_instance_id>
            <query_instance_id>0</query_instance_id>
            <query_result_type>
                <result_type_id>3</result_type_id>
                <name>XML</name>
                <display_type>CATNUM</display_type>
                <visual_attribute_type>LH</visual_attribute_type>
                <description>Generic query result</description>
            </query_result_type>
            <set_size>0</set_size>
            <obfuscate_method/>
            <start_date>2000-12-30T00:00:00</start_date>
            <end_date>2000-12-30T00:00:00</end_date>
            <query_status_type>
                <status_type_id>6</status_type_id>
                <name>COMPLETED</name>
                <description>COMPLETED</description>
            </query_status_type>
        </query_result_instance>
    </crc:response>
</message_body>
```

4. ARCHITECTURE

The CRC plug-ins can be developed in any language as long as it can be packaged as a command line script.

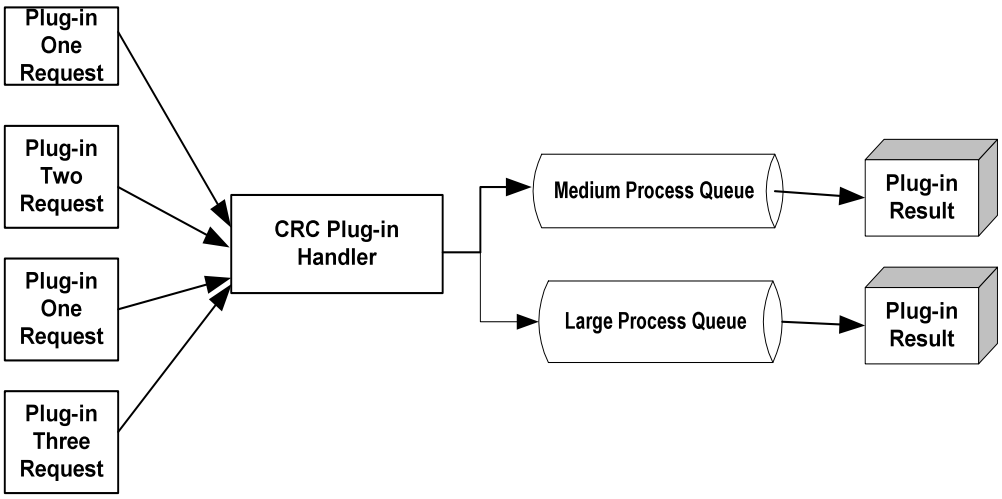
The analysis request is processed first by storing the request information in the **QT_QUERY_MASTER** table and then the plug-in process will be started using the Apache Exec Utility. The exec process will be started with a *set timeout value* and will be terminated automatically if the process does not complete *before* the timeout value.

The client can specify in the analysis request message the maximum timeout value (<result_waittime_ms>).

If the plug-in process does not complete within the *wait time value*, then it will be flagged to run in the queue. There are two types of queues.

1. Medium Queue
   - Handles medium size jobs; maximum time to complete is four hours.
   - If a job can't complete in this queue, then it is flagged to run in the large queue.

2. Large Queue
   - Supports jobs that can run for any configured maximum length.
   - In order to reduce the load on the server, these queues run jobs serially; at the most two queues are running (also configurable).



4.1 Plug-in pseudo code

CRC will pass parameters to the plug-in's command line script. Using one of the incoming parameters, the plug-in will lookup the datasource/db connection. Then plug-in can then read the database to process the request and finally write the result.

```
BEGIN
    -- Read the command line argument [-domain_id, -project_id, -user_id,
       -plugin_id]
    -- Lookup the project datasource using the domain, project and user id,
    -- Using the plugin_id, plug-in can access the analysis plug-in definition which
       is part of the requests for further process.
    -- Write the results (patient set/encounter set/XML format) to the result table
END;
```

5. INSTALL

To register a plug-in, simply add the entry in the **QT_ANALYSIS_PLUGIN** table and set up the plug-in script in appropriate folder.

The following steps show how to install a *sample* analysis plug-in named "CALCULATE_PATIENTCOUNT_FROM_CONCEPTPATH"

1. Create the analysis service directory and copy the jar files.
   - ant -f analysis_launch.xml deploy

2. Register the analysis plug-in information to the table:
   a. Open the database client and run the following SQL for each project databases.

```
insert into QT_ANALYSIS_PLUGIN(plugin_id, plugin_name, description, version,
command_line, working_folder, status_id) values
('1','CALCULATE_PATIENTCOUNT_FROM_CONCEPTPATH' ,
'CALCULATE_PATIENTCOUNT_FROM_CONCEPTPATH' , '1.0' ,
'/opt/jboss/server/default/analysis_commons_launcher/bin/run_conceptpatient_breakdown.sh' , '/opt/jboss/server/default/analysis_commons_launcher/bin','A');
```

3. Copy each project's datasource registered in **crc-ds.xml** to "**CRCApplicationContext.xml**". The *bean id* is the datasource name and that would start with '*java:*' plus the *datasource name* in **crc-ds.xml**.

```
<bean id="java:QueryToolDemoDS" class="org.apache.commons.dbcp.BasicDataSource"
destroy-method="close">
    <property name="driverClassName" value="oracle.jdbc.driver.OracleDriver"/>
    <property name="url" value="jdbc:oracle:thin:@localhost:1521:XE"/>
    <property name="username" value="i2b2demodata"/>
    <property name="password" value="i2b2demodata_password"/>
 </bean>
```